Buck Global, LLC
11 Stanwix Street
Suite 700
Pittsburgh, PA 15222

June 7, 2024

Bethany Rhodes
Director/General Counsel
Ohio Retirement Study Council
30 East Broad Street, 2nd Floor
Columbus, Ohio 43215

Dear Ms. Rhodes,

Thank you for including Buck in your Actuarial Auditor Services RFP process with the School Employees Retirement System (SERS) of Ohio. We are honored to have this opportunity to partner with you to better ensure the financial futures of your members.

Engaging an independent actuarial firm to conduct an independent full replication audit of your pension and retiree health care valuation results, actuarial assumptions, application of actuarial cost methods/procedures, and contribution rates is a valuable tool in ensuring the fund is being properly funded, which provides both security and sustainability, as well as meeting fiduciary responsibility.

We understand you need an experienced actuarial audit partner, one who can:

- Navigate the structural complexities of your plans.
- Determine appropriate methods and assumptions are being used.
- Be current with and fully grasp actuarial best practices to ensure they are being followed.
- Understand challenges that arise in administering and operating a retirement system so areas of potential concerns can be addressed to ensure proper handling.
- Advise on funding strategies to align with your policies and current actuarial standards. At Buck, we not only audit the policies but provide any consultative advice that may come to light during our audit. A value many auditing actuaries do not offer.

As SERS Actuarial Auditor, Buck will:

- Perform a full replication review/audit of the Actuarial Valuations of the pension and retiree health care plans as of June 30, 2023, including review of the raw and final census data provided and used.
- Review of the development of contribution rates.
- Complete a full review of the actuarial assumptions and methods used in the valuations and recommend assumptions adjustments (if any).
- Perform a compliance review with applicable Actuarial Standards of Practice.
- Provide a detailed results report of the actuarial audit.
- Provide an on-site presentation summarizing our audit results and recommendations.

All miscellaneous tasks, phone calls, and emails are included as part of our services. We encourage communication.

We have provided our methodology, detailing how we will perform each step of the audit process, in our response.

The proposed team for SERS consists of highly credential and experienced pension actuaries, with significant experience with public-sector plans and actuarial audits for large, public Retirement Systems. We have the expertise and experience needed as indicated by our recent actuarial audit services to CalPERS, Colorado PERA, Fort Worth, Texas, City of San Diego, and other Systems. We also provide annual actuarial pension and OPEB services to hundreds of public-sector clients, including Pennsylvania School Employees Retirement System (PSERS) and New York City Office of the Actuary (NYCOA), which has been a Buck client for more than 100 years.

Buck meets, and exceeds, the qualifications to perform the work required of the actuarial audit for the Ohio Retirement Study Council (ORSC).

Our proposal and cost/price proposal will be valid for a minimum of 120 calendar days from date of submission, and we will extend, if necessary, until a final contract is signed.

I am authorized to bind the company and will provide a Contract and applicable certificates of insurance upon contract award.

Thank you for the opportunity to submit our response to your RFP, and we look forward to discussing our capabilities.

Sincerely,

Michael Leskanic
Buck, Managing Director, U.S. Central Region

Jason L. Fine, ASA, EA, MAAA, FCA
Buck, Principal, Public Sector Wealth

BUCK
A Gallagher Company

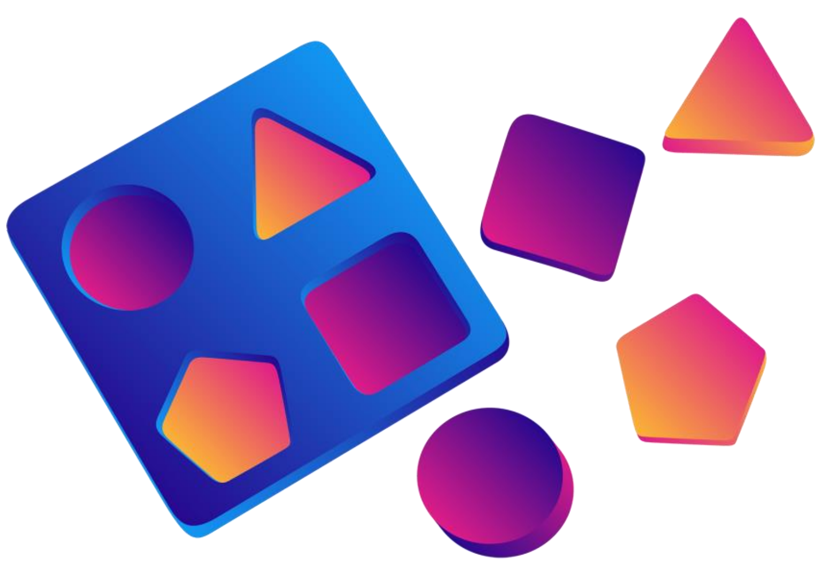
Buck's Response to ORSC's RFP

Actuarial Audit of the Ohio School Employees Retirement System (SERS)

June 7, 2024

Proposal Contact

Primary Contact	Jason Fine, ASA, EA, MAAA, FCA Principal | Wealth Practice Buck Global, LLC 1205 Westlakes Drive, Suite 290 Berwyn, PA 19312 856-689-4092 jason.fine@buck.com
Secondary Contact	Michael A. Ribble, FSA, EA, MAAA, FCA Principal, Retirement Buck, A Gallagher Company 12444 Powerscourt Suite 500 St. Louis, MO 63131 972.366.2011 michael.ribble@buck.com



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Proposal Summary

Each proposal shall provide a narrative summary of the proposal being submitted. This summary should identify all of the services and work products that are being offered in the proposal and should demonstrate the firm's understanding of the project.

At Buck, we take great pride in our history. Our more than 107-year heritage of excellence dates back to 1916, when Buck's founder, George B. Buck, established the actuarial basis of the New York State and City retirement systems. Since then, Buck has grown into a diversified firm that provides consulting services to both public and private entities, covering the entire employee benefit and human resource management fields.

In early 2023, Buck was acquired by Arthur J. Gallagher & Co., a global insurance brokerage, risk management and consulting services firm established in 1927. Headquartered in Rolling Meadows, IL, Gallagher provides these services in approximately 107 offices in the U.S. and in 130 countries around the world. Our combined organizations have produced a transformational next step for our clients as we have become one of the world's largest integrated employee benefits and HR consulting, administration, and technology firms.

Our commitment to the public sector.

We are proud of the fact that Buck was initially founded to serve the needs of the public sector, applying sound actuarial principles to retirement programs as a way to help keep the promises to employees and members.

Over the years, the challenges facing public sector clients have become pronounced, requiring them to re-evaluate both the programs they offer their employees and how they engage with providers, including actuarial services. Buck brings our public sector clients a "best-of-both-worlds" approach:

- Deep experience supporting public sector retirement programs, delivering the specific services our public sector clients need while considering their unique characteristics, ranging from sources of funding to the composition of their members, to their governance models; and

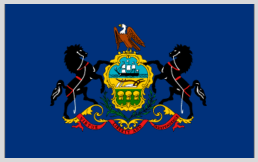
- Fresh perspective and creative ideas, based on our experience serving a vast array of organizations and plan types.

Qualifications and experience.

At the center of what makes Buck unique is our appreciation of the work and the impact our clients have on people. We embrace this and make it our own. It is one of the main reasons we have long-standing client relationships and are trusted by some of the largest public sector entities in the country. Several examples include:

City of New York

George B. Buck's first client in 1916 that led to the creation of his namesake company of today. A trusted relationship that has lasted over 100 years.



Pennsylvania Public School Employees' Retirement System (PSERS)

Actuary since 1919 performing all actuarial consulting services including: pricing legislative changes and collective bargaining agreements.

State of North Carolina

After 75 years of partnership, a required RFP process led NC to move to a lower cost provider. Five years later they re-engaged Buck, citing our "dedication to precision, factual accuracy, and the highest professional standards."

State of West Virginia

Long-standing client, Buck provides actuarial services to the State's multiple plans, including legislative updates, experience studies of actuarial assumptions, cost projections, and much more.

California Public Employees' Retirement System (CalPERS)

In partnership, we were retained to modernize the System's in-house actuarial software while also completing full-replication audits for all plans.

We understand the ORSC is seeking a qualified actuarial firm to perform actuarial audits consisting of full replication of the SERS retirement and retiree health care plan actuarial valuations as of June 30, 2023.

About Buck:

107+ years
Serving the public sector

40+ States
Support for public sector entities across the U.S.

23+ years
Average public sector client tenure

We further understand the funding valuation audit components will include a full replication of the System's liabilities, independent verification of data validity, assessment of actuarial valuation methods and procedures, actuarial valuation assumptions, retiree health care contributions determinations, and the consulting actuary's adherence to Actuarial Standards of Practices relevant to pension and post-employment benefit valuations. When completing the audit of the actuarial valuation assumptions, we will also audit the five-year experience study completed for the period from 2015 through 2020 and the process of performing periodic experience studies.

As shown above, Buck has significant experience working with large State System's containing many participants and varying Tiers and Divisions. In our proposed team (shown below), we have selected a group of professionals that provides actuarial services and has experience with audits of large state systems like Ohio SERS. Our team also contains both pension and health actuaries that specialize in their respective fields. You will also find that our team consists of members that serve on the Actuarial Standards Board, and investment professionals to assist the team with reviewing the System's economic assumptions.

Providing comprehensive retirement, health, and actuarial consulting services is at the heart of what we do – this includes funding valuations, financial statement reporting, experience studies, plan design analysis, actuarial reviews and audits, and multi-scenario projections. The knowledge and understanding needed to complete these services are vital for performing quality actuarial audits. We complete funding and GASB 67, 68, 74, and 75 actuarial valuations, as well as periodic experience studies, for all our public sector clients.

We have performed numerous actuarial audits for both pension and OPEB, that include a full replication of the plan's liabilities, review of the experience study to evaluate the reasonableness and appropriateness of each economic and demographic assumption being used for purposes of the measure, making sure full compliance with all generally accepted principles, actuarial standards, and

Board policies, as well as the contribution rates of both employer and member, and assuring the actuarially determined contribution is adequately paying down the unfunded liability.

We intend to bring our highly qualified team of experts in the public sector to the State of Ohio. Buck's proposed team is uniquely organized to provide services to the School Employees Retirement System (SERS) by a combination of strong public sector expertise, extensive experience with actuarial audits, many credentialed pension and health care actuaries, knowledgeable analysts and unmatched executive and strategic support.

Assigned staff

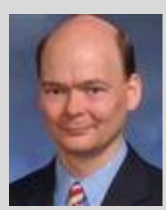
Audit Team (Retirement)

		
Michael Ribble	**Matthew Staback**	**Jonathan Dobbs**
FSA, EA, MAAA, FCA	FSA, EA, MAAA, FCA, CERA	ASA, EA, MAAA
Account Executive & Lead Actuary	Project Manager / Secondary Actuary	Valuation System Expert

OPEB Audit Team (Health)

		
Evi Laksana	**Christian Hershey**	**Kevin Penderghest**
ASA, MAAA, FCA	ASA, MAAA	ASA, MAAA, FCA
Lead OPEB Actuary	Secondary OPEB Actuary	Independent OPEB Peer Reviewer

Additional Support

			
Kelly Adams	**Jim Berberian**	**David Driscoll**	**Stuart M. Schulman**
FSA, EA, MAAA, FCA	ASA, EA, MAAA, FCA	FSA, EA, MAAA, FCA	FSA, CFA, FCA, MAAA, EA
Independent Pension Peer Reviewer	Independent Peer Reviewer for Experience Study	Strategic Advisor & Plan Audit Expert	ALM Consulting Leader, Financial Risk Management Group

Conclusion

When compared to other firms that provide actuarial services to the public sector, we generally have more credentials, more quality control, more sharing of knowledge and other public sector client experience amongst our larger bench of public sector actuaries, more service offerings, and many added advantages.

We hope as you read through our proposal you will agree we have assembled a top-notch team who will use due diligence to perform a thorough audit and recognize the value in the audit is either a clean report of the incumbent actuarial firm's work or suggestion of improvement or error corrections, if applicable. Our actuaries will not just look for a minor issue "just to have something to report and therefore show the value of the audit." We believe our job is to uncover any issues if they exist, offer enhancement suggestions or give the Council the confidence that everything is as it should be.

Buck also strives to provide proactive consulting. Therefore, our pledge to you is that while we perform the actuarial audit, we will also share any consultative ideas we may uncover that may be valuable to the fund. This is a step beyond just making sure everything is reasonable and we believe this proactive consulting alongside an actuarial audit creates a partnership that other firms struggle to provide.

We trust that this proposal demonstrates our capabilities and look forward to discussing it with you in greater detail. Thank you for your consideration of Buck and the opportunity to present our RFP response. We are confident that we will be able to meet your immediate service needs and objectives.

The ORSC + Buck: *Stronger together*

Now is the time for a fresh approach with Buck's full audit of the School Employees Retirement System of Ohio. Backed by deep industry experience, specialized expertise, empowering actuarial technology, and our very best team of public sector consultants, we are committed and prepared to deliver exceptional services. We look forward to taking the next steps with you.

In addition to the summary, please provide all of the following general information:

- The firm's primary contact for ORSC staff use and, if different, for SERS staff use during the audit, including the contact's address, telephone and e-mail address;

  The primary contact during the course of the audit will be:

  Matthew Staback, FSA, EA, MAAA, FCA, CERA
  Senior Consultant | Wealth Practice
  Buck Global, LLC
  12444 Powerscourt, Suite 500
  St. Louis, MO 63131
  Tel: 636.485.3707
  Email: Matthew.Staback@buck.com

- General ownership structure of the organization, including subsidiary and affiliated companies, and joint venture relationships;

  Buck Global, LLC, is a wholly owned subsidiary of Arthur J. Gallagher & Co.

- Information regarding any material change in the firm's structure or ownership within the last eighteen months, or any material change in ownership, staff, or structure currently under review or being contemplated by the firm;

  In April 2023, Buck was acquired by Arthur J. Gallagher & Co. (NYSE: AJG), a global insurance brokerage, risk management and consulting services firm. Buck became part of Gallagher's Benefits and HR Consulting division. This combination of two of the leading benefits organizations is a transformational next step for our clients as we have become one of the world's largest integrated employee benefits and HR consulting, administration, and technology firms.

- If available, a third-party assessment or report concerning client satisfaction and measures of the firm's strengths and weaknesses;

  Gallagher conducts an annual Client Experience Survey to gauge clients' satisfaction with our services. In addition to gaining insight into Gallagher's strengths and opportunities for improvement, the survey results include our Net Promoter Score (NPS). NPS measures our clients' willingness to recommend Gallagher to others. In the most recent Client Experience Survey, Gallagher's NPS score was 71; the industry average is 42. Any score above 70 is considered an "Excellent" rating. Gallagher teams use this information to build action plans to address clients' responses and ensure that we meet or exceed their expectations as well as identify opportunities for improvement.

Net Promoter Score result from the Benefits & HR Consulting Division's 2023 Client Experience Survey of more than 1,500 clients.

  Our commitment is also evident in the feedback we receive from our clients. In a recent independently conducted client survey, the following Buck attributes stood out. Our clients say that we are:

People-focused

91% say we're the best at developing and maintaining true partner relationships.

Outcome-driven

86% say we know their strategic goals as well as they do, and we proactively seek to achieve them.

Insightful

95% view their Buck team members as the most personable, professional, and knowledgeable in the industry.

- Any material litigation which has been threatened against the firm or to which the firm is currently a party;

  Any litigious claim or active litigation that Buck may be involved in is confidential in nature and will have absolutely no effect on the services provided to any of our clients, including the ORSC.

- A list and brief description of litigation brought against the firm by existing or former clients over the last five years; and

  Over the last five years, Buck, its affiliates, or parent has not been involved in any inquiry/investigation, by a federal or state governmental agency and/or business litigation or other legal proceedings that could impact the financial standing of our organization or affiliates, or our ability to deliver the required services.

- A list of any professional relationships involving the ORSC, the five Ohio public retirement systems, the State of Ohio, or its political subdivisions for the past five years, together with a statement explaining why such relationships do not constitute a conflict of interest relative to performing the proposed review. In the event that the firm has had any professional relationships involving the ORSC, the five Ohio public retirement systems, the State of Ohio, or its political subdivisions for the past five years, the firm shall provide a statement explaining why such relationships do not constitute a conflict of interest relative to performing the proposed review, or, if necessary, an explanation of the actions that will be taken to ensure an independent review.

  No such relationships exist.

Capabilities and Experience

Each proposal shall describe the firm's capabilities and recent experience (at least during the last five years) in performing actuarial valuations, audits, or studies of public employee retirement systems. The response should include information on the types and sizes of public employee retirement systems for which past work has been performed, including whether the systems were defined benefit or defined contribution plans, the types and number of participating employers, number of participants, and other relevant indicators of plan type, size, and comparability to SERS. You should include other information you believe may be relevant in demonstrating your capabilities in performing the actuarial audit, including other professional experience and data processing capabilities.

Buck has a proud history of providing professional actuarial services to public retirement systems. For more than a century, our consultants have delivered superior service and maximum value for our clients' benefit needs. We have been serving the public sector for more than 107 years, longer than any other actuarial consulting firm, ever since our founder George Buck set up the first rules of US public pension plan funding in 1916. Our first client, the City of New York, is still with us today.

We have the expertise and experience needed as indicated by our current and past actuarial audit and our annual actuarial services clients.

Recently, Buck has performed actuarial audit services similar to those requested by ORSC for CalPERS, Colorado PERA, AC Transit Authority, City of San Diego, City of Fort Worth, Amarillo Firemen's Relief and Retirement Fund, and in the past multiple statewide systems including South Dakota Retirement System, New Mexico, Kansas, Montana, North Dakota, Missouri, and Utah. We are currently working with the County of San Diego, West Virginia Municipal Pension Oversight Board, a Statewide system that we are unable to disclose, and we were just selected by a District in California, all to complete full actuarial audits of their actuary's valuations.

We have selected clients that are most applicable to performing actuarial audit reviews and validating our experience that is needed to perform the SERS actuarial audit, during the last five years, with a summary of the work performed.

CalPERS – Actuarial audit including parallel valuation (completed in 2024)

Client Since: 2016

Plan Type: Defined Benefit

Employer Type: Statewide

Number of Participating Employers: Over 2,800

Membership: More than 2 million

Assets: Over $350 billion

Relevance: We perform parallel valuation audits of the CalPERS staff actuaries. These are similar services requested for the SERS audit. CalPERS is the largest system in the US and has complicated benefits and huge datasets. Like SERS, CalPERS has retirement formulas that vary (based on classification), but CalPERS goes further with additional groups and categories in each classification. The work performed for this client clearly indicates Buck is fully capable of handling large complex actuarial audits and datasets. We have performed audit services for CalPERS since 2016 and are proud to say in 2021 we were selected to continue providing audit services to CalPERS.

Colorado PERA – Actuarial audit (completed in 2022)

Client Since: One-time audit 2022

Plan Type: Defined benefit and OPEB

Employer Type: Statewide, 5 systems and 2 OPEB

Number of Participating Employers: Over 500

Membership: 631,105 participants

Assets: $58.8 billion

Relevance: We performed a full replication audit including review of data, assumptions and methods and the most recent experience study, and with a four-month turnaround assuring ORSC we can meet expected timing requirements. Like SERS, Colorado PERA has retirement formulas that vary based on date of hire.

Pennsylvania Public School Employees' Retirement System (PSERS) – Annual actuarial valuations and experience studies (completed in 2023)

Client Since: 1919

Plan Type: Defined benefit, defined contribution and health care benefits

Employer Type: Statewide – school system, teachers

Number of Participating Employers: All PA schools are eligible

Membership: 521,763 participants

Assets: Approximately $58.7 billion

Relevance: We complete funding and GASB 67 & 68 actuarial valuations as well as periodic experience studies. Like SERS, PSERS has different retirement formulas and eligibilities for members hired after different dates. Providing annual actuarial valuation services requires the same expertise as conducting a parallel valuation. Providing experience studies for this client provides the expertise needed to audit reasonableness of other actuaries. We also completed an Asset Liability Management study in 2023 where economic assumptions like investment return and inflation are key.

State of Alaska – Annual actuarial valuations and periodic experience studies (completed 2023)

Client Since: 2006

Plan Type: Defined benefit, defined contribution and retiree health care

Employer Type: Statewide, 5 separate systems with 7 total plans

Number of Participating Employers: Teacher Retirement System – 58
Public Employees Retirement System – 161

Membership: Approximately 118,000 participants

Assets: Approximately $26 billion

Relevance: Performing work similar to that being audited provides the knowledge necessary to properly audit actuarial services. We complete funding and GASB 67 & 68 actuarial valuations and well as periodic experience studies. Members are also not covered by Social Security. Our actuarial work for the State of Alaska systems is required to be audited each year by an independent actuary. This demonstrates experience with cooperation between audit and annual service actuaries.

North Carolina Department of State Treasurer – Annual actuarial services including experience studies and stress testing (completed in 2023)

Client Tenure: over 75 years

Plan Type: Defined benefit retirement, disability and death benefit plans

Employer Type: Statewide, 9 systems/plans

Number of Participating Employers: Not available

Membership: Systems total over 900,000

Assets: Systems total over $109 billion

Relevance: We complete funding and GASB 67 & 68 actuarial valuations as well as periodic experience studies and stress testing. Performing work similar to that being audited provides the knowledge necessary to properly audit actuarial services.

West Virginia Consolidated Public Retirement Board - Annual actuarial services and experience studies for 5 of the 7 systems, review & general consulting on other 2 systems (completed in 2023)

Client Since: 1996

Plan Type: Defined benefit

Employer Type: Statewide, 7 systems

Membership: 178,990 participants

Assets: $17.3 billion in assets

Relevance: Performing work similar to that being audited provides the knowledge necessary to properly audit actuarial services. We complete funding and GASB 67 & 68 actuarial valuations and well as periodic experience studies. In addition, we annually complete a review of the investment return assumption. This review is pertinent to auditing the investment return and inflation assumptions of SERS as we utilize our subject matter experts in our Financial Risk Management (FRM) practice for this study as well as for audits. West Virginia Consolidated Public Retirement Board has internal actuarial staff that we work with. We informally provide audits for the plans they value, and they do the same for the ones we value. This demonstrates experience with cooperation between actuaries.

In addition to audits and annual actuarial services, Buck has added a dozen new public sector retirement and health plan clients in the last two years where the first step in transition or project set-up was to essentially perform a replication audit of the prior / incumbent actuary.

Other information that we feel strongly is relevant in providing actuarial auditing services, and that distinguishes us from our competitors, is shown below.

Financial Risk Management (FRM)

Although retirement actuaries may well be adept at conducting demographic experience studies and setting demographic assumptions, they may not be as knowledgeable or qualified in setting economic assumptions. At Buck, we recognize that setting economic assumptions involves understanding capital markets and the overall economy. Therefore, Buck maintains a Financial Risk Management (FRM) specialty practice that brings together the investment, risk management and pension actuarial skill sets for the benefit of our clients. We will use consultants from our FRM specialty practice when reviewing economic assumptions.

The FRM specialty practice specializes in both determining expected return on asset assumptions and Asset Liability Modeling. Buck's capital market assumptions are established by the FRM, and support is provided for pension and retiree health care actuarial consultants to understand the intricacies of determining reasonable expected return rates. This practice uses an Economic Scenario Generator (ESG) called GEMS® - an award-winning model from Conning and Company. GEMS® is a cutting-edge ESG that enables users to simulate future states of the global economy and financial markets, including the pricing of derivatives and alternative assets. It uses financial models that are the most technologically advanced in the industry, ensuring that models perform consistently with history, provide a realistic representation of extreme events, and support hedging strategies with market-consistent pricing. GEMS® includes comprehensive yield-curve modeling as well as a multifactor arbitrage pricing model that develops asset-class return series based on asset-class relationships to underlying economic and capital market variables such as GDP, inflation, interest rates, credit spreads, and unemployment. The model is calibrated to current market conditions and trends the economic variables to longer-term historical norms, simulating a variety of economic environments and concomitant asset-class returns in the process.

As part of our services, we will offer a GEMS® analysis, completed by our FRM team, of the System's investment return and inflation assumptions. This service sets us apart from our competitors. Representative members of our FRM team who may perform this analysis are **Stuart Schulman, FSA, CFA, EA, MAAA, FCA** and **Christopher Snel, ASA, EA, CFA, QKA**. Both Stuart and Chris bios' have been included as part of our proposed auditing team.

Buck's Public Sector Retirement Practice (PSR)

SERS has its unique characteristics. Complex systems need actuaries who truly understand the intricacies of public sector systems and stakeholders' roles in those systems.

Buck maintains a Public Sector Retirement (PSR) specialty practice within its Wealth practice. It is imperative that professionals who consult with public sector clients should not merely have one or two clients, but also have deep experience and understanding of the public sector retirement industry. Therefore, our PSR specialty practice ensures each consultant is qualified to provide services to our public sector clients and continue their education and enhance their knowledge of the sector.

The PSR consultants meet monthly for an informational and conversational meeting. There is always an open forum where consultants can bring up issues or thoughts they are experiencing and get multiple ideas and opinions of other public sector consultants. The PSR practice connects consultants across the nation so that each Buck public sector consultant learns about differences and similarities in public sector retirement across states. This is different than many competitors where consultants often only understand the state(s) where their clients are located. Understanding differences and similarities between public sector retirement systems across the nation provides clients with higher value consulting as something that has worked or not worked in one state may help inform other states.

The practice also produces research and education for our clients and prospects. This specialty practice's strong focus and comradery produces some of the most knowledgeable and proactive public sector consultants in the industry. It also provides a group of practitioners to assist in any rare circumstances where additional team members or experience are needed to meet key dates or specialized consulting.

Buck's OPEB Center of Excellence (COE)

Buck's unique approach to performing OPEB valuations means that the assigned auditing team will consist of health actuaries and analysts from our OPEB COE who specialize in retiree health benefits. Unlike most other firms where OPEB work is performed primarily by retirement actuaries who have only cursory knowledge of health issues, your team consists of experts in all areas of retiree healthcare, including plan design, funding, Medicare, and pharmacy benefits.

Staff Qualifications

Each proposal shall, at a minimum, describe the qualifications of all management and lead professional personnel who will participate in the audit. Each personnel description shall include: (1) a resume; (2) a summary of experience each has had in performing actuarial valuations, audits, or studies of public employee retirement systems; and (3) a management plan identifying the responsibilities each will have on the audit.

Each resume should include information on the current and past positions held with the firm, educational background, actuarial and other relevant credentials, and other relevant information to demonstrate the person's qualification.

Each proposal shall also include a description of the firm's procedures in the event that a key person assigned to this engagement leaves the firm during the engagement.

The experience summaries should include information on the types and sizes of public employee retirement systems for which the designated staff have completed actuarial work, including whether the systems were defined benefit or defined contribution plans, the types and number of participating employers, number of participants, and other relevant indicators of plan type, size, and comparability to SERS. It is permissible to reference, rather than repeat, duplicative information provided elsewhere in the proposal. The experience summaries should describe the work performed and detail the roles and responsibilities that the individual staff had on the projects.

The management plan should specify the roles and responsibilities that each of the management and professional staff will have on the actuarial audit and include an estimated portion of the audit's time that will be spent by each on the audit.

Actuaries included on the project team should meet the following criteria:

- Be members of the American Academy of Actuaries;
- Be enrolled actuaries with experience in governmental plans;
- Be, at a minimum, associates with at least five years of experience in public practice, although preference will be given to actuaries that are Fellows of the Society of Actuaries; and
- Have performed an actuarial valuation, audit, or study of a public employee retirement system within the last two years.

In the event that the firm or any personnel listed in the proposal has had any professional relationships involving the ORSC, the five Ohio public retirement systems, the State of Ohio, or its political subdivisions for the past five years, the firm shall provide a statement explaining why such relationships do not constitute a conflict of interest relative to performing the proposed review, or, if necessary, an explanation of the actions that will be taken to ensure an independent review.

Your Buck team members will be led by some of our most experienced and talented professionals on our public sector pension actuarial team, that have experience working with large State Systems and actuarial audits. The team we've assembled is comprised of actuarial professionals including Fellows and Associates of the Society of Actuaries.

Many of our actuaries actively participate in industry associations as shown below and are active in the Conference of Consulting Actuaries Public Plans Community. This is evidence in members descriptions and resumes.

A few examples of our active involvement in industry associations:

- National Association of State Retirement Administrators (NASRA) – Buck was co-lead of an actuarial roundtable at the 2021 annual meeting and a member of the actuarial panel at the 2022 annual meeting.
- National Conference on Public Employee Retirement Systems (NCPERS) – Buck co-presented an introduction to actuarial topics at the 2022 TEDS conference and an experience study session and the 2023 fall conference.
- National Conference on Teacher Retirement (NCTR) – Buck sat on an actuarial panel this past October at the annual meeting.

Professional standards and credentials are very important when providing actuarial audits as ORSC will want to be assured that their actuarial valuations are conducted in compliance with Actuarial Standards of Practice (ASOP). Buck has many actuaries who volunteer in actuarial professional organizations. A few examples are:

- Our Wealth practice Chief Actuary, Tonya Manning, has served as President of both the Society of Actuaries (SOA) and International Actuarial Association (IAA) and won the Conference of Consulting Actuaries Most Valuable Volunteer Award.
- A Buck actuary is currently the President of the Conference of Consulting Actuaries.
- We employ two actuaries who served on the Society of Actuaries Retirement Plan Experience Committee (RPEC) (one as Chair) and both on the Public Plans Subcommittee when the Society conducted its first study of public plan mortality and published the Pub-2010 tables.
- Our Public Sector Retirement leader and your peer reviewer, Kelly Adams, is currently on a CCA group that is refreshing the white paper on public sector funding policies and practices and sat on an industry workgroup regarding educating Funds on the updated Actuarial Standard of Practice (ASOP) No. 4 and the requirement to disclose and communicate a Low-Default-Risk Obligation Measure (LDROM).

The client team assigned to the ORSC consists of six key employees that are either a Fellow or Associate with Society of Actuaries and three actuarial associates providing analytical and technical skills. This client team is supported by five actuaries with specific additional expertise that enhance the value of an actuarial audit performed by Buck. The client team and support team encompass robust experience and knowledge in order to best handle an audit of a complex and unique system like SERS.

For each team member listed, we have identified the responsibilities each would have in accomplishing the services required by this RFP.

Michael Ribble, FSA, EA, MAAA, FCA – **Lead Actuary**. Mike has over 35 years of actuarial consulting experience, including actuarial audits of public sector plans like SERS, and will serve as the lead consulting actuary.

Matthew Staback, FSA, EA, MAAA, FCA, CERA – **Project Manager and Secondary Actuary**. Matt has over 15 years of experience and has performed actuarial audits of public sector systems like SERS. Matt will be responsible for actuarial coding and replication of results and overseeing the census and raw data files accuracy review for the SERS Retirement Plan and Experience Study. Matt will be a primary contact for ORSC and SERS staff.

Jon Dobbs, ASA, EA, MAAA – **Valuation System Expert**. Jon has over 30 years of experience and has performed actuarial audits of public sector systems like SERS. Jon will be responsible for reviewing the actuarial coding and replication of results for the SERS Retirement Plan. Jon has experience working with State public pension systems and performing actuarial audits.

Kelly Adams, FSA, EA, MAAA, FCA – **Peer Review Pension Actuary.** Kelly has 25 years of actuarial consulting experience, including actuarial audits of public sector plans like SERS, and will serve as the independent peer reviewer. This is unique to Buck compared to other consulting firms as Kelly and her team will serve as an independent audit of our own work before it gets sent to the client, including ASOPs and compliance with related governing laws.

Evi Laksana, ASA, MAAA, FCA – **Lead OPEB Actuary.** Evi has 20 years of OPEB experience and has performed replications of public sector OPEB systems. Evi will be the lead OPEB actuary responsible for reviewing and overseeing the results of the SERS OPEB liabilities full replications.

Christian Hershey, ASA, MAAA – **Support OPEB Actuary.** Christian has 10 years of OPEB experience and has performed replications of public sector OPEB systems. Christian will be the support OPEB actuary assigned to the team and responsible for managing OPEB projects and producing the results of the full replications of the OPEB valuations.

Kevin Penderghest, ASA, MAAA, FCA – **Peer Review Health Actuary.** Kevin has 20 years of actuarial consulting experience with OPEB plans, including actuarial audits and large, State public sector plans, and will serve as the independent per reviewer for the OPEB replication audit.

David Driscoll, FSA, EA, MAAA, FCA – **Strategic Advisor/Plan Audit Expert Actuary**. David has over 35 years of actuarial consulting experience, including actuarial audits of public sector plans like SERS. David has experience working with CalPERS and has performed numerous actuarial audits for public sector systems and is the lead actuary for PSERS. David will review the SERS actuarial report for adherence to all applicable Actuarial Standards.

James Berberian, ASA, EA, MAAA, FCA – **Independent Review of Actuarial Experience Study.** Jim has over 30 years of actuarial consulting experience and will provide a full review of the SERS assumptions reviewed in the 2015-2020 actuarial experience study and used in the actuarial valuation.

Stuart Schulman, FSA, CFA, EA, MAAA, FCA – **Financial Expert.** Stuart has over 35 years of actuarial, investment, and risk management experience. As part of our services, we will offer a GEMS® analysis, completed by our Financial Risk Management (FRM) team, of the System's investment return and inflation assumptions. This service sets us apart from our competitors.

We have estimated the percentage of time that each person would spend performing the needed services for the SERS actuarial audit.

Key Team Member	Percent of time on audit
Michael Ribble	10%
Matthew Staback	16%
Jon Dobbs	21%
Evi Laksana	8%
Christian Hershey	12%
Kelly Adams	3%
Kevin Penderghest	3%
David Driscoll	3%
James Berberian	3%
Stuart Schulman	1%

Additionally, we have assigned two actuarial support personnel to the team that are estimated to perform 20% of the overall project time.

For additional information about the proposed staff, please see Attachment A – Buck Biographical Profiles, located in the Additional Information section of this proposal.

The proposed staff meets and exceeds the qualifications as described above.

Buck has over 200 credentialed actuaries and a large number of qualified public sector actuaries. When we pick teams to service our clients, we always pair seasoned consultants as leads with up-and-coming consultants as support staff. Whenever possible we have both the lead and support actuary attend all in person meetings and several team members attend client calls. This gives the up-and-coming actuaries experience communicating results with clients and hearing first-hand information from the clients. This also ensures each client has at least two resources they can reach out to with questions or to provide information. Therefore, in the rare event key personnel assigned to ORSC should become temporarily or permanently unavailable, there would be a minimal disruption. We will move a member of the team into the Lead role and assign a new qualified team member. We will discuss any personnel changes with ORSC to make sure everyone feels comfortable and confident that services will not diminish.

In addition, no personnel listed in our proposal has had any professional relationships involving the ORSC, the five Ohio public retirement systems, the State of Ohio, or its political subdivisions for the past five years.

References

Each proposal must include a list of at least three organizations, but no more than five, that may be used as references for the firm's work on actuarial audits or studies. References may be contacted to determine the quality of the work performed, personnel assigned to the project, and contract adherence, The following should be included for the references listed:

- Date of the actuarial audit work;
- Name, email address, and address of client;
- Name, email address, and telephone number of an individual in the client organization who is familiar with the work; and
- Description of the work performed.

The following five references are a sampling of representative current public sector clients in which we performed similar, related services to those listed in the Scope of Services:

1. CalPERS – Actuarial audit including Parallel Valuation (Since 2006, most recently completed in 2023)	
Plan type:	Defined Benefit
Employer type:	Statewide
Number of participating employers:	More than 2,800
Membership:	More than 2 million
Assets:	More than $350 billion
Description:	We performed parallel valuation audits of the CalPERS staff actuaries. These are similar services requested for OCERS's audit. CalPERS is the largest system in the US and has complicated benefits and huge datasets. The work performed for this client clearly indicates Buck is fully capable of handling large complex actuarial audits and datasets. We have performed audit services for CalPERS since 2015 and are proud to say we have recently been selected to continue providing audit services to CalPERS.
Contact info:	Navdip Kang, Senior Program Auditor Phone: 916.795.0350 Email: Navdip.Kang@calpers.ca.gov

2. Colorado PERA – Full-Scope Actuarial Audit of Plan Actuary (Completed audit in 2023)	
Plan type:	Defined benefit and Retiree health
Employer type:	Statewide
Membership:	Over 631,000
Assets:	Over $60 billion
Description:	Buck performed a one-time full replication audit of the System's Pension and OPEB valuations.
Contact info:	Koren Holden, Senior Actuary Phone: requests email Email: kholden@copera.org

3. State of Alaska – Plan Actuary (Since 2006, and annually audited, most recently completed in 2023)	
Plan type:	Defined benefit, defined contribution
Employer type:	Statewide, 5 separate systems with 7 total plans
Number of participating employers:	Teacher Retirement System – 58 Public Employees Retirement System - 161
Membership:	Approximately 118,000 participants
Assets:	Approximately $26 billion
Description:	We provide annual actuarial valuations and services for all seven of the State's retirement plans. Our actuarial work for the State of Alaska systems is required to be audited each year by an independent actuary, and our cooperation is needed.
Contact info:	Kevin Worley, CFO Phone: 907.465.4460 Email: kevin.worley@alaska.gov

4. Fort Worth, Texas – Full-Scope Actuarial Audit of Plan Actuary (Completed audit in 2023)	
Plan type:	Defined benefit
Employer type:	City, Police, and Fire
Membership:	13,400
Assets:	Over $2.5 billion
Description:	Buck performed a one-time full replication audit of the City's Pension valuation.
Contact info:	Holly Moyer, Assistant HR Director Phone: 817.392.7847 Email: Holly.Moyer@fortworthtexas.gov

5. State of North Carolina – Annual actuarial valuations (Since 2009)	
Plan type:	7 defined benefit plans, a disability income plan and a death benefit fund
Employer type:	Statewide
Membership:	Over one million participants
Assets:	Approximately $114 billion
Description:	We perform actuarial valuations for all of the pension retirement, disability income and death benefit systems and funds, perform special projects, including legislative cost notes, experience studies, stress testing, actuarial audit support.
Contact info:	Patrick Kinlaw, Planning and Compliance Phone: 919.814.4157 Email: pkinlaw@nctreasurer.com

Methodology, Work Product, and Timeline

Each proposal shall describe the proposed methodology for each element of the components listed under Scope of Audit. The description should include specific techniques that will be used, including anticipated sampling techniques and sizes, and proposed sources of data and information. You may propose alternative ways of addressing the elements of the audit's scope.

In describing the proposed methodology, also identify the type and level of assistance that you anticipate will be needed from the staff of SERS and the consulting actuary, including; assistance to understand the operations and records of SERS; assistance to understand the actuarial assumptions, method, and procedures; and assistance to access, obtain, and analyze information needed for the audit. The description of the proposed methodology shall also identify meetings, interviews, programming support, space needs, etc., that you anticipate requiring from SERS and the consulting actuary.

Each proposal shall also include one or more examples of work product(s) from actuarial valuations or audits that may help to illustrate the proposed methodology and final work product.

Each proposal shall provide an estimated date that the final report will be submitted and the projected timeline or the anticipated work requirements and milestone dates to reach that date.

There are several important aspects to being able to provide the requested actuarial audit services in a timely manner. They are:

- Selecting the best team for the job that has the capacity to take on the additional scope of work and the project management skills to keep it on track.
- Understanding the scope of work and based on this understanding along with prior similar experience know how long items specified in the scope of work should take.
- Cooperation from the client and the actuarial firm being audited.
- Having back-ups and a strong bench to pull from if additional resources are needed.

Understanding the scope of work

ORSC is seeking the services of a qualified actuarial firm to perform an audit of the actuarial work performed by its Plan actuary through parallel valuations of the:

1) School Employees Retirement System (SERS) Annual Basic Benefits Valuation as of June 30, 2023, and
2) SERS Retiree Health Care Valuation as of June 30, 2023.

The audit will include:

- A review of all assumptions, procedures, and methods of each component for their appropriateness, compliance with generally accepted actuarial principles and standards, State statutes, and Board policies, including a review of the gain/loss analyses from the last four actuarial valuation reports
- Replication of the Annual Basic Benefits Valuation of the School Employees Retirement System of Ohio Prepared as of June 30, 2023:

  - Evaluate the raw and final census data used in the valuation, including ORSC's internal control procedures are being followed appropriately.

  - Replication of the Actuarial Value of Assets, Present Value of Future Benefits, Actuarial Accrued Liability, Normal Costs, Actuarially Determined Contributions, and Post-retirement Annuity Adjustment, including the allocations of these items to various populations.

  - Evaluate appropriateness of Employer and Employee contribution rates.

  - Evaluation of the asset smoothing method.

  - Reconcile any significant differences.

- Replication of the Report on the Retiree Health Care Valuation of the School Employees Retirement System of Ohio Prepared as of June 30, 2023

  - Evaluate the raw and final census data used in the valuation, including ORSC's internal control procedures are being followed appropriately.

  - Replication of the Fiduciary Net Position and Total OPEB Liability, Service Costs, and Actuarially Determined Contributions.

  - Review the GASB 74 disclosure report.

  - Assessment of whether the system appropriately and consistently determines retiree contributions to health care and whether the implementation of the SERS health care policies differ from those determinations.

  - Reconcile any significant differences.

- Review the School Employees Retirement System Experience Study Five-Year Period Ending June 30, 2020, and assess the impact and reasonableness, appropriateness for the measure, and compliance with applicable ASOPs.

- Provide recommendations on alternate assumptions and any improvements on quality or understandability from our review.

- Review recent actuarial communications.

When performing the actuarial audits for ORSC, we will review each plan's provisions taking note of differences among employees between the groups with active employees. We will code the audited data and plan provisions in our valuation system and determine an agreed upon threshold to which we will test our results versus those of the System actuary. To the extent there are differences outside the agreed upon threshold, we will attempt to reconcile them and comment on the potential for changes in the valuation processes currently in place for ORSC that could result in improvements in the work products it receives on an ongoing basis.

The following is a summary of our proposed approach that may be implemented for the ORSC actuarial audits ensuring services are completed in a timely manner. However, this approach may change as the needed audits progress if there is a need/desire to shift or make adjustments. These steps may be divided amongst team members, if applicable, to ensure deadlines are met.

Step 1: Meeting to discuss project elements and information needed	
What Buck will do:	Confirm the project steps, timetable, and frequency of status updates Discuss history of the plan Discuss any particular concerns Discuss the format of the final reports and board presentation Request needed information: • Actuarial valuation data • Data given to system actuary • Data used by system actuary • Access to actuarial valuation reports, if not available online • Sampling of benefit calculations covering different types of decrements and covering any different plan provisions; typically, one of each type of decrement and each benefit formula. This may be unique to Buck as others may not request this; however, in our experience issues found in actuarial valuation coding are often uncovered due to provisions of the actuarial system not matching the administration of actual benefit calculations. • Confirmation of applicable statutes • Financial statements, if not available online Discuss availability for test case details from the system actuary in the event we cannot match within the target tolerance. Often actuaries will not provide full test lives as they believe they are proprietary information. We need to understand how reconciliation will be accomplished.
Why does Buck do this?	Our experience shows a meeting at the beginning of each audit allows us to thoroughly understand your objectives. We may uncover particular issues or items of concern from ORSC that we should focus on in addition to our regular audit techniques. You may wish to include the system actuary in this phase to get their buy-in, or you may wish to discuss this with Buck only so that you can be more candid. As for the data requests, we've learned that our clients can save a lot of time with data collection if we explain exactly what is needed and why. When requested information is difficult to obtain, if our clients understand exactly why such information is requested, then we can decide together as to whether the data is absolutely necessary, or whether an approximation could be made using more easily obtainable data.

Step 2: Review of statutes	
What Buck will do:	This is an independent review of the plan provisions and statutes pertaining to each plan. We will verify that the statutes and the benefits being valued are consistent. The sample benefit calculations will be compared to system member test cases allowing us to test that the plan provisions were properly implemented into the actuarial valuation's liability calculations.
Why does Buck do this?	We do not just duplicate the numbers. Buck takes a step back to see the big picture so that we can review whether or not the actuarial valuations are consistent with statutory requirements and plan administration.

Step 3: Collection of member and valuation data	
What Buck will do:	While ORSC staff and the system actuary are collecting the data requested, Buck will begin review of the actuarial assumptions and the most recent experience study. We will also work with the system actuary to coordinate test cases (sample lives) if they are willing to provide them. Test cases are detailed calculation results for a sampling of the members included in the valuation.
Why does Buck do this?	Data collection is a critical component of the review. The main data needed is the final individual census data used by the system actuary as input to the valuations. The data supplied to the system actuary is also needed in order to review the original data preparation procedures. We have been involved in prior review situations where the actuarial calculations based on the data were accurate, but a significant number of participants were "lost" by the actuary in the data preparation step.

Step 4: Member data review	
What Buck will do:	As discussed above, Buck will verify the system actuary's data collection procedures. We will test several samples from the data supplied by ORSC staff to ensure it was appropriately classified for input to the actuarial valuations. We will also review the asset data provided to the system actuary to test proper inclusion in the valuations.
Why does Buck do this?	An actuarial valuation is only as good as the data used. An actuary who does not confirm the incoming data may give a clean audit report, despite "garbage in-garbage out" problems.

Step 5: Analysis of actuarial assumptions and triennial experience studies	
What Buck will do:	We will review the system actuary's experience studies and the assumption selection process. We will review each assumption independently based on the data provided in the experience study. We will assess the impact of credibility on the assumption setting process. We will also review the assumptions as a whole for reasonableness and internal consistency and review the reports to check that assumptions were properly disclosed. We will also review the retiree contribution methodology to verify that they were determined in a manner consistent with the intended policies.
Why does Buck do this?	Actuarial standards define the assumption setting process for both demographic and economic assumptions. The experience study should document the findings of the study and the proposed assumptions resulting from the study. In addition, setting demographic assumptions that are not internally consistent with benefit eligibility requirements can add a hidden risk of significant liability swings in future valuations.

Step 6: Calculation of individual member results	
What Buck will do:	This is a review of the liability calculated by the system actuary. We will calculate the liability of participants and compare the results with the individual results provided by the system actuary. Where discrepancies appear, we will need to obtain additional information from the system actuary to determine precisely what the differences are. We will discuss the differences with the system actuary on an as-needed basis. Cooperation between actuaries will be vital in this circumstance.
Why does Buck do this?	This is the actuarial "detective work" where we quantify and qualify the differences. Our experience shows the following examples of common problems detected during this review: • Improper application of retirement rates in valuing early retirement subsidies or late retirement benefits • Failure to value contribution refunds • Variety of issues around deferred termination benefits • Precise application of actuarial cost method • Temporary feature of a disability benefit • Improper handling of ancillary benefits (like death benefits) especially after a primary decrement • Service purchase subsidies

Step 7: Comprehensive analysis and peer review	
What Buck will do:	After the liability and experience analysis reviews are complete, we will take a comprehensive look at the results. We will analyze the funding method and actuarial asset valuation method and determine their reasonability. We will review the determination and appropriateness of the recommended contribution rates. We will reconcile any significant discrepancies between our results and those of the system actuary. Finally, we will thoroughly review and peer-review the actuarial report for completeness, comprehensibility, and accuracy.
Why does Buck do this?	The valuation results are reliable only if: • The plan provisions coded are accurate

Step 7: Comprehensive analysis and peer review	
	• The assumptions used are valid • The methods used are appropriate • The report is readable and complete Our experience shows an actuarial audit is more than simply a check of the liability calculations. It must look at the big picture. Actuaries like to look at trees. The retirement system sees the forest. The actuarial review must consider both.

Step 8: Completion of draft report	
What Buck will do:	We will send a draft report to ORSC and will be available to discuss our findings and go over the report in detail.
Why does Buck do this?	Our public plan clients' staff don't like to surprise their boards. We find that the staff can often add insight to our findings. After receiving feedback, we will revisit any aspect of our work, as needed, and begin drafting a final report and presentation.

Step 9: Final report issued	
What Buck will do:	As directed by ORSC staff, we will finalize the actuarial audit report and presentation. The presentation will be delivered in a timely manner so trustees may review it prior to the board meeting if they wish.
Why does Buck do this?	Buck's experience shows that some Board members like to review material prior to the meeting so they can ask detailed questions at the meeting.

FINAL STEP: Presentation of Actuarial Audit Results	
What Buck will do:	We will attend an in-person meeting with the ORSC and SERS Board and explain the findings of the review.
Why does Buck do this?	Buck prepares a Board presentation separately from the report because the report and presentation serve two different purposes. A key purpose of the report is comprehensiveness. By this point, we will have done a lot of work, and will want to make sure everything is documented. The key purpose of the presentation is comprehensibility. The ORSC and SERS Board need to understand the major findings of the review and be comfortable with them.

An important note regarding cooperation from the client and the actuarial firm being audited:

Having both completed many actuarial audits and the firm being audited, we don't anticipate having issues with cooperation. However, if any arise, we will advise the ORSC contact as soon as practical so that the issue may be resolved in a timely manner.

Proposed Timeline – Funding Valuation Component

Date	Task	Responsibility	
June 2024	Contract Award and Signed Agreement	Buck to sign	ORSC to inform and sign
July 2024	Step 1: Meeting to discuss project elements, timing, and information needed	Buck to set up a meeting with appropriate ORSC staff to discuss needs	ORSC to provide availability for meeting and make Buck

Date	Task	Responsibility	
		to complete audit and timing	introduction to Plan actuary
July 2024	Step 2: Review of statutes	Buck to review	ORSC to provide, if not publicly available
July 2024	Step 3: Collection of member and valuation data (through Secure File Transfer)	Buck to provide a Secure File Transfer to both ORSC for raw data, and to Plan actuary for final pension and health care data	ORSC to send the same raw data that was provided to Plan actuary to perform the June 30, 2023, valuations Plan actuary to provide the final census data that matches the counts in the final June 30, 2023, actuarial valuation reports
July 2024	Step 4: Member data review	Buck responsibility	ORSC and Plan actuary to be available for any questions
July / August 2024	Step 5: Analysis of actuarial assumptions	Buck responsibility	ORSC and Plan actuary to be available for any questions
July through October 2024	Step 6: Calculation of individual member results	Buck responsibility	Plan actuary to provide individual test lives selected by Buck
October 2024	Step 7: Comprehensive analysis and peer review	Buck responsibility	
November 2024	Step 8: Completion and submission of draft report	Buck responsibility; will set up a web meeting after submission to discuss	ORSC and Plan actuary to review draft and provide questions or comments, and be available to discuss
December 2024	Step 9: Final report issued	Buck responsibility	
December 2024	Step 10: DRAFT Board presentation and submit to ORSC for comment	Buck responsibility; will set up a web meeting to discuss before finalizing	ORSC to review draft and provide questions or comments and be available to discuss
Date TBD	FINAL STEP: In-person presentation of Actuarial Audit Results	Buck responsibility	ORSC to provide confirmation of day/time and Board attendance
and throughout Audit period	Updates on progress	Buck responsibility	Appropriate ORSC staff to be available

We will adjust the timing, as needed, to meet the needs of the ORSC.

Please see Attachment B – Sample Audit Report for Colorado PERA, located in the Additional Information section of this proposal (which is also available publicly here: https://www.copera.org/files/ceeac0494/CO+PERA+12-31-2021+Actuarial+Audit+Report+-+10-14-2022.pdf).

Additional Information

It is permissible to include additional information that will be helpful to gain an understanding of the proposal. This may include diagrams, excerpts from reports, or other explanatory documentation that would clarify or substantiate the proposal. Any material included here should be specifically referenced elsewhere in the proposal.

Attachment A – Buck Biographical Profiles

Attachment B – Sample Audit Report for Colorado PERA

Attachment A

Buck Biographical Profiles

Michael A. Ribble, FSA, EA, MAAA, FCA

Principal, Consulting Actuary, Wealth Practice

Mike Ribble is a Principal and Consulting Actuary at Buck. His responsibilities include managing and analyzing valuations of defined benefit retirement and postretirement health and life insurance plans. Mike specializes in public sector retirement systems providing consulting services on the financial, policy and design aspects of retirement benefits and valuations.

Career Highlights

Mike has over 30 years of private and public sector actuarial consulting experience, having started his career at Buck in 1993. His expertise covers a range of issues affecting employer-sponsored pension and postretirement health and life insurance programs. Mike's other areas of expertise include:

- Advising clients on funding policy, including calculations of minimum required and actuarially determined employer contributions,
- Financial accounting and reporting under both FASB and GASB standards for pension plans,
- Design of qualified and nonqualified defined benefit and defined contribution plans,
- Determination of withdrawal liability for multi-employer and public sector retirement plans,
- Analysis of legislative cost proposals to determine financial and other impacts,
- Oversight of experience reviews for large pension plans, and
- Performing actuarial audits of public retirement systems, including technical review of actuarial calculations and presentation of findings.

Education and Achievements

- B.S. degree in Applied Mathematical Sciences from Texas A&M University in 1992
- Fellow of the Society of Actuaries
- Enrolled Actuary
- Member of the American Academy of Actuaries
- Fellow of the Conference of Consulting Actuaries

To contact me: michael.ribble@buck.com

Matthew Staback, FSA, EA, MAAA, CERA, FCA

Senior Consultant, Wealth

Matthew Staback is a Senior Consultant in the Wealth practice. He has almost 10 years of actuarial valuation and defined benefit administration experience. Matthew specializes in the Public Sector by providing project management and guidance for the team on a variety of projects which include valuations, GASB 67/68, audits, plan design, data remediation, benefit calculation support, and compliance. Matthew is responsible for managing projects and communicating results to clients.

Experience

Matt joined Buck in 2014 and has significant experience in both actuarial valuation and defined benefit administration. Matthew has valuation and defined benefit experience with a wide variety of client types but specializing in the Public Sector including public schools, city, and unfirm Plans. Matt has experience and expertise specifically related to public sector valuations and GASB reporting as well as special projects and other client deliverable such as plan design modeling, funding analysis for legislative changes, multi-year deterministic forecasting, experience studies, and other ad hoc actuarial services. Considered an expert in supporting clients, project management, programming, reviewing benefit calculations, and analyzing data. Seasoned in communicating information to non-actuarial audiences, including public retirement board meetings and plan participants whether it is valuation meetings or educational sessions. Matt is active in the Missouri Association of Public Employee Retirement Systems (MAPERS).

Recent Clients

- Public School Retirement System of City of St. Louis
- City of Bridgeton, MO
- City of Clayton Uniform and Non-Uniform (Missouri)
- Ohio River Valley Water Sanitation Commission
- St. Louis County, MO
- Macon County, GA
- Delaware Public Employees' Retirement System
- Entergy Services, Inc.
- Distributors Association Warehousemen's Pension Trust

Education and Achievements

- Mathew graduated Summa Cum Laude from Maryville University with a B.S. in Actuarial Science with a minor in Business Administrations
- Fellow of the Society of Actuaries, Enrolled Actuary, Member of the American Academy of Actuaries, Charter Enterprise Risk Analyst, Fellow of Conference of Consulting Actuaries

To contact me: matthew.staback@buck.com

Jonathan Dobbs, ASA, EA, MAAA

Director, Retirement Consulting

Jonathan Dobbs is a Director in the Retirement Practice at Buck. He is a member of Buck's Global Valuation Center where he works on a broad range of retirement plans in the public and private sector. His responsibilities include, but are not limited to, managing all aspects of retirement plan valuations, performing experience studies, analyzing plan design alternatives, and projecting funding and accounting costs under multiple scenarios.

Experience

- Jon joined Buck in 2005 after serving for 15 years with two other consulting firms.
- Jon's expertise includes the actuarial analysis of design, funding, and compliance issues affecting a broad range of employee benefit plans.
- Jon currently provides annual servicing to approximately 30 Buck clients. A significant number of these are in the public sector.

Clients

- North Carolina Retirement Systems Division
- CalPERS
- City of San Diego
- Alameda-Contra Costa Transit District
- Middletown, RI
- North Miami Beach, FL
- San Joaquin Regional Transit District
- Branch County, MI
- Peace Bridge
- Taunton, MA Retirement Board
- Woburn, MA Retirement Board

Education and Achievements

- M.A. in Mathematics from Indiana University
- Associate of the Society of Actuaries
- Member of the American Academy of Actuaries
- Enrolled Actuary

To contact me: jonathan.dobbs@buck.com

Kelly L. Adams, FSA, EA, MAAA, FCA

Principal, Retirement Reviewing Actuary, Public Sector Retirement Specialty Practice Leader

Kelly Adams is a Principal, Reviewing Actuary and leader of the Public Sector Retirement (PSR) specialty practice with Buck. She works on the Central Review Team as the national public sector reviewer. In this capacity Kelly provides independent reviews of Buck's public sector retirement reports and communications for clients across the nation ensuring work completed by Buck actuaries is of high quality, complies with Buck's standards, Actuarial Standards of Practice (ASOP), any applicable laws and Governmental Accounting Standards. Her role allows her to see and understand a vast degree of differences and similarities among public sector retirement programs across the U.S. The information she gathers, which includes differences in system demographics and sponsorship, is provided to the consultants across Buck's public sector retirement practice who in turn bring this expertise and insights to their clients. She leads monthly calls with Buck's public sector actuarial consultants to share ideas and discuss current industry trends.

Experience

- 20+ years of actuarial consulting experience for defined benefit and other postemployment benefit plans.
- Joined Buck as reviewing actuary in 2018 from a national firm specializing predominantly in public sector actuarial consulting.
- Consulted clients in areas such as funding, accounting, experience studies, DROP benefits, plan design changes, plan benchmarking, and many other aspects related to retirement benefits.
- Served on prior firm's Governmental Accounting Standards Board (GASB) committee as well as the Other Postemployment Benefits (OPEB) committee.
- Assisted client's auditors in understanding GASB 43 / 45 when first implemented and then more recently GASB 67 / 68 and GASB 74 / 75.
- Extensive experience consulting Florida clients under Florida Statute Chapters 112, 175 and 185.
- Has served clients in 25 different States
- Actuarial audit services for Statewide / large municipal clients.
- Member of Buck's Office of the Chief Actuary as a public sector retirement Subject Matter Expert

Clients – As reviewing actuary – Buck's public sector retirement clients

Research and Publications – Authored paper on Variable Benefits specifically for one of Buck's largest public sector clients

Education and Achievements

- Fellow of the Society of Actuaries
- Enrolled Actuary
- Member of the American Academy of Actuaries
- Fellow of the Conference of Consulting Actuaries
- B.S. Mathematical Sciences – Actuarial Science from University of North Carolina at Chapel Hill

To contact me: kelly.adams@buck.com

Evi Laksana, ASA, MAAA

Director, Health Practice

Evi joined Buck in 2023. She is a Director within the Health practice at Buck. She works on actuarial valuations of postretirement and post-employment health and welfare benefit programs under GASB and FASB accounting, as well as numerous other projects within the health practice.

Experience

- Has considerable experience working on post-employment health and welfare benefit programs valuations for funding and accounting purposes for private sector under ASC and public sector under GASB accounting standards.
- Has extensive experience in supervising and peer reviewing actuarial valuations and financial reporting for public sector OPEB systems as well as presenting findings to Board of Trustees, Finance Department Staff, and auditors.
- Has numerous consulting experience on the management of post-employment health and welfare benefit programs liability, including but not limited to multi-year funding projections, withdrawal scenarios, and benefit provision changes.
- Has experience working on financial analysis, design, and pricing for healthcare plans, actuarial certification for MEWA health plans, Retiree Drug Subsidy Attestations, and incurred but not reported (IBNR) analyses.

Clients

- City of Pittsburgh, PA
- Alameda-Contra Costa Transit District and Trust
- New Jersey Turnpike Authority
- Office of Group Benefits of the State of Louisiana
- City of Hazleton. PA
- City of Clayton, GA
- Town of Middletown, RI
- City of Taunton, MA

Education and Achievements

Evi graduated with a Bachelor of Science degree in Actuarial Science and Statistics from Purdue University in 2004. She is an Associate of the Society of Actuaries, member of American Academy of Actuaries, and Fellow of Conference of Consulting Actuaries.

To contact me: Evi.Laksana@buck.com

Christian Hershey, ASA, MAAA

Senior Consultant, Health Practice

Christian Hershey is a Senior Consultant and actuary in the Health practice at Buck. He is responsible for actuarial valuations of postretirement and post-employment health and welfare benefit programs.

Experience

Christian joined Buck in 2014 and has over 10 years of experience in health consulting. He has a broad range of technical experience, including:

- Completion of all aspects of retiree medical benefits valuations for funding and expense purposes including data preparation, claims cost development, assumption setting, programming, analysis of results, and preparing reports.
- Projection of assets and liabilities for public sector clients to analyze funding requirements.
- Preparation of post-retirement actuarial results and analyses under numerous accounting standards, including those under FASB, GASB, and IAS.

Clients

Christian's private and public consulting clients have included:

- State of Alaska
- Clayton County, GA
- Massachusetts Bay Transportation Authority
- American Bureau of Shipping
- Americas Styrenics
- Duke University
- United Health Services Hospitals
- BWX Technologies
- DSM
- Flour Corporation
- Ingersoll Rand Inc.
- Kyo-Ya Hotels & Resorts
- SKF

Education and Achievements

He has a B.A.A. in Actuarial Science from Temple University and is an Associate of the Society of Actuaries and a Member of the American Academy of Actuaries.

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Kevin Penderghest, ASA, MAAA, FCA

Director, Health Practice

Kevin is a Director at Buck. He joined Buck in 2007 and is responsible for actuarial valuations of postretirement and post-employment health and welfare benefit programs. He currently leads Buck's OPEB Center of Excellence.

Experience

- Kevin has experience with actuarial valuations for pension plans and postretirement medical and life insurance programs under various financial reporting standards, including IFRS and GASB.
- He has experience in health care underwriting, including medical and prescription drug claims analysis. His experience also includes forecasting insured and self-insured group insurance costs used in corporate planning and budgeting.
- He has analyzed plan designs and costs for benchmarking benefits.

Clients

Kevin's clients have included:

- Clayton County, GA
- Delaware River Waterfront Corporation
- City of Havre de Grace, MD
- City of Mesa, AZ
- Office of Group Benefits of the State of Louisiana
- Pueblo County, CO
- City of San Diego, CA
- Shelby County, TN
- L3 Harris Technologies
- Merck & Co, Inc.

Education and Achievements

- Kevin graduated from the University of Delaware with an M.S. in mathematics and holds a B.S. in mathematics from Lafayette College.
- He is an Associate of the Society of Actuaries, a Fellow of the Conference of Consulting Actuaries, and a Member of the American Academy of Actuaries.

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David Driscoll, FSA, EA, MAAA, FCA

Principal, Consulting Actuary
National Public Consulting Leader

David Driscoll is a Principal and Consulting Actuary Buck, where he also serves as National Public Sector Consulting Leader. He joined Buck in 1999.

Experience

David has more than 30 years of actuarial consulting experience. Prior to joining Buck, David worked in the actuarial consulting division of a major insurance company.

- David is a frequent speaker on actuarial aspects of retirement systems and has spoken in recent years at gatherings of the Society of Actuaries, the National Conference on Public Employee Retirement Systems, the National Association of State Treasurers, and the Actuaries' Clubs of Boston and Hartford/Springfield.
- David is frequently quoted in press coverage on matters related to public retirement systems in such publications as the New York Times, USA Today, the Miami Herald and Pensions & Investments.

Clients

David's consulting clients have included:

- Alaska Retirement Management Board
- CalPERS
- Houston Firefighters' Relief and Retirement Fund
- Massachusetts Bay Transportation Authority Retirement Fund
- NBC Universal
- Public School Employees' Retirement System of Pennsylvania
- West Virginia Consolidated Public Retirement Board

Education & Achievements

- Fellow of the Society of Actuaries
- Enrolled to perform actuarial services under ERISA by the Joint Board for the Enrollment of Actuaries
- Member of the American Academy of Actuaries
- Fellow of the Conference of Consulting Actuaries
- Member, Pension Committee (2003-2006) and General Committee (2015 – 2017) of the Actuarial Standards Board
- Member (2016 – present) and Chair (2021 – present), Actuarial Board for Counseling and Discipline
- Chair, Retirement Plans Experience Committee, Society of Actuaries
- Bachelor of Arts with high distinction, Indiana University
- Master of Arts in Economics, University of Rochester
- Master of Liberal Arts in Government, Harvard University

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Jim Berberian, ASA, EA, MAAA, FCA

Principal, Reviewing Actuary

Jim manages Buck's Central Review Team that provides technical and peer review to all pension valuation clients across the US including reviewing the experience studies for Buck's public sector clients. He is a member of Buck's Office of Chief Actuary that develops policies and intellectual capital, including internal and external presentations on pension and retirement issues. Jim chairs Buck's Assumption Setting Center of Excellence.

Experience

Jim has more than 35 years of experience as an actuary working with plans ranging in size from several participants to over one hundred thousand in all sectors including public sector. Jim has worked with plans ranging in size from several participants to over one hundred thousand in all sectors including public sector. Jim's background covers plan creation and implementation, ongoing valuation and compliance including funding and accounting.

Clients

As reviewing actuary – book of Buck's pension valuation clients across the US including all public sector clients for which we conduct experience studies.

Pertinent Committees, Research, Presentations and Publications

- Society of Actuaries, Retirement Plans Experience Committee since 2016 – Committee Chair during Pub-2010 Public Retirement Plans Mortality Tables Report; Sub-Committee Chair for Pri-2012 Private Retirement Plans Mortality Tables Report; Sub-Committee member for MP mortality improvement scales since MP-2015
- Developed and presented an analysis of pension plans' mortality improvement for the New York City Office of the Actuary comparing the evolution of NYC mortality experience to the U.S. Population as reflected in annual mortality rates developed by the Social Security Administration
- Presenter of Experience Study Sessions at Enrolled Actuaries Conferences, most recently in March 2024 – also presenter for sessions on Mortality, Credibility and Mortality Improvement at Enrolled Actuaries Conferences and Conference of Consulting Actuaries Annual Meetings
- Buck Blog from 2023 – https://buck.com/do-we-really-need-an-experience-study/

Education and Achievements

- Bachelor of Arts in Mathematics and Economics from Oberlin College
- Master of Science in Statistics from The University of Texas
- Associate of the Society of Actuaries
- Enrolled Actuary under ERISA
- Member of the American Academy of Actuaries
- Fellow of the Conference of Consulting Actuaries

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Stuart Schulman, FSA, CFA, FCA, MAAA, EA

Principal, ALM Consulting Leader

Stuart Schulman is a Principal and Consulting Actuary, and ALM leader in the Financial Risk Management Group within Buck's Wealth practice. His expertise includes pension risk management and retirement and actuarial consulting services for domestic and international clients, including asset-liability management and modeling, plan design consulting, construction of pricing models and forecasts, reviews of demographic assumptions, financial reporting and other special projects for pension and postretirement benefit plans.

Experience

- Stuart has more than 30 years of experience in the field of benefit consulting.
- He is leader and manager in our Asset Liability Management (ALM) and Pension Investment Outsourcing (PIO) groups.
- Stuart's expertise includes the preparation of asset and liability forecasts including dynamic de- risking; open-group valuation methods, and stochastic simulations for ALM and other purposes.
- In addition to his ALM and Risk Management responsibilities, Stuart consults with clients on issues affecting their plans, including benefit design alternatives. He is a trusted advisor for several major clients.
- He is also responsible for reviewing the Buck Yield Curves published monthly and used by clients to discount liabilities for accounting purposes.
- Stuart has been a featured speaker at Society of Actuaries seminars, Conference of Consulting Actuaries and Enrolled Actuaries meetings, client education sessions and numerous internal continuing education sessions. He has authored articles on ALM-related topics and presented at the International Congress of Actuaries in June 2018.

Education and Achievements

- Bachelor of Arts degree in Statistics from Princeton University
- Fellow of the Society of Actuaries
- CFA Charterholder
- Fellow of the Conference of Consulting Actuaries
- Enrolled Actuary
- Member of the American Academy of Actuaries

To contact me: stuart.schulman@buck.com
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Attachment B

Sample Audit Report for Colorado PERA

Public Employees’ Retirement Association of Colorado

Actuarial Audit of December 31, 2021, Actuarial Valuations

State Division Trust Fund

School Division Trust Fund

Local Government Division Trust Fund

Judicial Division Trust Fund

Denver Public Schools Division Trust Fund

Health Care Trust Fund

Denver Public Schools Health Care Trust Fund

October 2022

110 West Berry Street
Suite 1300
Fort Wayne, IN 46802

October 14, 2022

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

Re: Actuarial Audit Report for December 31, 2021, Valuations

Dear Trustees:

Buck Global, LLC (Buck) has been retained to complete an actuarial audit of the December 31, 2021, actuarial valuations of the five Division Trust Funds and two Health Care Trust Funds of the Public Employees' Retirement Association of Colorado (PERA), as performed by Segal, the retained actuarial service provider for the PERA Board of Trustees. We would like to thank both PERA's professional staff and Segal's professional staff for their assistance and cooperation during this actuarial audit.

This report includes our findings and recommendations with respect to our actuarial audit. The Table of Contents, which immediately follows, outlines the material contained in the report. The service performed in our actuarial audit included the following:

- Review of all actuarial methods and economic and demographic actuarial assumptions currently used within the funding actuarial valuations;
- Review of any additional assumptions and new entrant profile data sets currently used in the annual funding actuarial projections;
- Replication of the most recent funding actuarial valuation census data and results as of December 31, 2021, performed on a "closed group" basis; including, but not limited to:
    - Review of the 2021 census data (both raw PERA-provided and final edited data used by the Board's actuary) for reasonability and continuity;
    - Replication of the development of the Actuarial Value of Assets;
    - Replication of the Present Value of Future Benefits and Actuarial Accrued Liability;
    - Replication of Normal Costs and Actuarially Determined Contributions; and
    - Replication of the results of the Automatic Adjustment Provision assessment.
- Replication of the most recent funding actuarial projections, based on the December 31, 2021, funding actuarial valuation results, performed on an "open group" basis; and
- Review of recent actuarial communications (most recent actuarial valuation and experience analysis reports).

The primary purpose of this report is to present the results of our actuarial audit. The report was prepared for the PERA Board of Trustees and professional staff of PERA for their use in evaluating the preparation of actuarial valuation reports and experience reviews prepared by Segal. Use of the report for any other purposes or by anyone other than PERA staff or the PERA Board of Trustees may not be appropriate and may result in mistaken conclusions because of failure to understand applicable assumptions, methods, or inapplicability of the report for that purpose. Because of the risk of misinterpretation of actuarial results, you should ask us to review any statement you wish to make on the results contained in this report. Buck will not accept any liability for any such statement made without prior review by Buck.

As discussed in the report, we believe the actuarial methods and assumptions used are reasonable for the purpose of the measurements in the report and the valuation reports comply with Actuarial Standards of Practice unless otherwise noted. We have summarized findings and recommendations that Segal and the Board of Trustees should consider for future actuarial valuations.

The results of this report are based upon participant data, financial data, Colorado statutes governing PERA and PERA administrative rules provided by PERA professional staff, as well as December 31, 2021, actuarial valuation reports and 2020 experience review reports prepared by Segal. In addition, we also relied upon verbal and written communications from PERA and Segal professional staff. Buck reviewed the final edited data used for the valuation for reasonableness and consistency with raw data provided by PERA for the valuation. The accuracy of the results presented in this report is dependent on the accuracy of the data and information provided.

Future actuarial measurements may differ significantly from current measurements due to plan experience differing from that anticipated by the economic and demographic assumptions, changes expected as part of the natural operation of the methodology used for these measurements, and changes in plan provisions, applicable law, or regulations. An analysis of the potential range of such future differences is beyond the scope of this actuarial audit.

Actuarial Standard of Practice No. 56 (ASOP 56) provides guidance to actuaries when performing actuarial services with respect to designing, developing, selecting, modifying, using, reviewing, or evaluating models. Buck used third-party software in the performance of replicating actuarial valuations and projections. The model is intended to calculate the liabilities associated with the provisions of the plans using data and assumptions as of the measurement date specified in this report. The output from the third-party vendor software is used as input to internally developed models that apply applicable funding rules to the liabilities derived and other inputs, such as plan assets and contributions, to generate many of the exhibits found in this report. Buck has an extensive review process whereby the results of the liability calculations are checked using detailed sample output. Other outputs and the internal models are similarly reviewed in detail and at a high level for accuracy and reasonability. Buck also reviews the third-party model when significant changes are made to the software. The review is performed by experts within the company who are familiar with applicable funding rules as well as the manner in which the model generates its output. If significant changes are made to the internal models, extra checking and review are completed. Significant changes to the internal models that are applicable to multiple clients are generally developed, checked, and reviewed by multiple experts within the company who are familiar with the details of the required changes.

This report was prepared under the supervision of David L. Driscoll, a Fellow of the Society of Actuaries, Member of the American Academy of Actuaries and Enrolled Actuary, Michael. A. Ribble, a Fellow of the Society of Actuaries, Member of the American Academy of Actuaries and Enrolled Actuary, and Kevin Penderghest, an Associate of the Society of Actuaries and Member of the American Academy of Actuaries.

David Driscoll and Michael Ribble meet the Qualification Standards of the American Academy of Actuaries in the retirement practice area, and Kevin Penderghest meets the Qualification Standards of the American Academy of Actuaries in the health practice area. Together, we meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained in this report. This report has been prepared in accordance with all applicable Actuarial Standards of Practice, and we are available to answer questions about it.

Respectfully submitted,

David L. Driscoll

David L. Driscoll, FSA, EA, MAAA, FCA
Principal, Wealth Practice

Michael A. Ribble

Michael A. Ribble, FSA, EA, MAAA, FCA
Principal, Wealth Practice

Kevin Penderghest, ASA, MAAA, FCA
Director, Health Practice

Table of Contents

Section

Schedules

Section I – Executive Summary

Introduction

This report summarizes our review of the results of the December 31, 2021, actuarial valuations of the five pension plans (collectively, the "Division Trust Funds") and two retiree health care subsidy plans (collectively, the "Health Care Trust Funds") as follows:

- Division Trust Funds
  - State Division Trust Fund
  - School Division Trust Fund
  - Local Government Division Trust Fund
  - Judicial Division Trust Fund
  - Denver Public Schools Division Trust Fund
- Health Care Trust Funds
  - Health Care Trust Fund
  - Denver Public Schools Health Care Trust Fund

The scope of this actuarial audit includes:

- Review of all actuarial methods and economic and demographic actuarial assumptions currently used within the funding actuarial valuations;
- Review of any additional assumptions and new entrant profile data sets currently used in the annual funding actuarial projections;
- Replication of the most recent funding actuarial valuation census data and results as of December 31, 2021, performed on a "closed group" basis; including, but not limited to:
  - Review of the 2021 census data, for reasonability and continuity regarding raw PERA-provided census data and the final edited data used by the Board's actuary;
  - Replication of the Actuarial Value of Assets;
  - Replication of the Present Value of Future Benefits and Actuarial Accrued Liability;
  - Replication of Normal Costs and Actuarially Determined Contributions;
  - Replication of the results of the Automatic Adjustment Provision assessment.
- Replication of the most recent funding actuarial projections, based on the December 31, 2021, funding actuarial valuation results, performed on an "open group" basis;
- Review of recent actuarial communications (most recent actuarial valuation and experience analysis reports).

Summary of Findings

Based on our review of the census data, experience study documents, liability replication, review of individual sample life calculations, and the actuarial valuation reports, we believe the December 31, 2021, actuarial valuations for Division Trust Funds and Health Care Trust Funds are reasonable, based on appropriate assumptions and methods, and the reports generally comply with the Actuarial Standards of Practice (ASOPs).

Division Trust Funds

The following is a summary of our key findings from the actuarial audit. Please refer to applicable sections of this report to review our findings in more detail.

- In our opinion, the methodology used to assess the reasonability of the economic assumptions complies with the guidance provided in ASOP 27, and the assumptions are reasonable.
- Based on our analysis, we believe the assumed long-term rate of investment return, in the actuary's professional judgment, is reasonable for the purpose of the measurement.
- In our opinion, the methodologies used to recommend demographic assumptions (e.g., future rates of mortality, mortality improvement, retirement, and termination of employment) comply with the guidance provided in ASOP 35, and the conclusions drawn concerning these assumptions were appropriate based on the information provided in the experience study.
- In our opinion, the actuarial methods used in the valuation, including the actuarial cost method, asset valuation method, amortization of unfunded actuarial accrued liability, administrative expense assumption, and active member growth assumption comply with applicable actuarial standards of practice and are reasonable for the purposes of the measurements.
- In our opinion, we believe the final valuation data used by the retained actuary is reasonable and valid for use in the December 31, 2021, valuations. The final data was consistent with the counts included in the report.
- We found that we were able to match to the market value of assets, cash flows and final actuarial value of assets for all five Division Trust Funds and both Health Care Trust Funds. In addition, we agree that the current asset valuation method satisfies ASOP 44.
- In our opinion, the methodologies used to recommend assumptions for future rates of active population growth comply with ASOP 27. The conclusions drawn for this assumption based on the experience study were appropriate.
- We were able to replicate Segal's 40-year actuarial projections for the Division Trust Funds within a reasonable tolerance. We were able to match the time to achieve full funding for all five divisions. In addition, the trend of the funded ratio over time was consistent between the projections modeled by us and Segal.
- In our review of actuarial communications, we found that key assumptions were properly summarized. We also made several recommendations for more accurate and transparent disclosure of certain assumptions.

- Our review has indicated that the actuarial process followed by Colorado PERA is thorough, complete, and complies with applicable Actuarial Standards of Practice (ASOPs) and U.S. Qualification Standards (USQ) of the American Academy of Actuaries (AAA).

Health Care Trust Funds

The following is a summary of our key findings from the actuarial audit. Please refer to applicable sections of this report to review our findings in more detail. We believe the report was prepared in accordance with ASOP 6, which governs the measurement of retiree group benefits obligations.

- Overall, we believe the data, methods, and assumptions used in the valuation of the Health Care Trust Funds (HCTF) are reasonable and appropriate, and in compliance with relevant Actuarial Standards of Practice. The report does not comment on the Actuarial Standard of Practice No. 6 Practice Note released in March 2021, which expands benefits that do not need to be age-adjusted to include Medicare Advantage, MA-PD, and stand-alone Medicare prescription drug plans.
- Our replication of results was within our tolerance level for present value of future benefits, actuarial accrued liability, and normal cost. We were not able to match as closely by benefit, due to the retirement decrement being applied at beginning-of-year, which is inconsistent with both how other decrements are applied for the HCTF valuations, as well as how decrements are applied for the pension valuation. One coding error was discussed with Segal, which had minimal impact on results.
- We were able to replicate the calculation of actuarial value of assets and actuarially determined contribution. Our replication of the funding projections yielded a match within 1 year for the calculation of when each Trust would be fully funded.
- Overall, we believe the Experience Study performed in 2020 was reasonable, but disclosure of the exposures included in the observation period for each assumption would assist in assessment of the actuary's recommendations.

Summary of Replication Results

The table below shows a high-level summary of liabilities for each Division and Health Care Trust Fund, with additional detail shown in Schedule A of this report. As seen in the table, our replication of results was well within our tolerance level, and we were able to replicate Segal's calculations of liabilities within an acceptable range.

Summary of Liabilities by Division Trust Fund *$ Millions*	**State**	**School**	**Local Government**	**Judicial**	**Denver Public Schools**
Actuarial Accrued Liability					
Segal	$27,159.8	$46,336.8	$5,745.0	$488.0	$4,637.9
Buck	$26,838.9	$45,828.9	$5,683.6	$487.8	$4,560.7
% Difference to Segal	*(1.2%)*	*(1.1%)*	*(1.1%)*	*(0.0%)*	*(1.7%)*
Present Value of Future Benefits					
Segal	$30,096.5	$52,746.8	$6,424.6	$570.3	$5,581.0
Buck	$29,969.9	$52,473.5	$6,419.7	$571.2	$5,546.2
% Difference to Segal	*(0.4%)*	*(0.5%)*	*(0.1%)*	*0.2%*	*(0.6%)*

Summary of Liabilities by Health Care Trust Fund *$ Millions*	**HCTF**	**DPS HCTF**
Actuarial Accrued Liability		
Segal	$1,345.5	$62.1
Buck	$1,334.2	$61.4
% Difference to Segal	*(0.8%)*	*(1.1%)*
Present Value of Future Benefits		
Segal	$1,457.7	$70.6
Buck	$1,450.8	$70.1
% Difference to Segal	*(0.5%)*	*(0.7%)*

The tables below show a high-level summary of normal cost for each Division and Health Care Trust Fund, with additional detail shown in Schedule B of this report. As seen in the table, our replication of results was well within our tolerance level, and we were able to replicate normal costs consistently with Segal.

Summary of Normal Cost by Division Trust Fund *% of Pay*	**State**	**School**	**Local Government**	**Judicial**	**Denver Public Schools**
Total Normal Cost as a % of Pay					
Segal	12.76%	14.57%	12.71%	17.15%	13.32%
Buck	12.88%	14.46%	12.91%	16.84%	13.27%
Difference to Segal	*0.12%*	*(0.11%)*	*0.20%*	*(0.31%)*	*(0.05%)*

Summary of Normal Cost by Health Care Trust Fund *% of Pay*	**HCTF**	**DPS HCTF**
Total Normal Cost as a % of Pay		
Segal	0.18%	0.14%
Buck	0.17%	0.13%
Difference to Segal	*(0.01%)*	*(0.01%)*

For all Division Trust Funds and Health Care Trust Funds, our calculation of the actuarially determined contribution rates, as a percentage of pay, differed by less than 0.7% from Segal's calculations. In addition, we were able to match the effective amortization periods for each division within two years.

A high-level summary of our replication is shown below, with additional detail shown in Schedule C of this report.

Actuarially Determined Contribution by Division Trust Fund *% of Pay*	**State**	**School**	**Local Government**	**Judicial**	**Denver Public Schools**
Segal	20.71%	21.13%	9.20%	13.83%	6.77%
Buck	20.25%	20.50%	8.93%	13.49%	6.24%
Difference to Segal	(0.46%)	(0.63%)	(0.27%)	(0.34%)	(0.53%)

Effective Amortization Period by Division Trust Fund	State	School	Local Government	Judicial	Denver Public Schools
Segal	23 years	26 years	12 years	7 years	9 years
Buck	23 years	24 years	11 years	6 years	9 years
Difference to Segal	0 years	(2) years	(1) year	(1) year	0 years

Actuarially Determined Contribution by Health Care Trust Fund *% of Pay*	HCTF	DPS HCTF
Segal	0.73%	0.24%
Buck	0.71%	0.23%
Difference to Segal	(0.02%)	(0.01%)

Effective Amortization Period by Health Care Trust Fund	HCTF	DPS HCTF
Segal	13 years	2 years
Buck	13 years	2 years
Difference to Segal	0 years	0 years

We were also able to imitate the ratio of the blended total contribution rate and the blended total required contribution. We arrived at a ratio of 99.97% compared to 98.21% for Segal. This means that under our calculation, we would also arrive at the same conclusion as Segal that the AAP assessment performed as of December 31, 2021 does not indicate the need to make automatic changes to member and employer contribution rates, the annual increase cap, and the direct distribution from the State.

We were able to replicate Segal's 40-year actuarial projections for the Division Trust Funds and Health Care Trust Funds within a reasonable tolerance. In general, we were able to match the time to achieve full funding within 1 year for all five Division Trust Funds and both Health Care Trust Funds. In addition, the trend of the funded ratio over time was consistent between the projections modeled by us and Segal.

Projected Years Until 100% Funded Based on 40-Year Projection			
Division Trust Fund	**Segal**	**Buck**	**Difference to Segal**
State Division	16 years	16 years	0 years
School Division	16 years	16 years	0 years
Local Government Division	2 years	2 years	0 years
Judicial Division	3 years	3 years	0 years
DPS Division	2 years	2 years	0 years

Projected Years Until 100% Funded Based on 40-Year Projection			
Health Care Trust Fund	**Segal**	**Buck**	**Difference to Segal**
HCTF	12 years	13 years	1 year
DPS HCTF	1 year	1 year	0 years

Detailed information showing a comparison of our projection results to Segal's projection results are shown in Schedule D of this report.

Summary of Recommendations – Division Trust Funds

The following is a summary of our key recommendations from the actuarial audit. Please refer to applicable sections of this report to review our recommendations in more detail.

- We recommend the assumed long-term rate of investment return assumption continue to be monitored given the current economic environment and our analysis indicating the current assumption of 7.25% is near the top of the range that we would consider to be reasonable.
- We recommend continued monitoring of the unfunded accrued liability of each Division Trust Fund, the pattern of amortization payments and whether the expected amortization payments are expected to fully amortize the unfunded actuarial accrued liabilities within a reasonable period and in accordance with policy objectives.
- We have the following recommendations with respect to our review of the census data used for the valuation:
  - We recommend all survivors in the valuations be tracked separately as beneficiaries.

  - We recommend that the valuation report include summaries of retirees, beneficiaries, and disabled census data and liability information separately rather than solely in the aggregate.
  - We recommend that the valuation report provide a more detailed summary for terminated vested and non-vested members.
- We recommend adding a description for post-termination death benefits prior to retirement to the plan provisions section of the report.
- We recommend review of the valuation for post-termination death benefits for active and deferred vested members to ensure it is valued in accordance with plan provisions.
- When recommending assumptions with respect to rates of termination of employment, we recommend giving more weight to recent experience in future experience studies, especially for larger divisions with more credibility in number of data observations.
- We recommend careful review of the observations to ensure proper categorization of reduced or unreduced retirement during the next experience study. For example, careful review of age rounding methodology may result in more observed unreduced retirements.
- We recommend that future experience studies review and describe the methodology of developing new entrant profiles for projections.
- We recommend future valuation reports provide demographic summaries of the new entrant profiles used in the open group projections.
- We recommend an additional statement in the valuation report that the actuaries who have performed the valuations meet the Qualification Standards “to render the statements of actuarial opinion presented in the report”.
- We recommend an additional statement that the actuaries are available to answer questions about the information contained in the report.
- ASOP 51, applicable when measuring pension obligations and determining pension contributions, requires a statement regarding the range of future actuarial measurements, which may differ from measurements presented in the report. While Segal made note of this and listed examples of factors that could cause future actuarial measurements to differ, we recommend that language be added to the Division Trust Fund report stating that the analysis of the potential range of future differences is beyond the scope of the valuation.

Summary of Recommendations – Health Care Trust Funds

The following is a summary of our key recommendations from the actuarial audit. Please refer to applicable sections of this report to review our recommendations in more detail.

- During the data preparation process, investigate records listed in the source data but also as Defined Contribution participants. 75 were excluded as of the last valuation, but it may be appropriate to include these individuals as they may be eligible for benefits from prior employment.
- Per the ASOP 6 Practice Note, remove aging from the valuation of MA-PD benefits, or provide justification why aging is still included.
- Document the justification for valuing only the employer subsidy for pre-Medicare benefits.
- Adjust the application of the retirement decrement to middle-of-year, which is consistent with other decrements' timing for the HCTF valuations as well as decrement timing for the pension valuations.
- Update coding to reflect the revised assumption regarding the percentage of disabled participants hired before April 1, 1986, assumed to qualify for premium-free Medicare Part A.
- Update the new entrant profiles used to be consistent with those used for the pension plans.
- Revisit participation assumptions for the MA-PD plans given the reduction in premiums under the new carrier.

Section II - Review of Actuarial Assumptions and Methods

We have reviewed the actuarial methods and economic and demographic actuarial assumptions used in Segal's December 31, 2021, actuarial valuations for the Division Trust Funds and the Health Care Trust Funds. To assist in our review of the assumptions and methods, we relied upon information in the actuarial experience reviews covering the period January 1, 2016, through December 31, 2019, as reported by Segal in October 2020 for the Division Trust Funds and November 2020 for the Health Care Trust Funds. The valuation reports indicate that these experience reviews formed the basis for the actuarial assumptions and methods used in these valuations. In addition, the valuation reports indicate that the Board reaffirmed the current 7.25% assumed long-term rate of investment return at the November 15, 2019, Board meeting based on the results of the 2019 Asset Liability Study. Finally, the valuation reports indicate that the Board adopted the current pension policy effective November 16, 2018, and the current OPEB funding policy effective January 19, 2018.

We also note that Actuarial Standards of Practice (ASOPs) provide guidance to actuaries when performing actuarial services. ASOP No. 27 discusses the selection of economic assumptions for the measurement of pension obligations. Similarly, ASOP No. 35 discusses the selection of demographic and other non-economic assumptions for the measurement of pension obligations and ASOP No. 4, section 3.13 discusses the selection of an actuarial cost method. In our opinion, the assumptions used in the December 31, 2021, actuarial valuations for the Division Trust Funds and the Health Care Trust Funds are reasonable, and the methodology used to select these assumptions is appropriate and consistent with the guidance provided in ASOP 27 and ASOP 35. In addition, the actuarial methods used for these funding valuations are reasonable and comply with the guidance provided in ASOP 4.

Division Trust Funds

Review of Economic Assumptions

As noted above, ASOP 27 provides guidance in the selection of economic assumptions for the measurement of pension obligations, primarily investment return, discount rate, post-retirement benefit increases, inflation, and compensation increases. ASOP 27 states that when selecting economic assumptions, the actuary should (1) identify components, if any, of the assumption, (2) evaluate relevant data, (3) take into account factors specific to the measurement, (4) take into account other general considerations, when applicable and (5) select a reasonable assumption. The actuary should also review the set of economic assumptions for consistency and adjust as necessary.

We have reviewed the economic assumptions used in the December 31, 2021, valuation for the Division Trust Funds. We have also reviewed the 2020 experience study prepared by Segal with assumption recommendations adopted by the Board, and in the case of the assumed long-term rate of return later reaffirmed by the Board based on the results of the 2019 Asset Liability Study.

The key valuation assumptions include the following:

- Assumed long-term rate of investment return: 7.25%, net of investment expenses
- Price inflation: 2.30%
- Payroll growth: 3.00% (including inflation of 2.30% and real wage inflation (or "productivity") of 0.70%)
- Salary increases assumption varies by division; full description can be found in both the December 31, 2021 valuation report for the Division Trust Funds and the 2020 experience study
- Post-Retirement Benefit Increases

We reviewed the manner in which economic assumptions were assessed in the 2020 experience study, specifically to ensure that the methods used were thorough and geared toward the development of recommended assumptions that were appropriate for the purpose of the measurements in which they would be used. We also reviewed the study to make sure the conclusions drawn based on the study were appropriate based on the information provided. We did not perform an audit of the analysis of plan experience.

Assumed Long-Term Rate of Investment Return

In order to review the assumed long-term rate of investment return assumption for the Division Trust Funds, Segal reviewed the historical investment returns of the funds over the past 5, 10, 15, 20, and 30 years, and compared the current assumption to the composite 20-year return based on the target allocation of the funds and the 20-year Capital Market Assumptions provided in the Horizon Survey of Capital Market Assumptions (2020 edition). Segal also cited a study of PERA's investments conducted by Aon in September 2019, which determined that the 7.25% investment return assumption was achievable.

In addition, we have reviewed the assumed long-term rate of investment return of 7.25%, net of investment expenses, using economic information and tools provided by Buck's Financial Risk Management (FRM) practice as well as the 2021 policy benchmark weight and long-term asset allocation target of the Funds effective January 1, 2020. A spreadsheet tool created by the FRM team converts averages, standard deviations, and correlations from Buck's Capital Markets Assumptions (CMA) that are used for stochastic forecasting into approximate percentile ranges for the arithmetic and geometric average returns. It is intended to suggest possible reasonable ranges for the assumed long-term rate of investment return without attempting to predict or select a specific best estimate rate of return. It takes into account the duration (horizon) of investment and the target allocation of assets in the portfolio to various asset classes. Based on our analysis, the percentiles generated by the tool described above indicate that the 7.25% assumption is near the top of the range that we would consider to be reasonable.

Price inflation

In reviewing the price inflation assumption for the Division Trust Funds, Segal examined 5, 10, 20, and 30-year average annual changes in the National Consumer Price Index for all urban consumers (CPI-U) as of December 31. Segal also cited 10-year and 20-year averages from respondents in the 2020 edition of the Survey of Capital Market Assumptions from Horizon. To review future inflation expectations, Segal also examined US Treasury Bond Yields, the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W) and the Philadelphia Federal Reserve Bank Survey of Professional Forecasters.

In our analysis of reasonability of the assumed long-term rate of investment return using economic information and tools from Buck's FRM practice, we also reviewed the long-term inflation expectation. The tools from the FRM specifically generate 10-year, 20-year, and 30-year (arithmetic) inflation expectations. We found that the price inflation assumption of 2.30% appears reasonable based on our analysis.

Payroll Growth

In reviewing the payroll growth assumption for the Division Trust Funds, Segal examined two key components of the assumption: inflation and real wage inflation (also referred to as productivity). Segal reviewed data published by the Social Security Administration and compared general wage growth to price inflation. Segal also summarized the historical payroll and active population growth of the Division Trust Funds.

Salary Scale

In reviewing the salary scale assumption for the Division Trust Funds, Segal examined the assumption of individuals' salary changes over the long term for each division as the sum of four components: inflation, productivity, merit, and seniority increases. Findings from the payroll growth review were used to assess inflation and productivity. Merit and seniority increases were assessed by using recent experience for each division. Segal indicated review of all divisions by both age and years since date of hire. Segal proposed salary increase rates are based on age for all divisions except Judicial, which are based on years since date of hire.

Findings – Economic Assumptions

- In our opinion, the methodology used to assess the reasonability of the assumed long-term rate of investment return complies with the guidance provided in ASOP 27.
- Based on our analysis, including review of consistency with other assumptions used in the valuation and the percentiles generated by Buck's FRM spreadsheet tool described above, we believe the assumed long-term rate of investment return, in the actuary's professional judgment, is reasonable for the purpose of the measurement.

- In our opinion, the methodologies used to develop recommended assumptions for price inflation, payroll growth and salary scale comply with the guidance provided in ASOP 27. The conclusions drawn for these assumptions in the experience study were appropriate based on the information provided.

General Commentary – Economic Assumptions

The economic assumptions used in the December 31, 2021, valuations do not appear to have been selected by Segal but rather were adopted by the Board based on recommendations from Segal. The assumed long-term rate of investment return assumption was adopted by the Board on November 18, 2016, as part of the 2016 experience study process, including the October 28, 2016, Assumptions Workshop. The assumption was also later reaffirmed by the Board based on the results of the 2019 Asset Liability Study and supported by Segal in the 2020 experience study. Other economic assumptions, including the underlying price, wage inflation, and merit and seniority increases were adopted by the Board on November 20, 2020, as part of the 2020 experience study process.

We should note that Section 4.2 of ASOP 27 covers disclosures about assumptions that have not been selected by the actuary and indicates that the actuary's report should identify the following, if applicable:

a. any such assumption that significantly conflicts with what, in the actuary's professional judgment, is reasonable for the purpose of the measurement (section 3.14); or
b. any such assumption that the actuary is unable to assess for reasonableness for the purpose of the measurement (section 3.14).

While ASOP 27 does not directly require the actuary to state an opinion, silence on the matter of the reasonableness of the assumptions implies that the actuary finds them reasonable. While Segal supports the economic assumptions selected by the Board in the 2020 experience study report, we recommend that future actuarial valuation reports include a statement supporting the continued belief in the reasonableness of the assumptions as of the valuation date.

Recommendations – Economic Assumptions

- We recommend the assumed long-term rate of investment return assumption continue to be monitored as our results indicate the current assumption of 7.25% is near the top of the range that we would consider to be reasonable.
- We recommend that Segal comment on the reasonability of the long-term rate of return assumption in future actuarial valuation reports.
- We note the executive summary of the 2020 experience study report indicates that the assumed investment rate of return is net of investment expenses. However, we recommend future experience studies clarify this point more prevalently in the investment rate of return section of the report.

- We note that the experience study did not include review or discussion of the assumption to be used for future post-retirement benefit increases. Further, we note that, for applicable members, this assumption changed from 1.25% per year in the December 31, 2020, valuation, to 1.00% per year in the December 31, 2021, valuation. We understand that this change in assumptions coincides with changes to provisions initiated by the Automatic Adjustment Provision as part of the funding policy. In fact, it appears that any liability decreases attributable to the decrease to the AI cap and coinciding assumption changes are bundled together in various parts of the report (e.g., reconciliation of ADC rates and UAAL amortization schedules). While we agree with this approach, we have the following recommendations:
  - Future experience studies should address the post-retirement benefit increase assumption if only to recommend and document that the long-term postretirement increase assumption be set equal to the current AI cap, where applicable.
  - Include a description of the change in assumption for future post-retirement benefit increases in the actuarial valuation report, when applicable, even if such assumption change is made in parallel with the Automatic Adjustment Provision impact on the AI cap.

Review of Demographic Assumptions

As noted above, ASOP 35 provides guidance in the selection of demographic and other noneconomic assumptions for pension obligations, most notably assumptions with respect to assumed future rates of mortality and mortality improvement, retirement, and termination of employment. ASOP 35 states that when selecting demographic assumptions, the actuary should select each assumption based on the universe of available tables considering such factors as (1) the purpose and nature of the measurement, (2) plan design features or changes in plan design, (3) appropriate experience from the specific plan, and (4) relevant factors known to the actuary that may affect future experience. Plan experience may be useful in forming a judgement, but the actuary should not give undue weight to experience that is not sufficiently credible nor to experience that may not be relevant to future expectations.

We have reviewed the demographic assumptions used in the December 31, 2021, valuation for the Division Trust Funds. We have also reviewed the 2020 experience study prepared by Segal with assumption recommendations adopted by the Board. The demographic assumptions reviewed included rates of mortality and mortality improvement, rates of termination, rates of retirement, and other demographic assumptions.

We reviewed how the demographic assumptions were assessed in the 2020 experience study, specifically to ensure that the methods used were thorough and appropriate to the measurements. We also reviewed the study to make sure the conclusions drawn based on the study were appropriate based on the information provided. We did not perform an audit of the analysis of plan experience.

Rates of Mortality and Mortality Improvement

To review the mortality assumption for the Division Trust Funds, Segal first reviewed tables of four types of members in each division: healthy post-retirement mortality, disabled mortality, beneficiary mortality and pre-retirement mortality. Segal used a benefit-weighted approach to review mortality experience, i.e., the calculated probability of death was weighted by the amount of each annuitant's benefit. In addition, Segal included adjustments for PERA-specific experience and applied either full or partial credibility, depending on the numbers of deaths observed within the group analyzed.

Retirement Rates

In assessing the retirement assumption for the Division Trust Funds, Segal used a benefit-weighted basis to and analyze experience for three groups: those eligible for a reduced benefit, those eligible for an unreduced benefit in the first year only, and those eligible for an unreduced benefit in all other years.

Termination Rates

In reviewing the termination assumption for the Division Trust Funds, Segal examined experience by age, service, and division. Segal proposed "select and ultimate" termination rates for all groups other than State Troopers, the Judicial Division, and the DPS Benefit Structure. All select termination rates are unisex and apply to applicable members until five years after hire date. All other rates proposed are ultimate rates and vary based on age. The proposed ultimate rates also varied by gender except for State Troopers and the Judicial Division. As in the case of mortality and retirement rates, experience was reviewed on a benefit-weighted basis. Finally, with the exception of the DPS Division (PERA Benefit Structure), proposed rates of termination were the result of the weighted average of two-thirds of the existing assumed rates (i.e., those established on the basis of previous experience studies) and one-third of rates based on recent experience (i.e., the period under examination for the 2020 experience study).

Other Demographic Assumptions

Other demographic assumptions reviewed in the 2020 experience study for Division Trust Funds included refund of contributions, disability retirement and spouse information. Disability retirement was reviewed by age. Very little data was available to assess refund of contribution experience for the Judicial Division and State Troopers. Consequently, Segal recommended no change to the prior assumptions. In addition, Segal indicated there was limited data available for the examination of marital status and spouse information but stated that current assumptions are reasonable and consistent with those used by other comparable plans.

Findings – Demographic Assumptions

In our opinion, the methodologies used to recommend assumptions for future rates of mortality, mortality improvement, retirement and termination of employment comply with the guidance contained in ASOP 35.

Recommendations – Mortality Assumptions

- When commenting on the recommended mortality table and improvements, the recommendation by Segal was to update the mortality improvement scale to Scale MP-2019 released by the Society of Actuaries in October 2019. The experience study provided no comment as to whether the mortality improvement scale would be updated in subsequent valuations based on future updates from the Society of Actuaries. We have no issue with keeping the mortality improvement scale the same until the next experience study. However, we recommend providing clarity in the next experience study as to whether the mortality improvement scale is to be updated each year. Based on the December 31, 2021, valuation it appears the intent is that Scale MP-2019 will be used in each valuation until a new table is recommended, likely as part of the next experience study.

Recommendations – Retirement Rates

- When reviewing the experience as shown in the report, we note that the reduced retirement rates assumed at age 59 are relatively high and are higher than rates shown at the same age for unreduced retirement. This may be caused by some observations during the experience study being categorized as reduced retirements instead of unreduced retirements. In our experience, we have observed age and service rounding issues result in mapping members into the wrong retirement eligibility group. We recommend careful review of the observations to ensure proper categorization of reduced or unreduced retirement during the next experience study. Assuming more members retire with eligibility for a reduced benefit when actual experience results in a higher number of members retiring with eligibility for an unreduced benefit would result in actuarial losses in future valuations.
- With regard to how these assumed retirement rates are presented in the valuation report, we note that for all divisions, the December 31, 2021, valuation report states that Deferred Vested (DV) members are assumed to retire at age 62 with a pension benefit, and the 2020 experience study report states that DV members are assumed to retire at age 62 with an unreduced pension benefit. We recommend Segal clarify that DV members are assumed to retire as soon as they are eligible for an unreduced pension benefit (whether that is upon attainment of age 62, 65 or some date in between).

Recommendations – Termination Rates

- As noted above, Segal proposed rates of termination by weighting two-thirds based on the current assumption (i.e., previous experience studies) and one-third based on recent experience (i.e., the period under examination for the 2020 experience study). We recommend giving more weight to recent experience in future experience studies, especially for larger divisions with relatively greater credibility. Assuming more members terminate employment prior to retirement eligibility when actual experience suggests that a higher number of members actually reach retirement eligibility would likely result in actuarial losses in future valuations.

Recommendations – Other Demographic Assumptions

For the Denver Public Schools (DPS) Division, both the experience study and valuation report state that the marital assumption is "80% for members of the DPS Division Trust Fund". It is unclear whether this applies to members of the DPS by division, or by the DPS benefit structure. We recommend Segal clarify that the assumption applies to members with the DPS benefit structure.

Review of Actuarial Methods

We have also reviewed the actuarial methods used in the December 31, 2021, valuation for the Division Trust Funds. As noted above, ASOP 4 provides guidance in the selection of an actuarial cost method. ASOP 44 provides guidance regarding the selection of an asset valuation method and appropriate disclosures regarding the method.

In the 2020 experience study for Division Trust Funds, Segal reviewed the actuarial cost method, asset valuation method, amortization of unfunded actuarial accrued liability, administrative expense assumption, and active member growth assumption.

Actuarial cost methods are used to allocate the total present value of future benefits to past, current, and future service. The value of past service is used to determine the actuarial accrued liability and the cost of benefit accruing during the upcoming year determines the normal cost. The entry age normal cost method used by PERA tends to result in a normal cost that stays level as a percent of pay over a member's career. As Segal stated, for this reason the entry age normal cost method is the most widely utilized method for U.S. public sector retirement systems.

Asset valuation methods smooth or average the market value returns over time to alleviate contribution volatility that results from market returns. PERA currently uses a smoothed market value method where asset returns that differ from the expected return on market value of assets are reflected over a four-year period. The asset valuation method does not restrict the actuarial value of assets to a "corridor" (i.e., to differ from the market value of assets by not more than a certain percentage).

Amortization methods determine the payment schedule for reducing the unfunded actuarial accrued liability (UAAL or the difference between the actuarial accrued liability and actuarial value of assets). For purposes of determining the actuarially determined contribution rates, the amortization method for PERA is as follows:

- Amortization payment is determined based on a level percentage of pay basis. This means that future amortization payments are assumed to grow at the same rate as future payroll growth, or 3% per year. When payroll does not grow at that rate, the payoff of the UAAL will not be paid off as assumed.

- Amortization periods are closed, meaning that the amortization period of each amortization base will decrease by one year in each subsequent valuation until reaching zero years.
- Amortization periods are multi-layered, meaning that actuarial gains and losses and other changes that impact the UAAL in a subsequent valuation will be amortized over a new time period.
- The length of the amortization periods varies by source of the change in UAAL. As of December 31, 2021, the legacy UAAL as of December 31, 2017, and any subsequent balances due to contribution deficiencies/(surpluses) resulting from the funding policy have 26 years of amortization remaining. Actuarial experience gains and losses and the impacts of any assumption changes are to be amortized over 30 years. The amortization periods for the impacts of benefit enhancements or reductions are amortized over periods determined on the basis of the nature of the benefit changes and the demographics of the groups impacted by the changes, but in any case will not exceed 25 years.
- The funding policy also provides contingent amortization procedures if a division has a negative UAAL and further adjustments occur if the AAP resulting ratio equals or exceeds 120%.

Findings - Actuarial Methods

In our opinion, the actuarial methods used in the valuation including the actuarial cost method, asset valuation method, amortization of unfunded actuarial accrued liability, administrative expense assumption, and active member growth assumption comply with applicable actuarial standards of practice and are reasonable for the measurement.

Commentary and Recommendations – Actuarial Methods

- The asset smoothing method used for both the pension and OPEB plans involves deferred recognition of investment gains and losses but does not incorporate a corridor or any other mechanism whereby the “smoothed” value would be constrained from deviation to an excessive degree from market value. In the experience study reports, Segal argues (correctly) that constraining differences of the smoothed value from market value is not necessary if the smoothing method “recognizes differences from market value in a sufficiently short period,” and that four years is a defensibly short period. We would suggest that this claim (which we think is valid) be made in the assumptions and methods sections of the valuation reports.
- For information on our review of the actuarial value of assets, please refer to Section V - Review of Actuarial Valuation Results.
- The amortization periods used to calculate the contribution rates against which the fixed contribution rates are compared to determine their adequacy do not exceed any limits codified an any actuarial standard of practice. The Conference of Consulting Actuaries’ Public Plans Community (CCA PPC) published a white paper entitled “Actuarial Funding Policies and Practices for Public Policies and Practices.” The CCA white paper is intended to provide model practices for

applying a Level Cost Allocation Model (LCAM) not general best practices for funding public pension plans. Further, the CCA white paper states, *“Some pension plans have contributions rates that are set on a fixed basis, rather than being regularly reset to a specific, actuarially determined rate. The CCA PPC believes that such plans should develop an actuarially determined contribution rate for comparison to the fixed rate. However, this white paper does not address procedures for evaluating that comparison, or for determining whether the fixed rate is sufficient or when and how the fixed rate should be changed.”*

- We understand that the current amortization periods were selected to assist in comparing and monitoring the effectiveness of PERA’s funding policy, including the Automatic Adjustment Provision. We do note that the amortization periods for the Division Trust Fund valuations exceed those found in the “LCAM Model Practices” for amortization periods, as set forth in the CCA white paper. The LCAM is a defensible and “well established actuarial practice” that Colorado PERA may want to use to determine the adequacy of fixed contribution rates. Having said that, the CCA white paper includes a footnote that states, “*Some commentators have interpreted ‘model practices’ as synonymous with ‘best practices.’ That is not the intent of this categorization of practices. Given their circumstances retirement boards may find that other practices, particularly those categorized and acceptable or acceptable with conditions, are considered both appropriate and reasonably consistent with the policy objectives stated herein.”*
- Focusing on the broader amortization method utilized in the Division Trust Fund valuations to calculate the Actuarially Determined Contribution (ADC), we note the following:
  - The combination of the 30-year amortization period for most bases and the 3% assumed payroll growth assumption results in a negative amortization pattern. A negative amortization pattern means that for the first several years of the amortization period, the amortization payment drawing down the outstanding balance on the unfunded actuarial accrued liability does not exceed the interest on the unfunded actuarial accrued liability. Essentially, the unfunded actuarial accrued liability continues to grow for the first few years of the amortization period.
  - Longer amortization patterns exceed the average future service of active and therefore spreads the cost longer than while in active service. In order to balance intergenerational equity with volatility management, an amortization period closer to the average future service of active members should be considered.
  - We recommend reviewing the amount and duration of negative amortization occurring in each division and considering whether such pattern aligns with Colorado PERA’s funding policy objectives.
  - We note that the most recently updated version of ASOP 4, *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions*, will be effective for actuarial reports issued on or after February 15, 2023 that also have a measurement date on or after February 15, 2023. Specifically, the soon-to-be effective ASOP 4 addresses amortization methods, adds requirements with regard to disclosure of amortization methods and indicates factors the actuary should in consider in selecting a method, which include, amongst other items the

anticipated pattern of the payments, including the length of time until the payments exceed interest on the outstanding balance. The actuary will also need to assess whether the unfunded actuarial accrued liability is expected to be fully amortized and will need to select a method that will fully amortize the unfunded actuarial accrued liability within a reasonable time period or reduce the unfunded actuarial accrued liability by a reasonable amount within a sufficiently short period. The revised standard will also require the actuary to make a statement regarding whether the actuarial accrued liability is not expected to be fully amortized.

Health Care Trust Funds

The valuation of the HCTF plans relies on a number of assumptions used by the pension plans, including rates of retirement, termination, disability, mortality, and salary scale. The HCTF valuations use the headcount-weighted versions of the base mortality tables used for the pension valuations, which we believe is appropriate. In addition, the actuarial cost method, asset valuation method, and amortization method were selected to be consistent with the pension plans. Below is a summary of our review of assumptions specific to the HCTF valuations.

Per Capita Cost Assumptions

Based on our review of the valuation report, we assume that only the PERA/DPS subsidies are valued for pre-Medicare medical and prescription drug benefits and most Medicare medical and prescription drug benefits. For enrollees who are age sixty-five or older and who are either not eligible for premium-free Medicare Part A or where the selected plan premium is lower than the service-based subsidy, per capita health care costs of the Medicare plans are adjusted to reflect expected health care cost changes related to age. These costs are based on 2022 MA-PD premiums.

<u>Findings – Per capita cost assumptions</u>

For pre-Medicare benefits, we believe the approach described above is reasonable, as any costs beyond the PERA/DPS subsidies to purchase coverage will be paid by retirees. In addition, it is our understanding that the premium is set to include the entire cost of coverage, such that no implicit subsidy exists. There is no documentation in the report providing justification for this methodology. We recommend documenting the justification for no age-related implicit subsidy for pre-Medicare coverage in future reports.

Similarly, valuing only the PERA/DPS subsidies for most Medicare participants is reasonable as any costs beyond the PERA/DPS subsidies to purchase coverage will be paid by retirees.

For enrollees who are age sixty-five or older and who are either not eligible for premium-free Medicare Part A or where the selected plan premium is lower than the service-based subsidy, we believe using 2022 premiums as a basis for these costs is appropriate. The Actuarial Standard of Practice (ASOP) No. 6 Practice Note released in March 2021 expands benefits that do not need to be age-adjusted according to Section 3.7.7 (c) to include Medicare Advantage, MA-PD, and stand-alone Medicare prescription drug plans. Risk adjusted federal subsidies received under these plans are intended to eliminate any difference in costs due to age, gender, or health status. Currently aging is still reflected for MA-PD benefits, but the report does not include justification for this assumption or any discussion of this Note. We believe it is appropriate to either remove aging from the cost assumption for the MA-PD plans or provide documentation explaining why it is appropriate for aging to still be reflected.

Health Care Cost Trend

Based on our review of the valuation report, health care cost trend rates for the Medicare plans are based on published annual health care inflation surveys in conjunction with actual plan experience (if credible), building block models and industry methods developed by health plan actuaries and administrators. Increase rates for Medicare Part A premiums are based on projected trends for the Federal Hospital Insurance Trust Fund (Medicare Part A premiums) provided by the Centers for Medicare & Medicaid Services.

Findings – Health Care Cost Trend

The sources cited by the actuary for the trend assumptions are appropriate. Based on Buck's review of similar source information to recommend trend assumptions for similar plans, we believe the assumptions used are reasonable.

Non-Economic Assumptions

Non-economic assumptions specific to the HCTF valuations are primarily based on historical experience from 2016 through 2019. These include assumptions related to participation, coverage of dependents, Medicare eligibility, plan election, and commencement of benefits for inactive members. Participation rates for future retirees vary by age at retirement. Changes to assumptions were generally selected by beginning with the midpoint of the current assumption and the assumption indicated by the experience reviewed, with adjustments made for credibility of the experience. While the midpoint approach is reasonable, we recommend for future studies to include the number of exposures included in the experience for each assumption analyzed. A higher number of exposures for a particular assumption would support a recommendation aligned with recent experience, while a lower number would support a recommendation closer to the current assumption. Disclosing the exposure information would help assess the reasonability of the actuary's recommendations.

Findings – Non-Economic Assumptions

The overall methodology of selecting non-economic assumptions is reasonable. Please note the following recommendations:

- Upon review of sample lives provided by Segal for the pension and HCTF valuations, Buck observed significant differences between the present value of future salary amounts for the same records between the pension and HCTF valuations. Since eligibility for benefits and assumptions regarding decrements and salary growth are consistent between the pension and HCTF plans (except for the use of headcount-weighted vs. amount-weighted mortality tables), we would expect these values to be consistent. Buck reached out to Segal regarding this discrepancy, and Segal confirmed that all decrements were being applied at middle-of-year for the HCTF valuation, except for the retirement assumption, which is applied at beginning-of-year. This is inconsistent with how pension decrements are applied, which are all applied at middle-of-year (except for when 100% retirement is assumed, which uses beginning-of-year timing). Buck does not believe decrements should be applied differently for pension and HCTF benefits and did not identify any provisions of the plan or characteristics of the population that would indicate assuming beginning of year retirement is appropriate. We recommend updating this assumption to be consistent with the valuation of the pension plans.

- The report documents separate assumptions for the commencement of benefits for active participants expected to terminate at a future date and current inactive members. Buck reached out to Segal to confirm that separate assumptions are used, and Segal confirmed that the assumptions listed for active participants are used for current inactive members. We recommend clarifying that the assumption used for active participants is also used for current inactive members in the report and remove the language regarding the assumption for current inactive participants since this is not used in the valuation.

- Participation rates have decreased overall based on the data provided in the most recent experience study. Given the subsidy provided is not expected to increase over time, while premiums are expected to increase with healthcare cost trend, this decrease is reasonable and expected to continue over time. Given this, we recommend analyzing the number of participants who drop coverage after initially electing and implementing a persistency assumption if the experience supports this to reflect expected lower participation over time.

- Subsidies for the retiree health plan are based on years of service completed, which indicates participation is correlated to years of service. We recommend considering basing participation on years of service instead of the current assumptions which only consider age at retirement.

- Segal notes in their 2020 experience study that plan election assumptions should be reviewed annually given evolving health care market forces that cause volatility year to year. We also recommend that participation assumptions be reviewed annually for this reason. In particular, Medicare Advantage premiums decreased significantly in 2022 in conjunction with the change in plan carrier and cost sharing provisions. This decrease in premiums will likely impact participation in the plans for future retirees as the employer subsidy will now cover a larger percentage of the plan premium. We recommend an increased initial participation assumption be considered given the magnitude of the change.

- The percentage of disabled participants hired before April 1, 1986, assumed to qualify for premium-free Medicare Part A was increased from 90% to 95%. The 2020 experience study indicates the last 4 years of experience is consistent with the initial assumption (90% vs 91%). We recommend clarifying why this assumption was changed based on the experience presented.

Section III - Review of Census Data

As part of our actuarial audit, we received several sets of census data files for both the Division Trust Funds and the Health Care Trust Funds. We received preliminary census data ("raw data"), including active members, inactive members, retirees, and beneficiaries as of December 31, 2021, as originally provided by Colorado PERA to the retained actuary Segal for the actuarial valuations. We also received correspondence between Segal and Colorado PERA regarding any questions about the preliminary data. Additionally, we received final census data ("final edited data"), including active members, inactive members, retirees, and beneficiaries as of both December 31, 2020, and December 31, 2021, as used by Segal for the actuarial valuations. We also received data field descriptions and summaries for both the raw data from Colorado PERA and the final edited data from Segal detailing the significance of the data fields provided.

We used this data, along with the census summaries included in the valuation reports, to review the valuation data process. Specifically, for active members, we reviewed number counts and average pay, age, and service amounts. For inactive members, we reviewed number counts, and for retirees and beneficiaries, we reviewed number counts and average annual benefit amounts to ensure the appropriate final census was used in the calculation of the liabilities. For all members, we reviewed counts by division and by benefit structure, where applicable. We also compared the preliminary census from Colorado PERA to the final census from Segal to ensure missing members and/or information was addressed.

In addition to reviewing the data for reasonability, we reviewed the data summaries and statistics shown in the final valuation report to make sure that sufficient information was provided to inform the review of the report by a third party.

We have some recommendations regarding the census data and demographic information shown in the valuation report.

Findings – Census Data

In our opinion, we believe the final valuation data used by the retained actuary is reasonable and valid for use in the December 31, 2021, valuations. The final data was consistent with the counts included in the report.

Recommendations – Census Data

Division Trust Funds

In the final census data used by Segal to perform the final December 31, 2021, for all divisions, many survivors are tracked under a retiree record with a separate field identifying that the original retiree had deceased. However, not all survivors and beneficiaries are tracked in this manner.

- We recommend all survivors should be tracked as beneficiaries rather than retirees in their own record for internal consistency.

We also recommend some additional data disclosures:

- We recommend that the valuation report include summaries of retirees, beneficiaries, and disabled census data information separately rather than solely in the aggregate.
- We recommend that the valuation report provide a more detailed summary for terminated vested members, specifically showing average benefits at unreduced retirement age and the average age of terminated vested members as of the valuation date.
- We recommend that the valuation report provide a more detailed summary for inactive non-vested members, specifically showing the total balance of contributions due.
- The average expected remaining service life for Local Government Division State Troopers in the valuation report was reported as 8.22 years. Based on Buck’s review of the final edited census data and calculation of liabilities, the average expected remaining service life was much higher at 15.63 years. Segal noted assumptions for Local Non-Troopers were applied to the 29 members of the Local Troopers group. We recommend Segal apply the correct assumptions for these members in future valuations. We anticipate the adjustment would not have a material impact on the results of the valuation.

The following comments only apply to internal data fields received from Segal as part of the actuarial audit. While the recommendations could certainly aid in future actuarial audits, Segal might find that some of the recommendations improve efficiency or reduce the risk of future errors.

- The “Entry Age” field was provided by Segal but is not used to value Entry Age Normal (EAN) liabilities. Benefit service is used to determine the funding span for EAN liabilities.
- Deferred vested accrual amounts (“Acru1” field) were provided by Segal but are not used to determine liabilities. In addition, amounts in the field were calculated inconsistently with the valuation of final benefits. Accrued benefits for deferred vested members were calculated based on the final average salary (“HAS”) and benefit service (“Esvc”) fields. We recommend that the “Acru1” field either be updated to make it consistent with the valuation of benefits in the plan’s liabilities or be omitted from the data to avoid confusion.
- We recommend that pop-up annuity amounts be provided explicitly in a separate data field. Pop-up benefit amounts were not provided in the data received from Segal. Calculations were required across multiple data fields from the original client data to obtain these amounts, which compromises transparency when reviewing the data and opens the possibility for errors.
- The description of the “DCBAL1” field containing the balance of contributions under the Defined Contribution (DC) plan was unclear as to whether it included employer contributions. We recommend updating data field descriptions to clarify that employer contributions are excluded from the DC balance field.
- Active participant data was originally provided by Segal without the historical pay information, used to determine the Actuarial Accrued Liability. We recommend including historical pay information used to calculate plan liabilities in the data.

- We recommend that Segal review and update their data field descriptions to incorporate additional clarity for the fields provided. In particular, the “CERT1” field for certain periods was provided in years, not months. Also, the “ATE111” data field for January 1, 2011, retirement eligibility has a default value of blank that was not consistent with the participant tiers. Lastly, the description of the “Sal01” field for current-year salary should clearly state whether it contains prior earnings for the year ending December 31, 2021, or a salary rate in effect as of January 1, 2022.

Health Care Trust Funds

- Our review of the census data used for the HCTF valuations confirmed that the same active and terminated vested data was used for the pension and HCTF valuations.
- We performed a comparison of the source and final retiree data for the HCTF valuations. Overall, these files are consistent, but Buck noted the following:
  - 75 records in the source data were not included in the final data. These individuals were reported in the Defined Contribution (DC) census; Segal has confirmed that these records were intentionally excluded since they were DC participants. We recommend for future valuations that records like this be questioned as they could be eligible for OPEB benefits from prior employment, and later re-hired as a DC participant.
  - Fewer than 10 other records were either identified as participants receiving benefits in the source data but excluded from the final data or identified as non-participants in the source data but included in the final data. While it was not clear why these data adjustments were made, the adjustments do not have a material impact on the results of the valuation.
- The final data was consistent with the counts included in the report. We would recommend some additional data disclosures that would help compare census information between valuations:
  - Average age and service for the active population, including an age/service scatter (in 5-year increments).
  - Active counts by division
  - Average age and service for deferred vested participants.
  - Inactive counts by age (in 5-year increments)
- In addition, retiree data is reported as “under age 65” vs “age 65 and older” on page 57, while actives are summarized by “Eligible for Medicare” on pages 16 and 17 with the footnote “State and Local Government Division employees hired (or rehired) after March 31, 1986, are subject to mandatory Medicare coverage.” This is misleading, because the active eligible for Medicare count is the number over age 65, regardless of whether they were hired before or after March 31, 1986.

Section IV – Review of Actuarial Liabilities

The steps followed in our replication of actuarial liabilities are described below.

We requested a copy of the final December 31, 2021, valuation report for the five Division Trust Funds and two Health Care Trust Funds of Colorado PERA, and completed the following steps:

1. We requested:
   a) The complete decrement tables used by Segal to prepare the valuation
   b) The final participant data used in generating the valuation report
   c) The key actuarial results presented in each valuation report (Normal Cost, Actuarial Accrued Liability, Present Value of Future Benefits, etc.) both in the aggregate as well as with specific subtotals of liabilities, including liability by benefit type for active members and liabilities by status.
   d) Sample participant liabilities for different members in different divisions and across different statuses
   e) Sample individual benefit calculations to ensure benefits are calculated consistently with plan administration

2. Colorado PERA also provided:
   a) Colorado PERA Law including legislation enacted in 2021
   b) Colorado PERA Rules effective January 1, 2022
   c) Enacted legislation passed during 2022 that impacted the funds
   d) PERA Administrative Rules as of January 1, 2021

3. Using the information provided in the valuation report and in 1(a) and 1(b) above, we produced a valuation for the plan using ProVal®, a commercially available valuation system used worldwide by actuaries and investment professionals. We refined our understanding of the provisions based on information provided in item (2) above and the summary of the plan provisions stated in Colorado PERA's 2021 Annual Comprehensive Financial Report. We independently generated the key actuarial results for comparison to results published in the actuarial valuation report.

4. In the reconciliation process, using the data provided in 1(b) above and the output from ProVal®, we compared the key results in total for the present value of future benefits, actuarial accrued liability, and normal cost. We also compared each of these values by status and by benefit type. We then used the sample participant liabilities to continue our refinements. Throughout this process, we communicated our progress and discussed issues with our replication with Colorado PERA and Segal through conference calls and emails. As needed, we requested additional sample lives to help resolve differences.

5. In matching to liability calculations, we generally aim to arrive at aggregate results that fall within a 5% tolerance level. Although we may initially fall within 5% of the liability calculations in the aggregate, we also compare subtotals by status as well as by benefit type. The reason we review calculations in total as well as by different subtotals is that aggregate valuation results that differ by less than 5% in total may camouflage systematic errors with respect to particular types of participants. Comparing results by benefit type, by status and by individual sample participant calculations helps us to detect any discrepancies and ensure that differences in aggregate that fall within the tolerance indeed indicate we are valuing liabilities appropriately.

Note that in the following tables of this section numbers may not sum due to rounding. We have shown the “Difference to Segal” as the excess/(deficiency) of the Buck value over/(under) the Segal value. We have shown “% Difference to Segal” as the percentage excess/(deficiency) of the Buck value over/(under) the Segal value.

Division Trust Funds

The table below shows a high-level summary of liabilities by status for each division. As seen in the table, our replication of results was well within our tolerance level, and we were able to replicate liabilities consistently with Segal. The tables in Schedule A of this report also provide a more detailed comparison of each plan’s liabilities by status and by benefit type.

Liabilities by Status and Division Trust Fund
$ Millions

	State	School	Local Government	Judicial	Denver Public Schools
Segal					
Active Members - Actuarial Accrued Liability					
Active	$8,080.6	$16,573.0	$1,766.9	$156.3	$1,716.3
Active Members - Present Value of Future Benefits					
Active	$11,017.3	$22,983.0	$2,446.5	$238.6	$2,659.5
Inactive					
Terminative Vested	$641.5	$1,071.3	$244.7	$4.3	$121.2
Terminated Non-Vested	193.1	304.6	59.3	0.2	51.8
Subtotal	$834.6	$1,375.9	$304.0	$4.5	$173.0
Members in Receipt of Payments					
Retirees	$17,283.6	$27,571.3	$3,471.3	$315.5	$2,648.8
Disableds	747.7	623.1	161.5	8.3	77.0
Beneficiaries	213.3	193.4	41.4	3.4	22.8
Subtotal	$18,244.6	$28,387.8	$3,674.2	$327.2	$2,748.6
Actuarial Accrued Liability	$27,159.8	$46,336.8	$5,745.0	$488.0	$4,637.9
Present Value of Future Benefits	$30,096.5	$52,746.8	$6,424.6	$570.3	$5,581.0
Buck					
Active Members - Actuarial Accrued Liability					
Active	$7,919.0	$16,309.7	$1,734.0	$155.6	$1,664.7
% Difference to Segal	*(2.0%)*	*(1.6%)*	*(1.9%)*	*(0.5%)*	*(3.0%)*
Active Members - Present Value of Future Benefits					
Active	$11,050.0	$22,954.2	$2,470.0	$239.0	$2,650.3
% Difference to Segal	*0.3%*	*(0.1%)*	*1.0%*	*0.2%*	*(0.3%)*
Inactive					
Terminative Vested	$646.1	$1,078.0	$246.3	$4.3	$121.1
Terminated Non-Vested	193.1	304.6	59.3	0.2	51.8
Subtotal	$839.2	$1,382.6	$305.6	$4.5	$172.9
% Difference to Segal	*0.6%*	*0.5%*	*0.5%*	*0.3%*	*(0.0%)*
Members in Receipt of Payments					
Retirees	$17,120.2	$27,321.5	$3,441.2	$316.0	$2,625.7
Disableds	747.6	622.5	161.5	8.3	76.9
Beneficiaries	212.8	192.6	41.3	3.4	20.4
Subtotal	$18,080.6	$28,136.6	$3,644.0	$327.7	$2,723.0
% Difference to Segal	*(0.9%)*	*(0.9%)*	*(0.8%)*	*0.2%*	*(0.9%)*
Actuarial Accrued Liability	$26,838.9	$45,828.9	$5,683.6	$487.8	$4,560.7
% Difference to Segal	*(1.2%)*	*(1.1%)*	*(1.1%)*	*(0.0%)*	*(1.7%)*
Present Value of Future Benefits	$29,969.9	$52,473.5	$6,419.7	$571.2	$5,546.2
% Difference to Segal	*(0.4%)*	*(0.5%)*	*(0.1%)*	*0.2%*	*(0.6%)*

As shown in the tables above, when grouping present value of future benefits by status, Buck's calculations are within 1% across each division and status. This liability measurement gives us confidence that we have benefits and assumptions coded very consistently with Segal. For actuarial accrued liability, the discrepancy is slightly larger, up to a maximum of 1.7% for DPS when comparing total actuarial accrued liability and up to maximum of 3.0% for DPS when only comparing actuarial accrued liability for active members. The actuarial accrued liability is calculated using the entry age normal cost method, which spreads the normal cost as a level percentage of payroll over the funding span for each active member. There are inherent differences in the details of how this spread is accomplished from valuation system to valuation system and actuary to actuary. Therefore, it is normal and expected to see a larger difference in the accrued liabilities and normal cost as compared to the present value of future benefits. Although the discrepancy is larger on this measurement, these differences are still within the 5% tolerance.

In addition to reviewing liability measurements, we also replicated the calculation of the normal cost rates used in the calculation of the actuarially determined contribution.

Normal Cost by Division Trust Fund
% of Pay

	State	School	Local Government	Judicial	Denver Public Schools
Segal					
Normal Cost as a % of Pay					
Total Normal Cost as a % of Pay	12.76%	14.57%	12.71%	17.15%	13.32%
Less Member Contribution Rate	(11.08%)	(11.00%)	(9.01%)	(11.00%)	(11.00%)
Employer Normal Cost Rate	1.68%	3.57%	3.70%	6.15%	2.32%
Buck					
Normal Cost as a % of Pay					
Total Normal Cost as a % of Pay	12.88%	14.46%	12.91%	16.84%	13.27%
Less Member Contribution Rate	(11.08%)	(11.00%)	(9.01%)	(11.00%)	(11.00%)
Employer Normal Cost Rate	1.80%	3.46%	3.90%	5.84%	2.27%
Difference to Segal					
Normal Cost as a % of Pay					
Total Normal Cost as a % of Pay	0.12%	(0.11%)	0.20%	(0.31%)	(0.05%)
Less Member Contribution Rate	0.00%	0.00%	0.00%	0.00%	0.00%
Employer Normal Cost Rate	0.12%	(0.11%)	0.20%	(0.31%)	(0.05%)

Total Normal Cost reflects administrative expenses load.

As shown in the table above, normal cost rates were matched fairly closely. When comparing to dollar amounts of normal cost in total for each division, the normal cost was within 2% of Segal's values. Additional details showing dollar amounts by division as well as by benefit are shown in Schedule B of this report.

Upon finalizing our replication and reviewing our understanding of the manner in which Segal measures liabilities, we arrived at a few recommendations regarding the calculation and reporting of liabilities.

Recommendations – Actuarial Liabilities for Division Trust Funds

- We first note that the plan provision section in the December 31, 2021, valuation does not include a description for post-termination death benefits prior to retirement. We recommend such a description be added to the valuation report.

- In addition, this is how post-termination death benefits are valued for active and deferred vested members:

   a. Survivors of active members who are not in DPS with the DPS benefit structure with 10 years of service or less receive 25% of Highest Average Salary.

   b. Survivors of active members who are not in DPS with the DPS benefit structure with more than 10 years of service receive the greater of 25% of Highest Average Salary or the value of the accrued benefit as a 100% joint and survivor annuity.

   c. Survivors of deferred members who are not in DPS with the DPS benefit structure the death benefit is the greater of the accrued benefit as a 100% joint and survivor annuity or the return of contributions.

   d. Survivors of both active and deferred vested members in DPS with the DPS benefit structure receive a return of contributions.

   e. Recommendation: Based on the descriptions above, active and deferred vested members are valued differently. We recommend the two be valued consistently and in accordance with the provisions of the plan.

Health Care Trust Funds

The table below shows a high-level summary of liabilities by status for each Health Care Trust Fund. As seen in the table, our replication of results was within our tolerance level, and we were able to replicate liabilities consistently with Segal. The tables in Schedule A of this report also provide a more detailed comparison of each plan's liabilities by status and by benefit type.

Liabilities by Status and Health Care Trust Fund *$ Millions*	**HCTF**	**DPS HCTF**
Segal		
Active Members - Actuarial Accrued Liability		
Active	$372.4	$21.4
Present Value of Future Benefits		
Active	$484.7	$30.0
Terminative Vested	$37.6	$2.0
Retirees and Survivors in Receipt of Benefits	$935.4	$38.7
Actuarial Accrued Liability	$1,345.5	$62.1
Present Value of Future Benefits	$1,457.7	$70.6
Buck		
Active Members - Actuarial Accrued Liability		
Active	$366.9	$20.7
% Difference to Segal	*(1.5%)*	*(3.3%)*
Present Value of Future Benefits		
Active	$483.4	$29.4
% Difference to Segal	*(0.3%)*	*(2.0%)*
Terminated Vested	$36.0	$1.9
% Difference to Segal	*(4.3%)*	*(5.0%)*
Retirees and Survivors in Receipt of Benefits	$931.4	$38.8
% Difference to Segal	*(0.4%)*	*0.3%*
Actuarial Accrued Liability	$1,334.2	$61.4
% Difference to Segal	*(0.8%)*	*(1.1%)*
Present Value of Future Benefits	$1,450.8	$70.1
% Difference to Segal	*(0.5%)*	*(0.7%)*

As shown in the table above, when grouping present value of future benefits and actuarial accrued liability by trust and status, Buck's calculations are within the 5% tolerance across each trust and status. As shown in Schedule A, liabilities by decrement do not match as closely, which can be explained by Segal's use of beginning of year retirement decrements as described in Section II.

Buck performed additional calculations based on sample lives provided by Segal to confirm that adjusting for this difference in decrement timing would result in a closer match by decrement. These calculations along with the results above give us confidence that we have benefits and assumptions coded very consistently with Segal.

Consistent with the pension plans, we also replicated the calculation of the normal cost rates used in the calculation of the actuarially determined contribution.

Normal Cost by Health Care Trust Fund *% of Pay*	**HCTF**	**DPS HCTF**
Segal		
Normal Cost as a % of Pay		
Total Normal Cost as a % of Pay	0.18%	0.14%
Less Member Contribution Rate	0.00%	0.00%
Employer Normal Cost Rate	0.18%	0.14%
Buck		
Normal Cost as a % of Pay		
Total Normal Cost as a % of Pay	0.17%	0.13%
Less Member Contribution Rate	0.00%	0.00%
Employer Normal Cost Rate	0.17%	0.13%
Difference to Segal		
Normal Cost as a % of Pay		
Total Normal Cost as a % of Pay	(0.01%)	(0.01%)
Less Member Contribution Rate	0.00%	0.00%
Employer Normal Cost Rate	(0.01%)	(0.01%)

As shown in the table above, normal cost rates were matched closely. Expressed in dollars, our normal cost amounts were within 5% of Segal's values. Note that the normal cost calculations are also impacted by the decrement timing discrepancy described above.

Recommendations – Actuarial Liabilities for Health Care Trust Funds

Upon finalizing our replication and reviewing our understanding of how Segal measures liabilities, we arrived at some recommendations concerning their calculation and description in the report.

- All decrements are being applied at middle-of-year for the HCTF valuations, except for the retirement assumption, which is applied at beginning-of-year. This is inconsistent with how pension decrements are applied, which are all applied at middle-of-year (except for when 100% retirement is assumed, which uses beginning-of-year timing). Buck does not believe decrements should be applied differently for pension and HCTF benefits and did not identify any provisions of the plan or characteristics of the population that would indicate assuming beginning of year retirement is appropriate. We recommend updating this assumption to be consistent with the valuation of the pension plans.
- During our review and subsequent discussions with Segal, we discovered that the percentage of disabled participants hired before April 1, 1986, assumed to qualify for premium-free Medicare Part A being valued was 90% instead of 95% as documented in the valuation report. This assumption was updated from 90% to 95% based on the 2020 experience study. This should be corrected for future valuations, but the impact on liabilities is minimal.

Section V – Review of Actuarial Valuation Results

Schedule C summarizes the results for the five Division Trust Funds and two Health Care Trust Funds of Colorado PERA.

In our parallel valuation and review, we compared present values of future benefits, actuarial accrued liabilities, and total normal costs for each Division and Health Care Trust Fund. We also replicated the calculation of the actuarial value of assets.

Actuarial Value of Assets

Actuarial Standard of Practice No. 44 (ASOP 44) guides the actuary in selecting or recommending an asset valuation method and determining the appropriate disclosures regarding the asset method, in particular the reasonability of the asset smoothing method. Specifically, the actuarial value of assets should (a) produce values which are sometimes above and sometimes below the market value; (b) fall within a reasonable range of the corresponding market values; and (c) recognize differences between the market value and the actuarial value within a reasonable period of time.

The current actuarial value of assets method smooths asset gains and losses over a four-year period without a corridor around the market value.

To facilitate our replication of the calculation of the actuarial value of assets, Colorado PERA provided financial statements and accompanying financial information as of December 31, 2020, and December 31, 2021. We first matched to the reconciliation of the market value of assets from December 31, 2020, to December 31, 2021. Using our independent market value reconciliation, we then determined the expected return based on descriptions from the valuation report and the gains and losses on assets to smooth into the final actuarial value of assets over a four-year period.

Findings – Actuarial Value of Assets

We found that we were able to match to the market value of assets, cash flows and final actuarial value of assets for all five Division Trust Funds and both Health Care Trust Funds. In addition, we agree that the current asset valuation method satisfies ASOP 44.

Key Valuation Results

We used key valuation results to compute and compare the actuarially determined contributions as well as the effective amortization periods based on statutory and related employer contribution rates to the values shown in the actuarial valuations of the five Division Trust Funds and two Health Care Trust Funds.

We also imitated the calculation of the ratio of the blended total contribution rate and the blended total required contribution. This ratio, when less than 98% or greater than 120%, triggers automatic changes to member and employer contribution rates, the annual increase cap, and the direct distribution from the State under certain circumstances.

Findings – Key Valuation Results

For all Division Trust Funds and Health Care Trust Funds, our calculation of the actuarially determined contribution rates, as a percentage of pay, differed by less than 0.7% from Segal's calculations. In addition, we were able to match the effective amortization periods for each division within two years.

A high-level summary of our replication is shown below, with additional detail shown in Schedule C of this report.

Note that in the following tables of this section numbers may not sum due to rounding. We have shown the "Difference to Segal" as the excess/(deficiency) of the Buck value over/(under) the Segal value. We have shown "% Difference to Segal" as the percentage excess/(deficiency) of the Buck value over/(under) the Segal value.

Actuarially Determined Contribution by Division Trust Fund
% of Pay

	State	School	Local Government	Judicial	Denver Public Schools
Segal	20.71%	21.13%	9.20%	13.83%	6.77%
Buck	20.25%	20.50%	8.93%	13.49%	6.24%
Difference to Segal	(0.46%)	(0.63%)	(0.27%)	(0.34%)	(0.53%)

Effective Amortization Period by Division Trust Fund

	State	School	Local Government	Judicial	Denver Public Schools
Segal	23 years	26 years	12 years	7 years	9 years
Buck	23 years	24 years	11 years	6 years	9 years
Difference to Segal	0 years	(2) years	(1) year	(1) year	0 years

Actuarially Determined Contribution by Health Care Trust Fund *% of Pay*	**HCTF**	**DPS HCTF**
Segal	0.73%	0.24%
Buck	0.71%	0.23%
Difference to Segal	(0.02%)	(0.01%)

Effective Amortization Period by Health Care Trust Fund	**HCTF**	**DPS HCTF**
Segal	13 years	2 years
Buck	13 years	2 years
Difference to Segal	0 years	0 years

We were also able to imitate the ratio of the blended total contribution rate and the blended total required contribution. We arrived at a ratio of 99.97% compared to 98.21% for Segal. This means that under our calculation, we would also arrive at the same conclusion as Segal that the AAP assessment performed as of December 31, 2021 does not indicate the need to make automatic changes to member and employer contribution rates, the annual increase cap, and the direct distribution from the State.

Section VI – Review of Actuarial Projections

In addition to our review of the key results of the actuarial valuations for the five Division Trust Funds and two Health Care Trust Funds of Colorado PERA, we also reviewed 40-year projection information. We reviewed the additional assumptions and new entrant profile data sets used in the actuarial projections included in the valuation reports.

Projection Assumptions

New Entrant Growth

For each of the five Division Trust Funds, a 40-year deterministic forecast of valuation results was performed on an open-group basis. Assumptions and methods to project liabilities and assets matched those disclosed in the December 31, 2021, valuation. The active population for School, Local Government, and Denver Public Schools Divisions was assumed to grow at 1.0% per year. The active population for State and Judicial Divisions was assumed to grow at 0.25% per year. Projected payroll for new entrants was assumed to grow at 3.0% per year.

In the 2020 experience study, Segal reviewed the active member growth assumption. They reviewed the annual active member growth over a 10-year period for each of the five Division Trust Funds. In addition, Segal reviewed the data included in the “Colorado Department of Affairs State Demography Office – Dashboard.”

New Entrants

New entrant profile data for the pension plans is based on new hires over the last five years, according to the description provided in the December 31, 2021, valuation report. However, in the Summary Review of December 31, 2021, Actuarial Valuation Results for the Division Trust Funds and Health Care Funds presentation from Segal presented on June 17, 2022, the presentation states that the new entrant profiles have the same demographic mix as new hires over the last three years. Regardless, we reviewed the new entrant profile for reasonability and completeness.

Separate profiles were developed for members of the State and Local Government Divisions (both State Troopers and other than State Troopers), and members of the School, Judicial, and DPS Divisions. A demographic summary is shown in Schedule D of this report.

Findings – Projection Assumptions

In our opinion, the methodologies used to recommend assumptions for future rates of active population growth comply with the guidance provided in ASOP 35. The conclusions drawn for this assumption based on the experience study was appropriate.

Recommendations – Projection Assumptions – Division Trust Funds

We have no recommended updates to the new entrant profile data used in the actuarial projection for the five Division Trust Funds and believe the profile data to be reasonable. We have two recommendations for the valuation report:

- We recommend that in future experience studies Segal describe the methodology of developing the new entrant profile and provide demographic summaries in the study.
- We recommend Segal clarify the period that was used to determine new entrant demographics.

Projection Results - Division Trust Funds

We performed the 40-year deterministic forecast of valuation results using assumptions from the December 31, 2021, valuation and new entrant information provided by Segal. The forecast assumes that Colorado PERA continues its present funding policy as described in the December 31, 2021, actuarial valuation. Specifically, for each of the five divisions the plan sponsor contributes the statutory rate as a percentage of pay, the Amortization Equalization Disbursement, the Supplemental Amortization Equalization Disbursement, and the amount attributable to the DC supplement, offset by amounts directed to the Health Care Trust Funds, the Annual Increase Reserve (AIR), and the PCOP offset (where applicable).

We were able to replicate Segal's 40-year actuarial projections for the Division Trust Funds within a reasonable tolerance. We were able to match the time to achieve full funding for all five divisions. In addition, the trend of the funded ratio over time was consistent between the projections modeled by us and Segal.

Detailed information showing a comparison of our projection results to Segal's projection results are shown in Schedule D of this report.

Projected Years Until 100% Funded Based on 40-Year Projection			
Division Trust Fund	**Segal**	**Buck**	**Difference to Segal**
State Division	16 years	16 years	0 years
School Division	16 years	16 years	0 years
Local Government Division	2 years	2 years	0 years
Judicial Division	3 years	3 years	0 years
DPS Division	2 years	2 years	0 years

Projection Results - Health Care Trust Funds

For the HCTF valuations, Segal shared that no new entrant profiles were used. For PERA HCTF, all 2020 hires were used, while for DPS HCTF all those hired between 2016 – 2020 were used. In addition, service is set to zero.

We recommend that new entrant profiles that are consistent with the pension projections be used for the HCTF projections. In addition, given the pandemic and resulting shutdown that began in 2020, it is reasonable to consider that 2020 hiring experience may be different from future years.

We were able to replicate Segal's actuarial projections for the Health Care Trust Funds within a reasonable tolerance. We matched the time to achieve full funding exactly for the DPS HCTF, and within 1 year for the HCTF.

Projected Years Until 100% Funded Based on 40-Year Projection			
Health Care Trust Fund	**Segal**	**Buck**	**Difference to Segal**
HCTF	12 years	13 years	1 year
DPS HCTF	1 year	1 year	0 years

Recommendations – Projection Assumptions – Health Care Trust Funds

In addition to the recommendations above regarding the new entrant profile for these plans, we recommend including additional documentation when presenting this information; in particular, including the projected benefit payments and administrative fees used.

Section VII – Review of Actuarial Communications

First, we would like to note that our review has indicated that the actuarial process followed by Segal is thorough, complete and complies with applicable Actuarial Standards of Practice. In this section, we will recommend some updates and refinements to the actuarial communications issued by Segal.

Actuarial Assumptions Section – Valuation Report Recommendations

We recommend the following updates to the assumptions section of the Division Trust Funds valuation report:

- We recommend the assumptions section be updated to state that the credibility-weighted Pub-2010 Contingent Annuitant mortality tables are also applied prior to the original retiree's death.
- We recommend the assumptions section state the disability decrement rates continue after retirement eligibility.
- We recommend the assumption section be updated to reflect that the 80% married assumption for DPS is applied only to those members in the DPS Division with the DPS Benefit Structure. Currently, the valuation report states that it is applied to all members in the DPS Division.
- We recommend the assumptions section clarify the assumed retirement ages used to value the deferred vested participants.
- We recommend the assumption section state that the 0.4% administrative expense is based on a percentage of payroll.
- We recommend the assumptions section state the assumed frequencies of optional payment forms.
- The assumptions section should state that decrements are applied at middle of year.
- We recommend the assumptions section state the assumptions or methods used for missing or incomplete data.

We recommend the following updates to the assumptions section of the Health Care Trust Funds valuation report:

- We recommend the HCTF valuation report should document the rationale for not valuing any implicit subsidy for pre-Medicare benefits.
- We recommend the HCTF valuation report should clarify that the assumption that survivors of current retirees under the PERA benefit structure with a Joint and Survivor pension will continue to receive the explicit subsidy upon the retiree's death applies to all DPS participants with any PERA service, regardless of the plan of benefits under which they are valued.

- The HCTF valuation report states that 95% of disabled participants are assumed to qualify for premium-free Medicare Part A. We recommend that the documentation should be clarified to indicate that this applies only to those hired before April 1, 1986, and that 100% hired after that date are assumed to qualify for premium-free Medicare Part A.

Actuarial Standards of Practice and Qualification Standards

Our review has indicated that the actuarial process followed by Colorado PERA is thorough, complete, and complies with applicable Actuarial Standards of Practice (ASOPs) and U.S. Qualification Standards (USQ) of the American Academy of Actuaries (AAA). We have the following recommendations with regard to the ASOPs and USQs:

1. From both the pension and OPEB valuation reports, acknowledgements of the USQ of the AAA are phrased as follows:
    a. Pension: "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."
    b. OPEB: "The undersigned are independent actuaries. All are Fellows or Associates of the Society of 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."
2. We recommend that the above statements be amended as follows:
    a. Include a statement that the actuaries who have performed the valuations meet the Qualification Standards "to render the statements of actuarial opinion presented in the report" in order to match the prototype statement in the current edition of the Qualification Standards and to be consistent with how these standards are referenced in the experience study; and
    b. Include a statement that the actuaries are available to answer questions about the information contained in the report. This will more fully comply with the guidance provided in Section 3.1.4 of ASOP 41, which states: "Unless the actuary judges it inappropriate, the actuary issuing an actuarial communication should also indicate the extent to which the actuary is available to provide supplementary information and explanation."
3. ASOP 51, applicable when measuring pension obligations and determining pension contributions, requires a statement regarding the range of future actuarial measurements, which may differ from measurements presented in the report. While Segal made note of this and listed examples of factors that could cause future actuarial measurements to differ, we recommend that language be added to the Division Trust Fund report stating that the analysis of the potential range of future differences is beyond the scope of the valuation.
4. The HCTF valuation report should document consideration of the ASOP 6 Practice Note concerning aging of Medicare Advantage plans, and the rationale for not complying with the recommended approach.

Additional Communications Recommendations

- The asset smoothing method used for both the pension and OPEB plans involves deferred recognition of investment gains and losses but does not incorporate a corridor nor any other mechanism whereby the "smoothed" value would be constrained from deviation to an excessive degree from market value. In the experience study reports, Segal states that constraining differences of the smoothed value from market value is not necessary if the smoothing method "recognizes differences from market value in a sufficiently short period," and that four years is a defensibly short period. We recommend this claim also be made in the assumptions and methods sections of the valuation reports.
- The experience study reports develop different credibility adjustments for the base mortality tables for post-retirement mortality at ages below 80 and for ages 80 and above. We recommend the reports indicate what the rationale is for partitioning experience at the age of 80.
- We recommend making the differences in the "amortization periods" (specifically, the effective amortization period and the equivalent single amortization period) referenced in the report clearly distinguished and defined in the report, as well as making clear their uses and calculation methods for the benefit of the reader.
- We recommend under Section 4, rather than using exhibits for the Actuarial Assumptions and Actuarial Cost Methods and the Summary of Plan Provisions, instead giving each its own Section given the volume information contained in each and the similarity in the two exhibits.

Typographical Errors and Clean-Up

Finally, we call attention to a handful of typographical errors and that could be clarified in the December 31, 2021, valuation reports issued by Segal:

- On page 85 of the pension valuation report, the Judicial projected payroll is shown as $28,238,682. This value should be $58,238,682.
- For the Judicial Division for the Unfunded Actuarial Accrued Liability Amortization Schedule, the December 31, 2019, balance of (143,776) is reported as a contribution deficiency. This should be reported as a contribution surplus.
- For the Local Government Division for the Unfunded Actuarial Accrued Liability Amortization Schedule, the December 31, 2019, balance of (6,326,553) is reported as a contribution deficiency. This should be reported as a contribution surplus.
- We recommend plan provisions state that the benefit payment forms under the PERA Benefit Structure include a residual refund of member contributions, consistent with the description of benefit payment forms under the DPS Benefit Structure.
- We recommend the summary of the plan provisions in the valuation report address how compensation and 415 benefit limits are applied.

- The funding policy definitions under the definition of the Actuarial Accrued Liability (AAL) and Asset Values state that such amounts include the balance in the affiliated annual increase reserve. This appears to be incorrect for these definitions shown throughout the report.
- In the Reduced Service Retirement Benefit section of the DPS Benefit Structure assumptions:
  - For those hired prior to July 1, 2005, the reduction amount for those over age 55 with 15 years of service should read as over age 55 with 15-25 years of service.
  - For those hired prior to July 1, 2005, the reduction amount from ages 50-55 with 25-30 years of service should show the lesser of 4% for each year of service below 30 years and 4% for each year below age 55 (rather than age 50).
  - For those hired on or after July 1, 2005, but before January 1, 2010, the reduction amount for those over age 55 with 15 years of service should read over age 55 with 15-25 years of service.
  - For those hired on or after July 1, 2005, but before January 1, 2010, the reduction amount from ages 50-55 with 25-30 years of service should show the lesser of 6% for each year of service below 30 years and 6% for each year below age 55 (rather than age 50).
- For the HCTF valuation report, we recommend documenting retirement eligibility provisions.

Schedule A – Comparison of Actuarial Liabilities

State Division Trust Fund			
Liabilities by Status and Benefit Type			
$ Millions	**Segal**	**Buck**	**% Difference to Segal**
Active Members - Actuarial Accrued Liability			
Retirement	$7,518.4	$7,441.8	(1.0%)
Disability	106.1	101.3	(4.5%)
Death	106.6	98.9	(7.2%)
Withdrawal	349.4	276.9	(20.7%)
Total	$8,080.6	$7,919.0	(2.0%)
Active Members - Present Value of Future Benefits			
Retirement	$9,439.2	$9,491.9	0.6%
Disability	185.9	186.8	0.5%
Death	165.0	159.5	(3.4%)
Withdrawal	1,227.2	1,211.8	(1.2%)
Total	$11,017.3	$11,050.0	0.3%
Inactive Members			
Terminated Vested	$641.5	$646.1	0.7%
Terminated Non-Vested	193.1	193.1	0.0%
Total	$834.6	$839.2	0.6%
Members in Receipt of Payments			
Retirees	$17,283.6	$17,120.2	(0.9%)
Disableds	747.7	747.6	(0.0%)
Beneficiaries	213.3	212.8	(0.2%)
Total	$18,244.6	$18,080.6	(0.9%)
Totals			
Actuarial Accrued Liability	$27,159.8	$26,838.9	(1.2%)
Present Value of Future Benefits	$30,096.5	$29,969.9	(0.4%)

Schedule A – Comparison of Actuarial Liabilities

School Division Trust Fund			
Liabilities by Status and Benefit Type			
$ Millions	**Segal**	**Buck**	**% Difference to Segal**
Active Members - Actuarial Accrued Liability			
Retirement	$15,615.3	$15,486.4	(0.8%)
Disability	128.2	123.9	(3.3%)
Death	148.9	140.2	(5.8%)
Withdrawal	680.6	559.1	(17.9%)
Total	$16,573.0	$16,309.7	(1.6%)
Active Members - Present Value of Future Benefits			
Retirement	$20,202.0	$20,210.7	0.0%
Disability	226.6	225.1	(0.6%)
Death	238.7	230.4	(3.5%)
Withdrawal	2,315.8	2,288.0	(1.2%)
Total	$22,983.0	$22,954.2	(0.1%)
Inactive Members			
Terminated Vested	$1,071.3	$1,078.0	0.6%
Terminated Non-Vested	304.6	304.6	0.0%
Total	$1,375.9	$1,382.6	0.5%
Members in Receipt of Payments			
Retirees	$27,571.3	$27,321.5	(0.9%)
Disableds	623.1	622.5	(0.1%)
Beneficiaries	193.4	192.6	(0.4%)
Total	$28,387.8	$28,136.6	(0.9%)
Totals			
Actuarial Accrued Liability	$46,336.8	$45,828.9	(1.1%)
Present Value of Future Benefits	$52,746.8	$52,473.5	(0.5%)

Schedule A – Comparison of Actuarial Liabilities

Local Government Division Trust Fund Liabilities by Status and Benefit Type *$ Millions*	Segal	Buck	% Difference to Segal
Active Members - Actuarial Accrued Liability			
Retirement	$1,643.4	$1,628.8	(0.9%)
Disability	23.4	22.3	(4.5%)
Death	25.3	23.2	(8.5%)
Withdrawal	74.8	59.7	(20.2%)
Total	$1,766.9	$1,734.0	(1.9%)
Active Members - Present Value of Future Benefits			
Retirement	$2,096.2	$2,122.4	1.2%
Disability	40.7	41.3	1.5%
Death	40.1	38.7	(3.6%)
Withdrawal	269.5	267.7	(0.7%)
Total	$2,446.5	$2,470.0	1.0%
Inactive Members			
Terminated Vested	$244.7	$246.3	0.7%
Terminated Non-Vested	59.3	59.3	0.0%
Total	$304.0	$305.6	0.5%
Members in Receipt of Payments			
Retirees	$3,471.3	$3,441.2	(0.9%)
Disableds	161.5	161.5	(0.0%)
Beneficiaries	41.4	41.3	(0.1%)
Total	$3,674.2	$3,644.0	(0.8%)
Totals			
Actuarial Accrued Liability	$5,745.0	$5,683.6	(1.1%)
Present Value of Future Benefits	$6,424.6	$6,419.7	(0.1%)

Schedule A – Comparison of Actuarial Liabilities

Judicial Division Trust Fund			
Liabilities by Status and Benefit Type			
$ Millions	**Segal**	**Buck**	**% Difference to Segal**
Active Members - Actuarial Accrued Liability			
Retirement	$150.9	$150.7	(0.2%)
Disability	1.5	1.3	(17.8%)
Death	2.8	2.7	(4.1%)
Withdrawal	1.0	0.9	(10.5%)
Total	$156.3	$155.6	(0.5%)
Active Members - Present Value of Future Benefits			
Retirement	$223.3	$223.9	0.3%
Disability	3.6	3.6	0.8%
Death	5.1	5.0	(3.0%)
Withdrawal	6.6	6.5	(1.7%)
Total	$238.6	$239.0	0.2%
Inactive Members			
Terminated Vested	$4.3	$4.3	0.3%
Terminated Non-Vested	0.2	0.2	0.0%
Total	$4.5	$4.5	0.3%
Members in Receipt of Payments			
Retirees	$315.5	$316.0	0.2%
Disableds	8.3	8.3	0.0%
Beneficiaries	3.4	3.4	0.0%
Total	$327.2	$327.7	0.2%
Totals			
Actuarial Accrued Liability	$488.0	$487.8	(0.0%)
Present Value of Future Benefits	$570.3	$571.2	0.2%

Schedule A – Comparison of Actuarial Liabilities

Denver Public Schools Division Trust Fund			
Liabilities by Status and Benefit Type			
$ Millions	**Segal**	**Buck**	**% Difference to Segal**
Active Members - Actuarial Accrued Liability			
Retirement	$1,529.2	$1,516.6	(0.8%)
Disability	16.9	16.0	(5.3%)
Death	16.0	14.8	(7.5%)
Withdrawal	154.2	117.4	(23.9%)
Total	$1,716.3	$1,664.7	(3.0%)
Active Members - Present Value of Future Benefits			
Retirement	$2,151.2	$2,153.9	0.1%
Disability	31.8	31.1	(2.0%)
Death	28.6	26.8	(6.1%)
Withdrawal	448.0	438.4	(2.1%)
Total	$2,659.5	$2,650.3	(0.3%)
Inactive Members			
Terminated Vested	$121.2	$121.1	(0.0%)
Terminated Non-Vested	51.8	51.8	0.0%
Total	$173.0	$172.9	(0.0%)
Members in Receipt of Payments			
Retirees	$2,648.8	$2,625.7	(0.9%)
Disableds	77.0	76.9	(0.0%)
Beneficiaries	22.8	20.4	(10.8%)
Total	$2,748.6	$2,723.0	(0.9%)
Totals			
Actuarial Accrued Liability	$4,637.9	$4,560.7	(1.7%)
Present Value of Future Benefits	$5,581.0	$5,546.2	(0.6%)

Schedule A – Comparison of Actuarial Liabilities

Health Care Trust Fund			
Liabilities by Status and Benefit Type			
$ Millions	**Segal**	**Buck**	**% Difference to Segal**
Active Members - Actuarial Accrued Liability			
Retirement	$353.5	$347.9	(1.6%)
Disability	3.6	4.0	11.1%
Death	2.5	2.4	(4.0%)
Withdrawal	12.9	12.6	(2.3%)
Total	$372.4	$366.9	(1.5%)
Active Members - Present Value of Future Benefits			
Retirement	$446.8	$441.7	(1.1%)
Disability	6.0	6.7	11.7%
Death	3.7	4.0	8.1%
Withdrawal	28.1	31.0	10.3%
Total	$484.7	$483.4	(0.3%)
Terminated Vested Members	$37.6	$36.0	(4.3%)
Retirees and Survivors in Receipt of Benefit	$935.4	$931.4	(0.4%)
Totals			
Actuarial Accrued Liability	$1,345.5	$1,334.2	(0.8%)
Present Value of Future Benefits	$1,457.7	$1,450.8	(0.5%)

Schedule A – Comparison of Actuarial Liabilities

DPS Health Care Trust Fund			
Liabilities by Status and Benefit Type			
$ Millions	**Segal**	**Buck**	**% Difference to Segal**
Active Members - Actuarial Accrued Liability			
Retirement	$19.9	$19.2	(3.5%)
Disability	0.2	0.2	0.0%
Death	0.1	0.1	0.0%
Withdrawal	1.2	1.2	0.0%
Total	$21.4	$20.7	(3.3%)
Active Members - Present Value of Future Benefits			
Retirement	$26.6	$25.7	(3.4%)
Disability	0.4	0.4	0.0%
Death	0.2	0.2	0.0%
Withdrawal	2.8	3.1	10.7%
Total	$30.0	$29.4	(2.0%)
Terminated Vested Members	$2.0	$1.9	(5.0%)
Retirees and Survivors in Receipt of Benefit	$38.7	$38.8	0.3%
Totals			
Actuarial Accrued Liability	$62.1	$61.4	(1.1%)
Present Value of Future Benefits	$70.6	$70.1	(0.7%)

Schedule B – Comparison of Normal Cost

State Division Trust Fund			
Normal Cost by Benefit Type			
$ Millions	**Segal**	**Buck**	**% Difference to Segal**
Normal Cost			
Retirement	$262.4	$269.5	2.7%
Disability	10.2	10.5	3.1%
Death	8.1	8.0	(1.7%)
Withdrawal	120.3	117.0	(2.7%)
Normal Cost	$401.0	$405.0	1.0%
Administrative Expenses	$13.0	$13.0	0.0%
Total Normal Cost	$414.0	$418.0	1.0%

% of Pay	**Segal**	**Buck**	**Difference to Segal**
Normal Cost as a % of Pay			
Total Normal Cost as a % of Pay	12.76%	12.88%	0.12%
Less Member Contribution Rate	(11.08%)	(11.08%)	0.00%
Employer Normal Cost Rate	1.68%	1.80%	0.12%
Payroll	$3,244.1	$3,244.4	$0.3

Schedule B – Comparison of Normal Cost

School Division Trust Fund			
Normal Cost by Benefit Type			
$ Millions	**Segal**	**Buck**	**% Difference to Segal**
Normal Cost			
Retirement	$585.3	$584.1	(0.2%)
Disability	12.2	12.1	(0.5%)
Death	11.7	11.1	(4.6%)
Withdrawal	207.1	202.6	(2.2%)
Normal Cost	$816.3	$810.0	(0.8%)
Administrative Expenses	$23.0	$23.0	0.0%
Total Normal Cost	$839.3	$833.0	(0.8%)

% of Pay	**Segal**	**Buck**	**Difference to Segal**
Normal Cost as a % of Pay			
Total Normal Cost as a % of Pay	14.57%	14.46%	(0.11%)
Less Member Contribution Rate	(11.00%)	(11.00%)	0.00%
Employer Normal Cost Rate	3.57%	3.46%	(0.11%)
Payroll	$5,759.7	$5,761.0	$1.3

Schedule B – Comparison of Normal Cost

Local Government Division Trust Fund			
Normal Cost by Benefit Type			
$ Millions	**Segal**	**Buck**	**% Difference to Segal**
Normal Cost			
Retirement	$62.3	$64.9	4.0%
Disability	2.3	2.4	4.3%
Death	2.1	2.0	(1.4%)
Withdrawal	27.0	26.0	(3.9%)
Normal Cost	$93.7	$95.2	1.6%
Administrative Expenses	$3.0	$3.0	0.0%
Total Normal Cost	$96.7	$98.2	1.6%

% of Pay	**Segal**	**Buck**	**Difference to Segal**
Normal Cost as a % of Pay			
Total Normal Cost as a % of Pay	12.71%	12.91%	0.20%
Less Member Contribution Rate	(9.01%)	(9.01%)	0.00%
Employer Normal Cost Rate	3.70%	3.90%	0.20%
Payroll	$761.0	$761.0	$0.0

Schedule B – Comparison of Normal Cost

Judicial Division Trust Fund			
Normal Cost by Benefit Type			
$ Millions	**Segal**	**Buck**	**% Difference to Segal**
Normal Cost			
Retirement	$8.6	$8.5	(1.9%)
Disability	0.2	0.3	15.2%
Death	0.3	0.3	(6.1%)
Withdrawal	0.6	0.6	(3.9%)
Normal Cost	$9.8	$9.6	(1.8%)
Administrative Expenses	$0.2	$0.2	0.0%
Total Normal Cost	$10.0	$9.8	(2.0%)
% of Pay	**Segal**	**Buck**	**Difference to Segal**
Normal Cost as a % of Pay			
Total Normal Cost as a % of Pay	17.15%	16.84%	(0.31%)
Less Member Contribution Rate	(11.00%)	(11.00%)	(0.00%)
Employer Normal Cost Rate	6.15%	5.84%	(0.31%)
Payroll	$58.2	$58.3	$0.1

Schedule B – Comparison of Normal Cost

Denver Public Schools Division Trust Fund			
Normal Cost by Benefit Type			
$ Millions	**Segal**	**Buck**	**% Difference to Segal**
Normal Cost			
Retirement	$76.6	$75.3	(1.6%)
Disability	1.8	1.8	(2.2%)
Death	1.6	1.4	(10.6%)
Withdrawal	33.2	34.3	3.0%
Normal Cost	$113.2	$112.7	(0.4%)
Administrative Expenses	$3.5	$3.5	0.0%
Total Normal Cost	$116.7	$116.2	(0.4%)
% of Pay	**Segal**	**Buck**	**Difference to Segal**
Normal Cost as a % of Pay			
Total Normal Cost as a % of Pay	13.32%	13.27%	(0.05%)
Less Member Contribution Rate	(11.00%)	(11.00%)	0.00%
Employer Normal Cost Rate	2.32%	2.27%	(0.05%)
Payroll	$875.7	$875.7	$0.0

Schedule C – Comparison of Key Actuarial Valuation Results

State Division Trust Fund			
Actuarially Determined Contribution *% of Pay and $ Millions*	**Segal**	**Buck**	**Difference to Segal**
Total Normal Cost as a % of Pay	12.76%	12.88%	0.12%
Less Member Contribution Rate	(11.08%)	(11.08%)	0.00%
Employer Normal Cost Rate	1.68%	1.80%	0.12%
Unfunded Actuarial Accrued Liability Rate	19.03%	18.45%	(0.58%)
Actuarially Determined Contribution Rate	20.71%	20.25%	(0.46%)
Effective Amortization Period	23 years	23 years	0 years
Payroll	$3,244.1	$3,244.4	$0.3

Schedule C – Comparison of Key Actuarial Valuation Results

School Division Trust Fund			
Actuarially Determined Contribution			
% of Pay and $ Millions	**Segal**	**Buck**	**Difference to Segal**
Total Normal Cost as a % of Pay	14.57%	14.46%	(0.11%)
Less Member Contribution Rate	(11.00%)	(11.00%)	0.00%
Employer Normal Cost Rate	3.57%	3.46%	(0.11%)
Unfunded Actuarial Accrued Liability Rate	17.56%	17.04%	(0.52%)
Actuarially Determined Contribution Rate	21.13%	20.50%	(0.63%)
Effective Amortization Period	26 years	24 years	(2) years
Payroll	$5,759.7	$5,761.0	$1.3

Schedule C – Comparison of Key Actuarial Valuation Results

Local Government Division Trust Fund			
Actuarially Determined Contribution			
% of Pay and $ Millions	**Segal**	**Buck**	**Difference to Segal**
Total Normal Cost as a % of Pay	12.71%	12.91%	0.20%
Less Member Contribution Rate	(9.01%)	(9.01%)	0.00%
Employer Normal Cost Rate	3.70%	3.90%	0.20%
Unfunded Actuarial Accrued Liability Rate	5.50%	5.03%	(0.47%)
Actuarially Determined Contribution Rate	9.20%	8.93%	(0.27%)
Effective Amortization Period	12 years	11 years	(1) year
Payroll	$761.0	$761.0	$0.0

Schedule C – Comparison of Key Actuarial Valuation Results

Judicial Division Trust Fund			
Actuarially Determined Contribution			
% of Pay and $ Millions	**Segal**	**Buck**	**Difference to Segal**
Total Normal Cost as a % of Pay	17.15%	16.84%	(0.31%)
Less Member Contribution Rate	(11.00%)	(11.00%)	(0.00%)
Employer Normal Cost Rate	6.15%	5.84%	(0.31%)
Unfunded Actuarial Accrued Liability Rate	7.68%	7.65%	(0.03%)
Actuarially Determined Contribution Rate	13.83%	13.49%	(0.34%)
Effective Amortization Period	7 years	6 years	(1) year
Payroll	$58.2	$58.3	$0.1

Schedule C – Comparison of Key Actuarial Valuation Results

Denver Public Schools Division Trust Fund			
Actuarially Determined Contribution			
% of Pay and $ Millions	**Segal**	**Buck**	**Difference to Segal**
Total Normal Cost as a % of Pay	13.32%	13.27%	(0.05%)
Less Member Contribution Rate	(11.00%)	(11.00%)	0.00%
Employer Normal Cost Rate	2.32%	2.27%	(0.05%)
Unfunded Actuarial Accrued Liability Rate	4.45%	3.96%	(0.49%)
Actuarially Determined Contribution Rate	6.77%	6.24%	(0.53%)
Effective Amortization Period	9 years	9 years	0 years
Payroll	$875.7	$875.7	$0.0

Schedule C – Comparison of Key Actuarial Valuation Results

Health Care Trust Fund			
Actuarially Determined Contribution *% of Pay and $ Millions*	**Segal**	**Buck**	**Difference to Segal**
Total Normal Cost as a % of Pay	0.18%	0.17%	(0.01%)
Less Member Contribution Rate	0.00%	0.00%	0.00%
Employer Normal Cost Rate	0.18%	0.17%	(0.01%)
Unfunded Actuarial Accrued Liability Rate	0.55%	0.54%	(0.01%)
Actuarially Determined Contribution Rate	0.73%	0.71%	(0.02%)
Effective Amortization Period	13 years	13 years	0 years
Payroll	$9,823.0	$9,824.3	$1.3

Schedule C – Comparison of Key Actuarial Valuation Results

DPS Health Care Trust Fund			
Actuarially Determined Contribution			
% of Pay and $ Millions	**Segal**	**Buck**	**Difference to Segal**
Total Normal Cost as a % of Pay	0.14%	0.13%	(0.01%)
Less Member Contribution Rate	0.00%	0.00%	0.00%
Employer Normal Cost Rate	0.14%	0.13%	(0.01%)
Unfunded Actuarial Accrued Liability Rate	0.10%	0.09%	(0.01%)
Actuarially Determined Contribution Rate	0.24%	0.23%	(0.01%)
Effective Amortization Period	2 years	2 years	0 years
Payroll	$875.7	$875.7	$0.0

Schedule C – Comparison of Key Actuarial Valuation Results

Automatic Adjustment Provisions (AAP)
Ratio of Blended Total Contribution Rate to Blended Total Required Contribution for 2023 Plan Year

	State	School	Local Government	Judicial	Denver Public Schools	Total Weighted Average
Segal						
Unfunded Actuarial Accrued Liability	9,780,329,667	16,083,611,995	654,444,885	68,781,194	608,779,266	27,195,947,007
Member Contribution Rate	11.08%	11.00%	9.01%	11.00%	11.00%	10.98%
Employer Contribution Rate	19.99%	19.80%	13.06%	23.33%	9.00%	19.47%
Actuarially Determined Employer Contribution Rate	20.71%	21.13%	9.20%	13.83%	6.77%	20.35%
Direct Distribution Rate						0.32%
Blended Total Contribution Rate						30.77%
Blended Total Required Contribution						31.33%
Ratio of Blended Total Contribution Rate to Blended Total Required Contribution						**98.21%**
Buck						
Unfunded Actuarial Accrued Liability	9,459,408,396	15,575,746,114	593,040,904	68,567,535	531,590,580	26,228,353,529
Member Contribution Rate	11.08%	11.00%	9.01%	11.00%	11.00%	10.98%
Employer Contribution Rate	19.99%	19.80%	13.06%	23.33%	9.00%	19.51%
Actuarially Determined Employer Contribution Rate	20.25%	20.50%	8.93%	13.49%	6.24%	19.84%
Direct Distribution Rate						0.32%
Blended Total Contribution Rate						30.81%
Blended Total Required Contribution						30.82%
Ratio of Blended Total Contribution Rate to Blended Total Required Contribution						**99.97%**
Difference to Segal						*1.76%*

Schedule D – Comparison of Actuarial Projections

New entrant demographics

Summary of Segal's New Entrant Profile Demographics

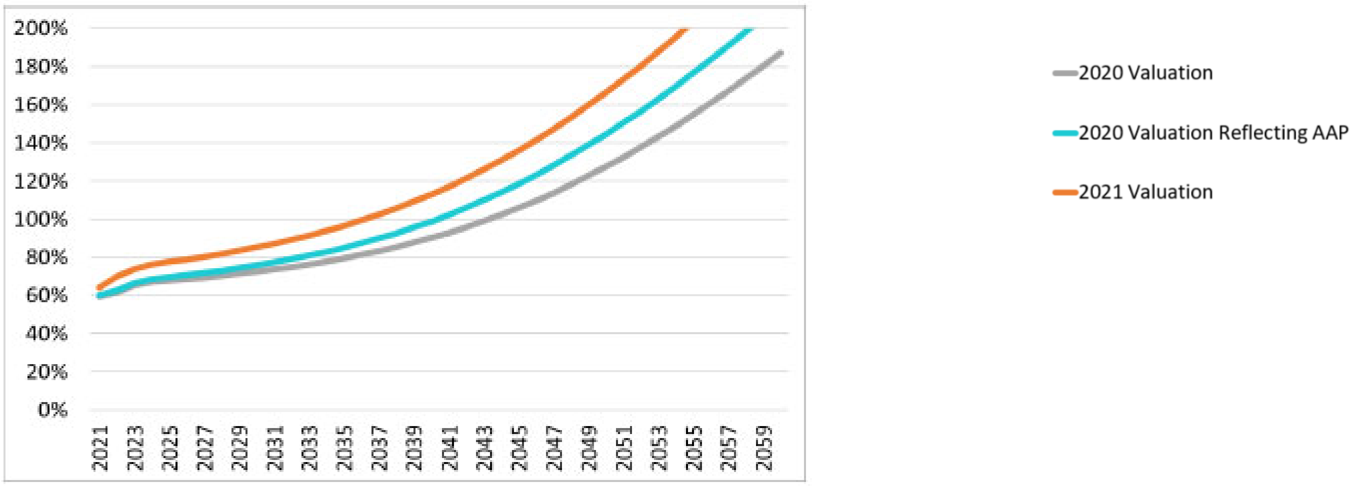
	State Division			Local Government Division			
	Other Than State Troopers	State Troopers	School Division	Other Than State Troopers	State Troopers	Judicial Division	Denver Public Schools Division
Count	12	11	12	12	11	8	12
Percent Male	46%	71%	34%	51%	71%	46%	34%
Average Age	36.20	31.03	37.37	37.44	31.03	45.95	32.86
Average Entry Service	0.50	0.50	0.38	0.50	0.50	0.62	0.38
Average Entry Salary*	43,989	60,695	28,005	40,489	60,695	153,312	38,827
Minimum Weight	1.14%	0.13%	1.59%	1.43%	0.13%	1.75%	0.65%
Maximum Weight	20.19%	33.67%	20.10%	15.27%	33.67%	24.56%	29.28%

**Average Entry Salary increases by 3.00% in each projected year.*

Schedule D – Comparison of Actuarial Projections

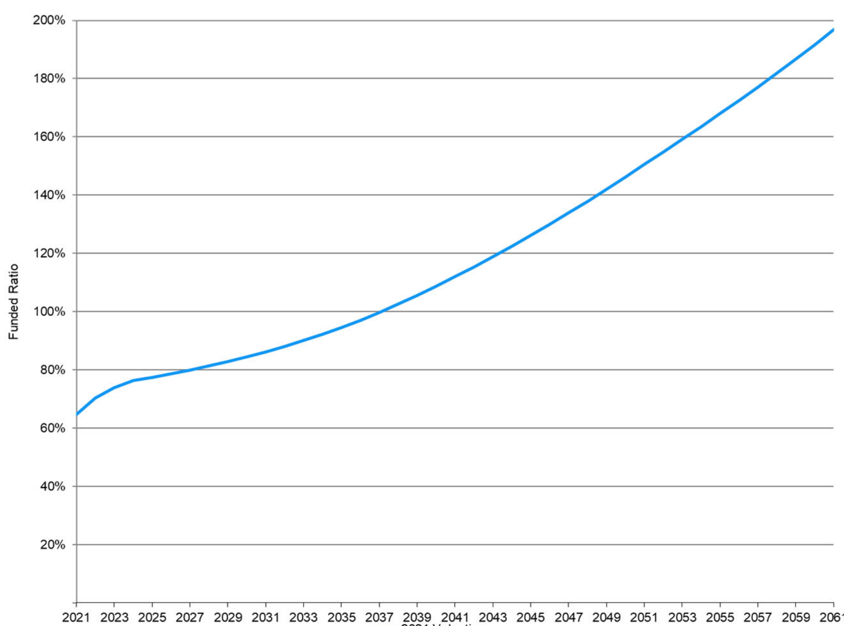
Funded Ratio – State Division

Segal



The State Division achieves 100% funding as of 12/31/2037, which is 16 years from the valuation date.

Buck

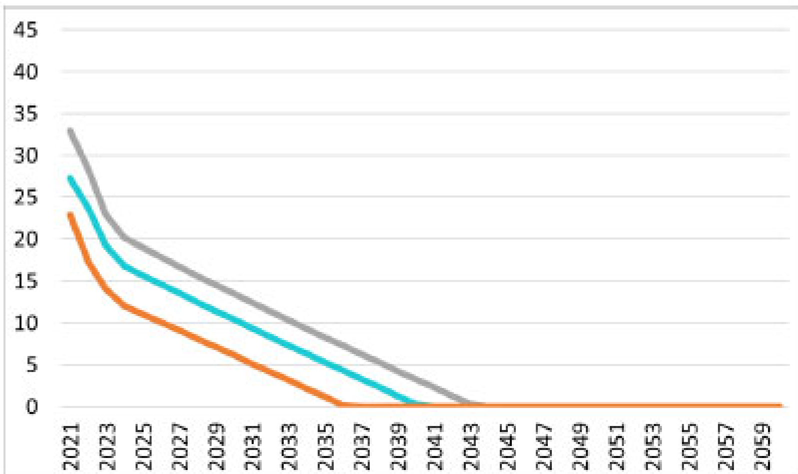


The State Division achieves 100% funding as of 12/31/2037, which is 16 years from the valuation date.

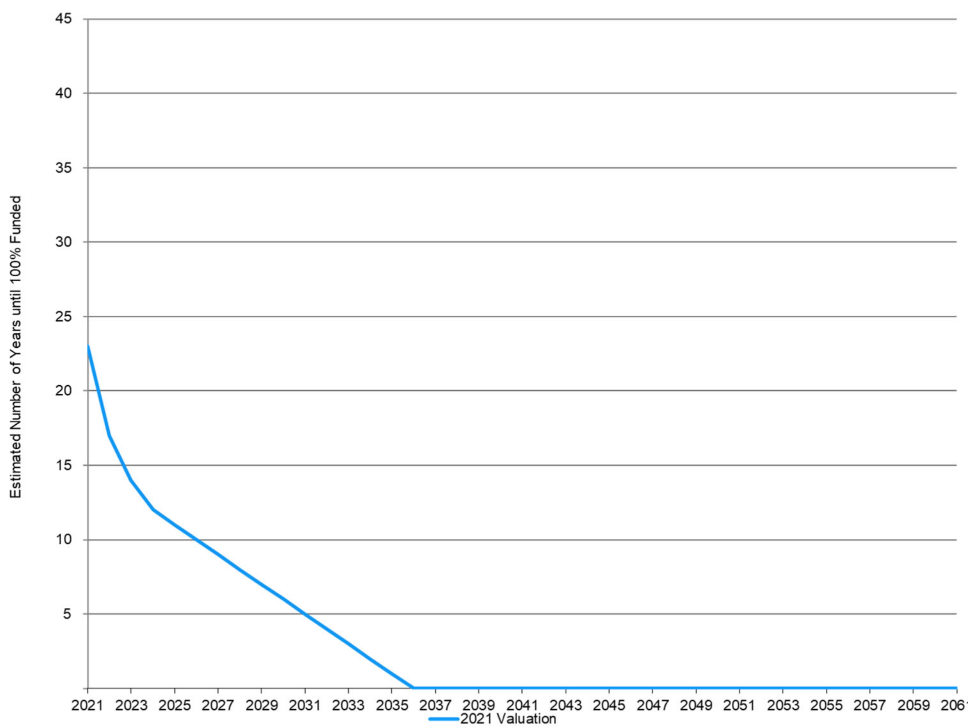
Schedule D – Comparison of Actuarial Projections

Estimated Number of Years until 100% Funded – State Division

Segal



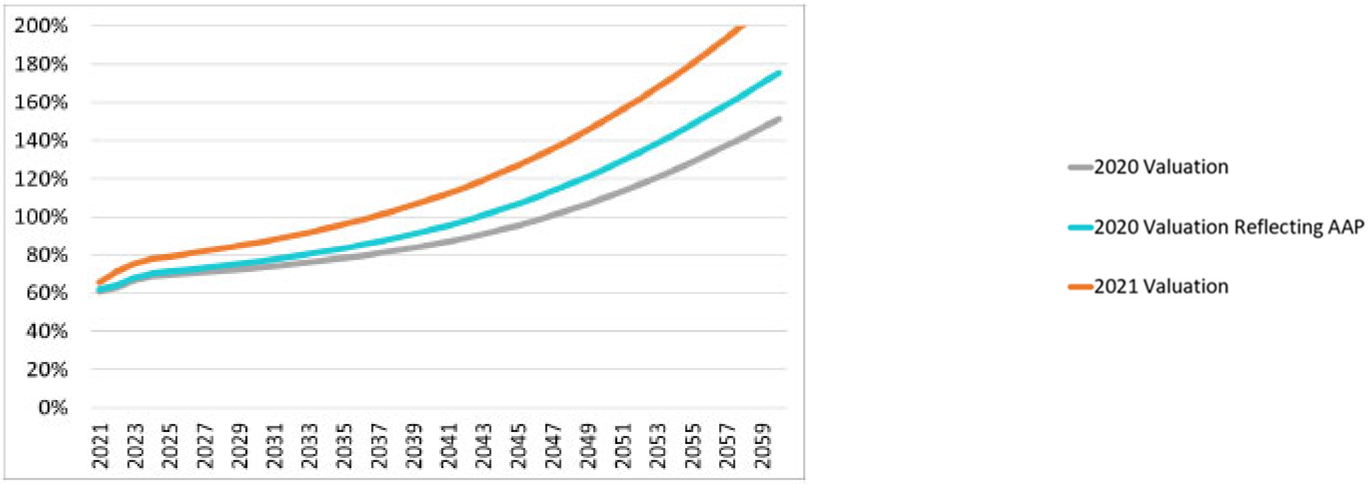
Buck



Schedule D – Comparison of Actuarial Projections

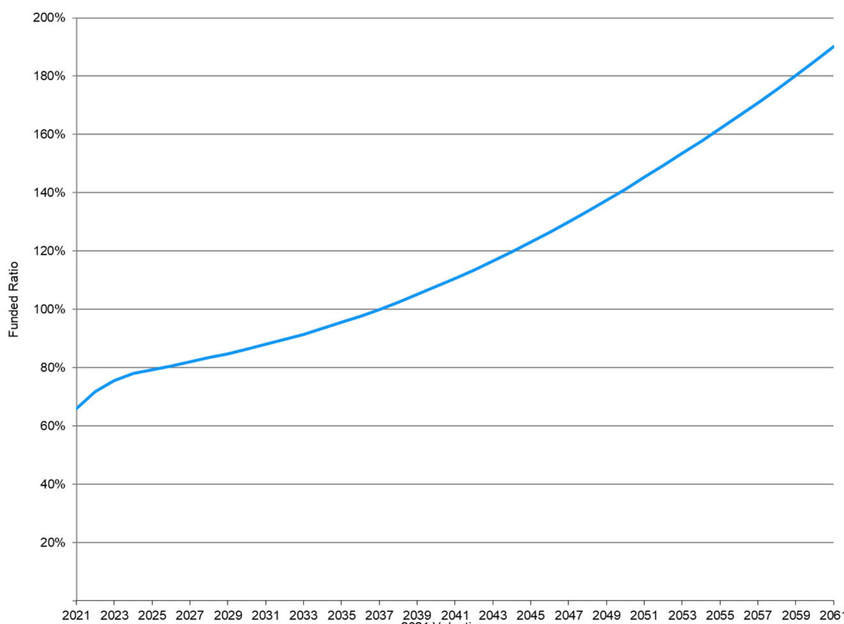
Funded Ratio – School Division

Segal



The School Division achieves 100% funding as of 12/31/2037, which is 16 years from the valuation date.

Buck

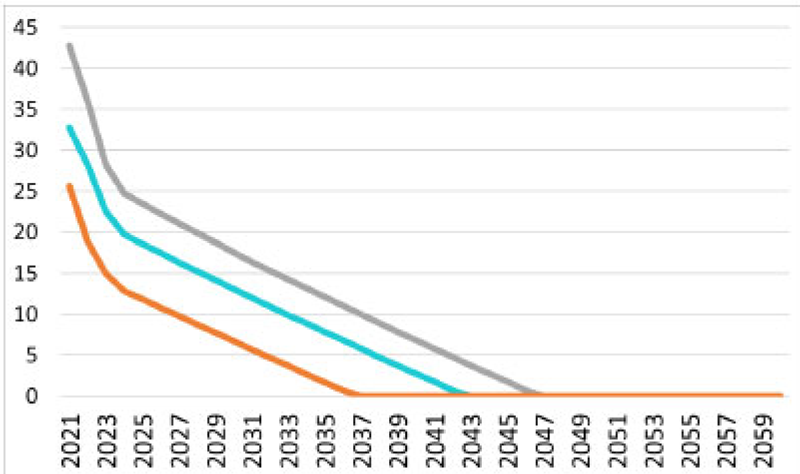


The School Division achieves 100% funding as of 12/31/2037, which is 16 years from the valuation date.

Schedule D – Comparison of Actuarial Projections

Estimated Number of Years until 100% Funded – School Division

Segal



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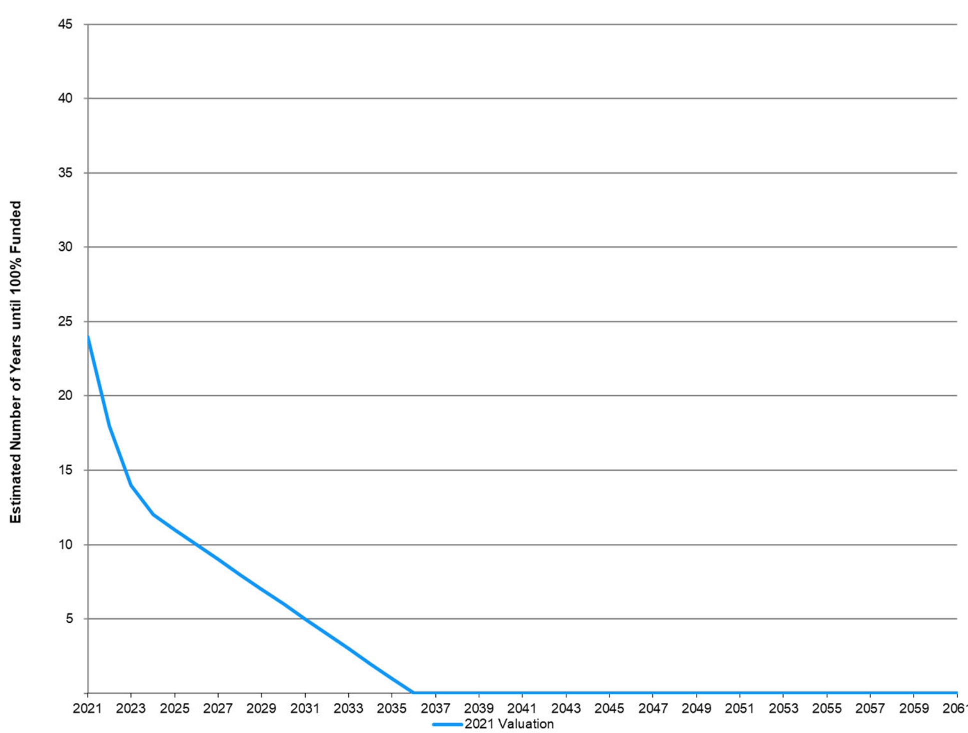
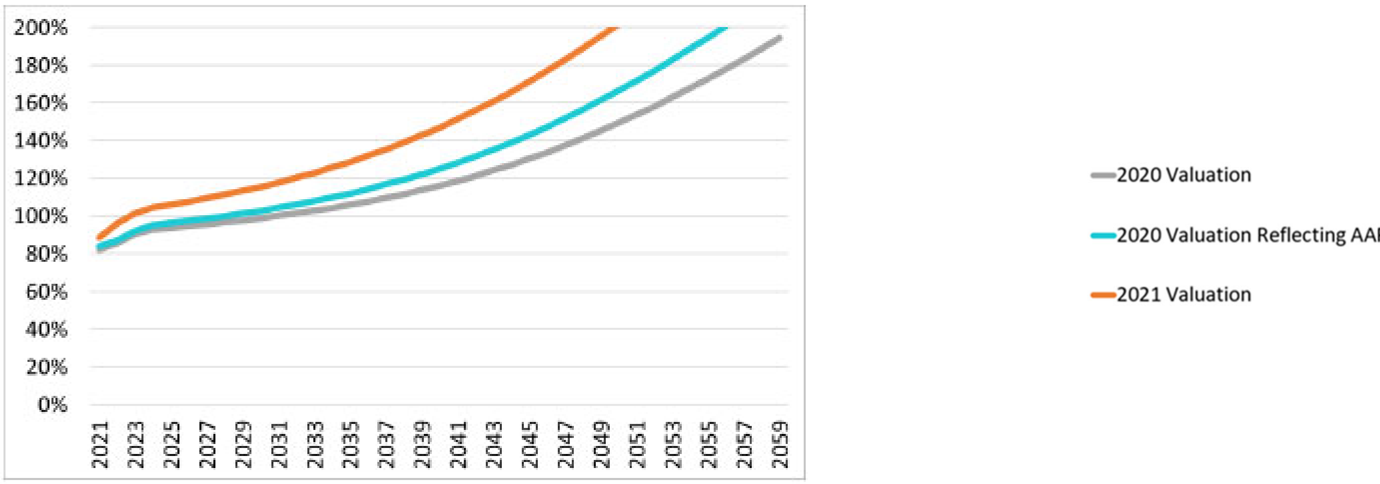


Schedule D – Comparison of Actuarial Projections

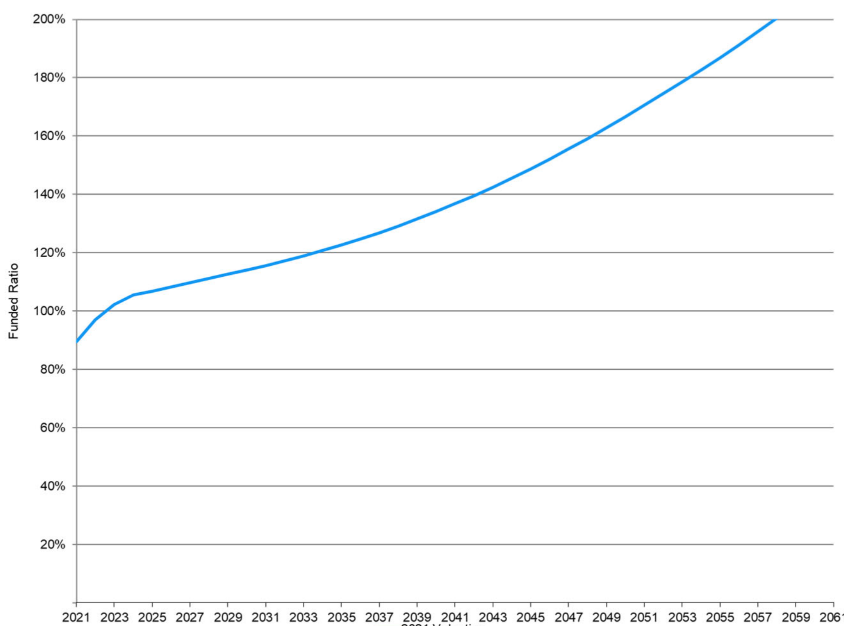
Funded Ratio – Local Government Division

Segal



The Local Government Division achieves 100% funding as of 12/31/2023, which is 2 years from the valuation date.

Buck

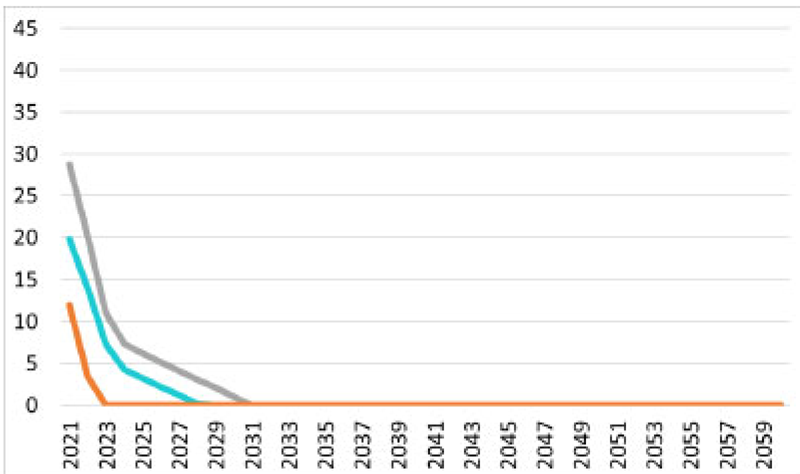


The Local Government Division achieves 100% funding as of 12/31/2023, which is 2 years from the valuation date.

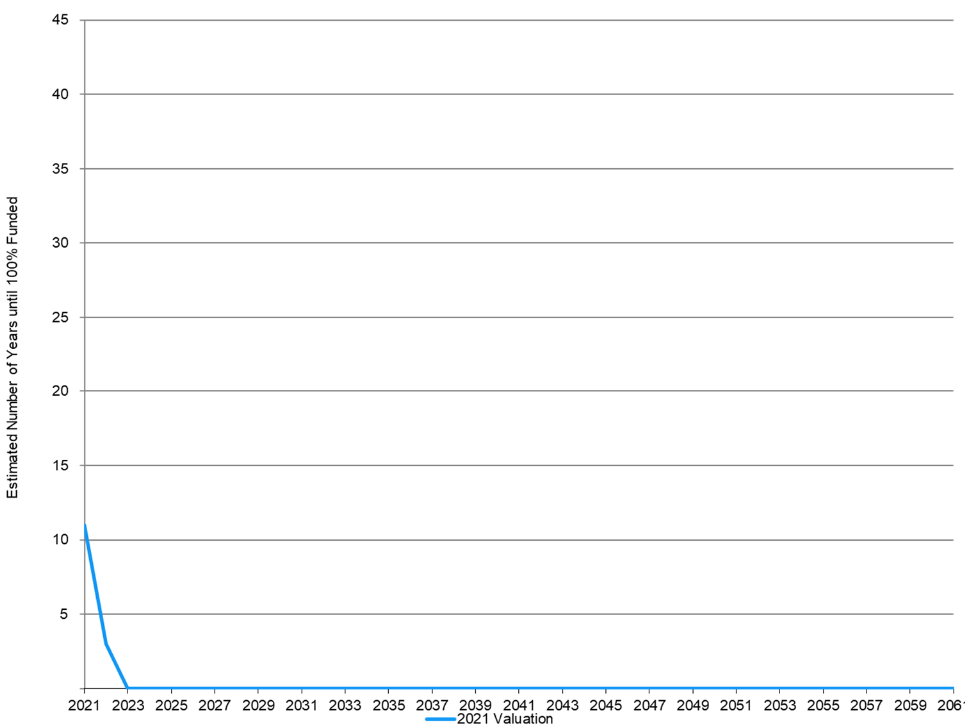
Schedule D – Comparison of Actuarial Projections

Estimated Number of Years until 100% Funded – Local Government Division

Segal



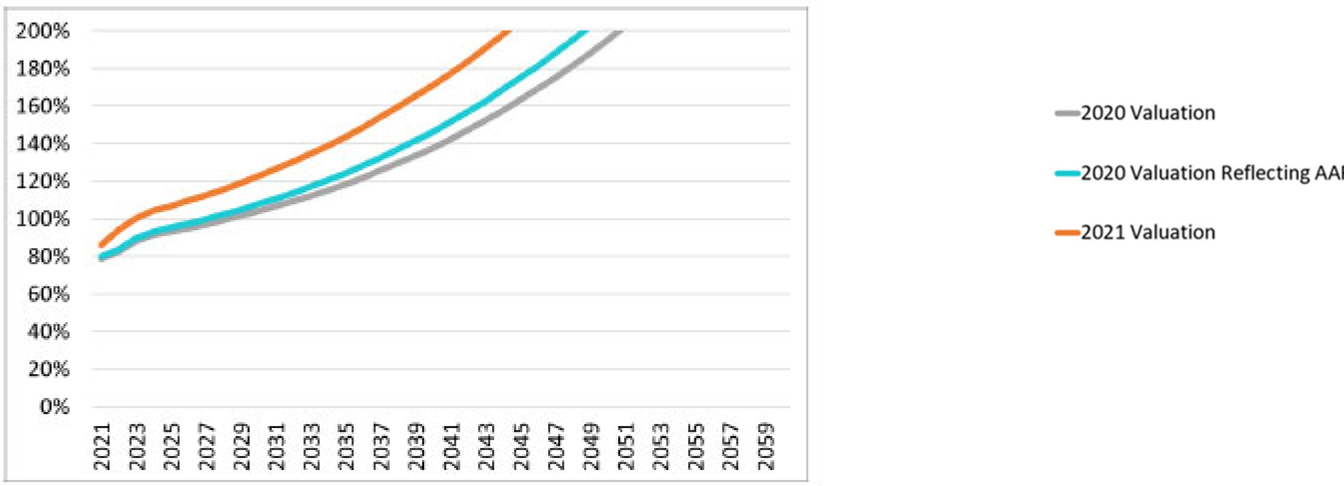
Buck



Schedule D – Comparison of Actuarial Projections

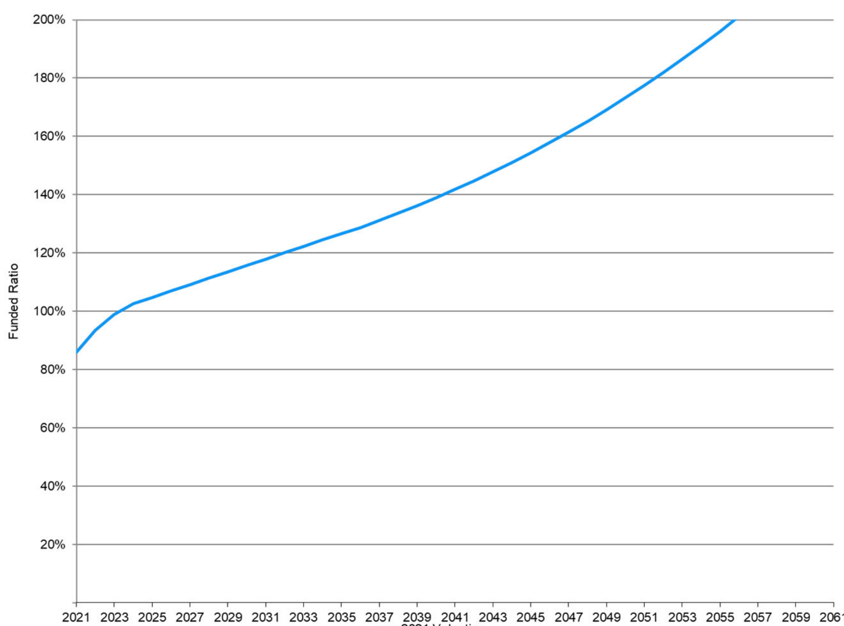
Funded Ratio – Judicial Division

Segal



The Judicial Division achieves 100% funding as of 12/31/2024, which is 3 years from the valuation date.

Buck

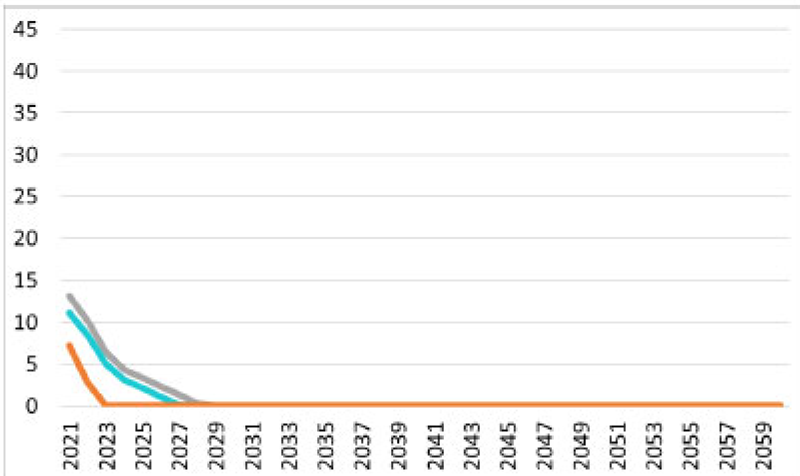


The Judicial Division achieves 100% funding as of 12/31/2024, which is 3 years from the valuation date.

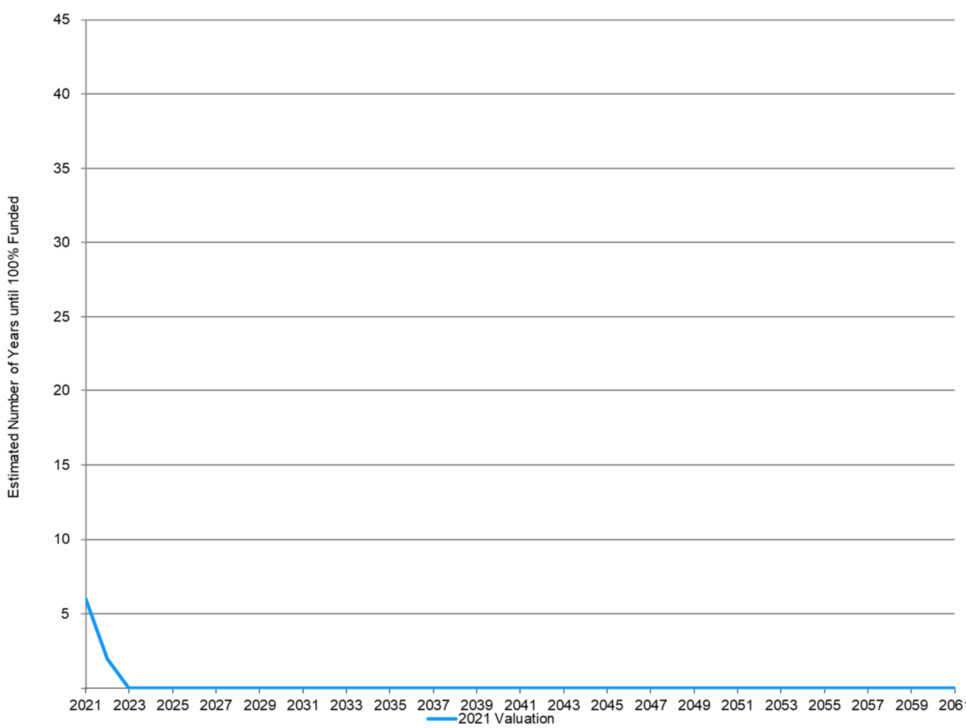
Schedule D – Comparison of Actuarial Projections

Estimated Number of Years until 100% Funded – Judicial Division

Segal



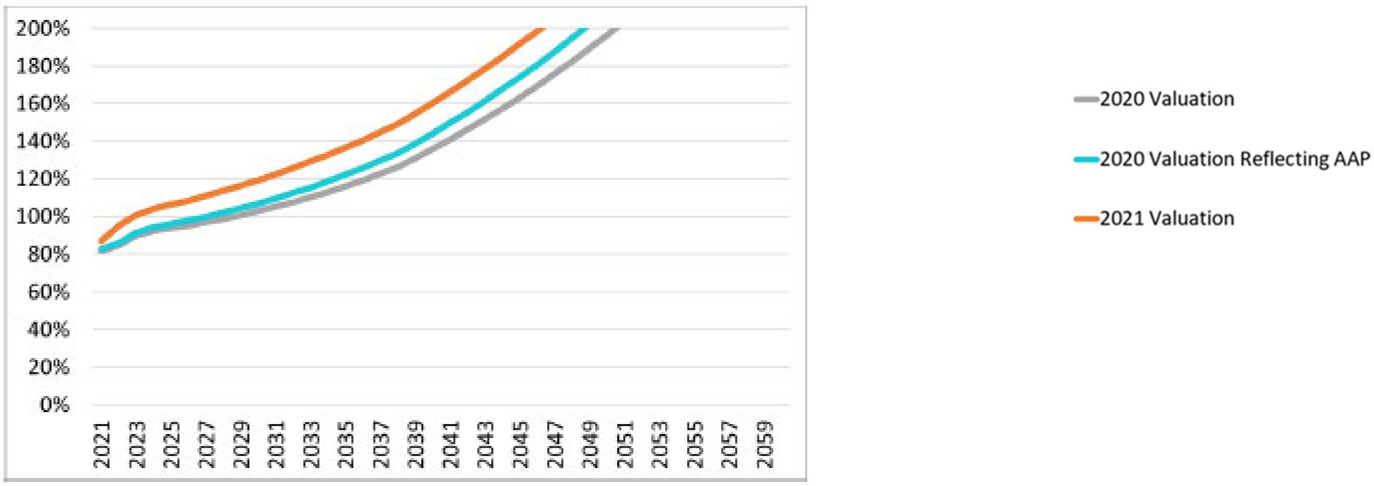
Buck



Schedule D – Comparison of Actuarial Projections

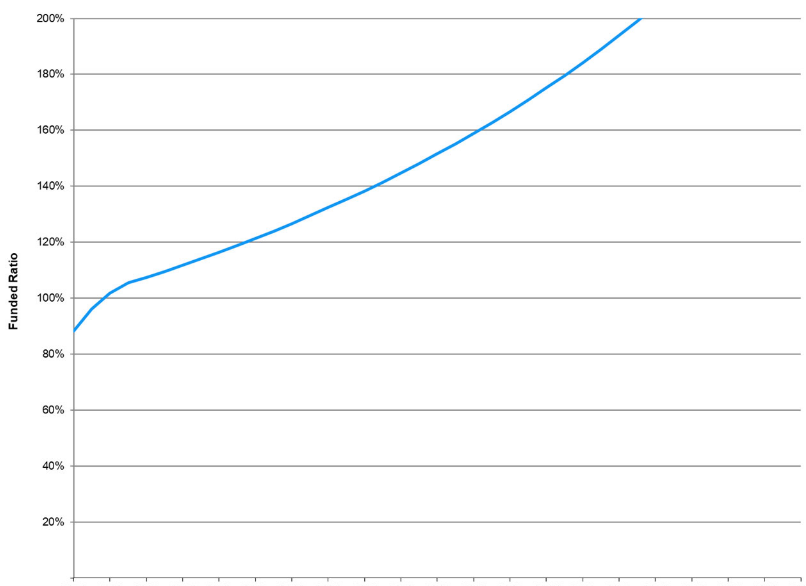
Funded Ratio – Denver Public Schools Division

Segal



The Denver Public Schools Division achieves 100% funding as of 12/31/2023, which is 2 years from the valuation date.

Buck

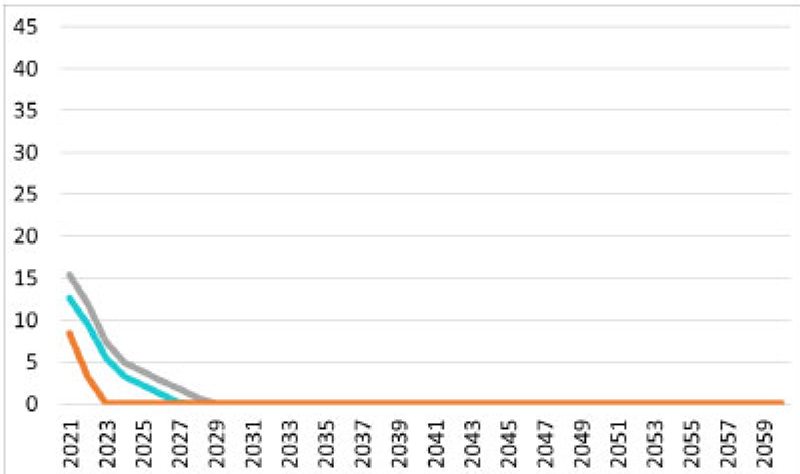


The Denver Public Schools Division achieves 100% funding as of 12/31/2023, which is 2 years from the valuation date.

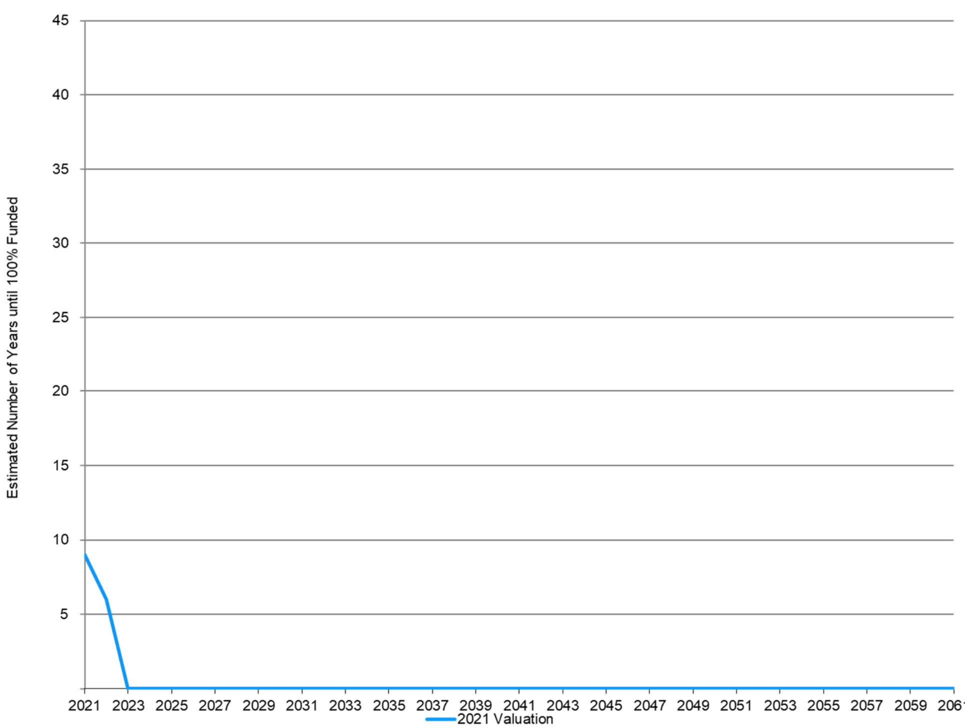
Schedule D – Comparison of Actuarial Projections

Estimated Number of Years until 100% Funded – Denver Public Schools Division

Segal



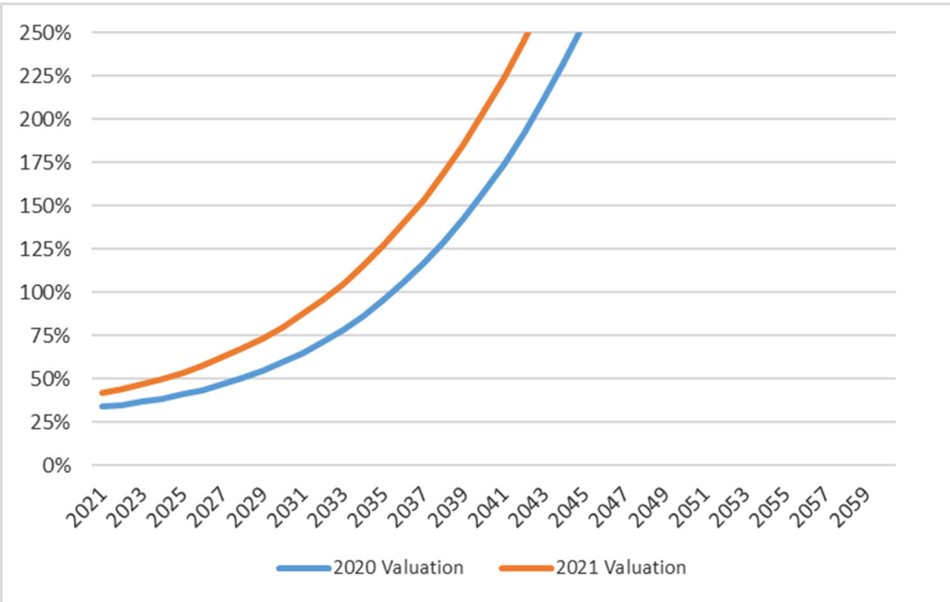
Buck



Schedule D – Comparison of Actuarial Projections

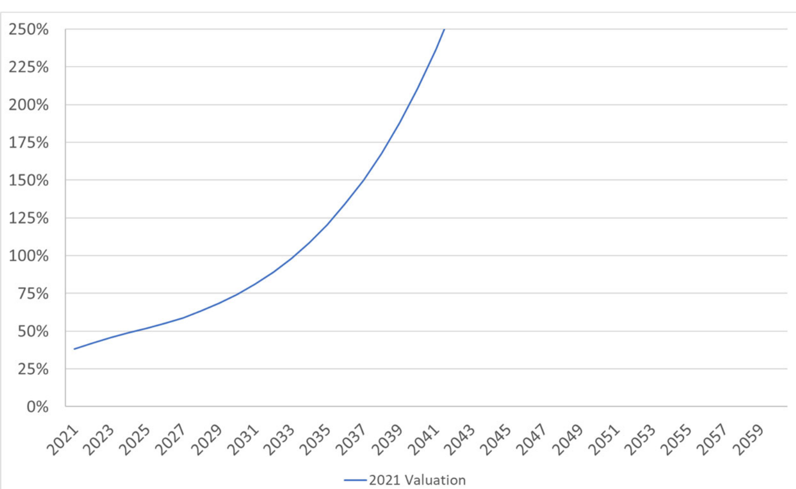
Funded Ratio – Health Care Trust Fund

Segal



The Health Care Trust Fund achieves 100% funding as of 12/31/2033, which is 12 years from the valuation date.

Buck

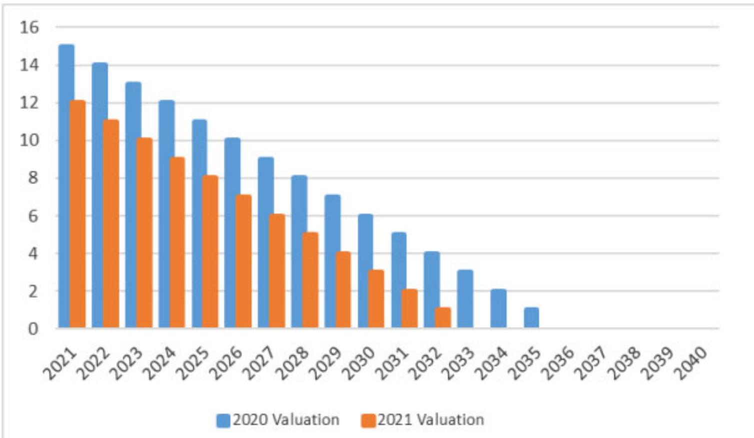


The Health Care Trust Fund achieves 100% funding as of 12/31/2034, which is 13 years from the valuation date.

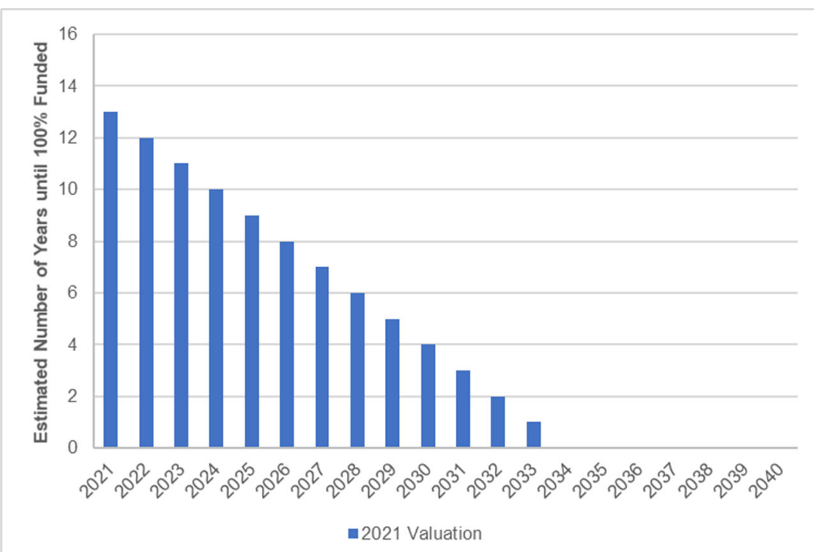
Schedule D – Comparison of Actuarial Projections

Estimated Number of Years until 100% Funded – Health Care Trust Fund

Segal



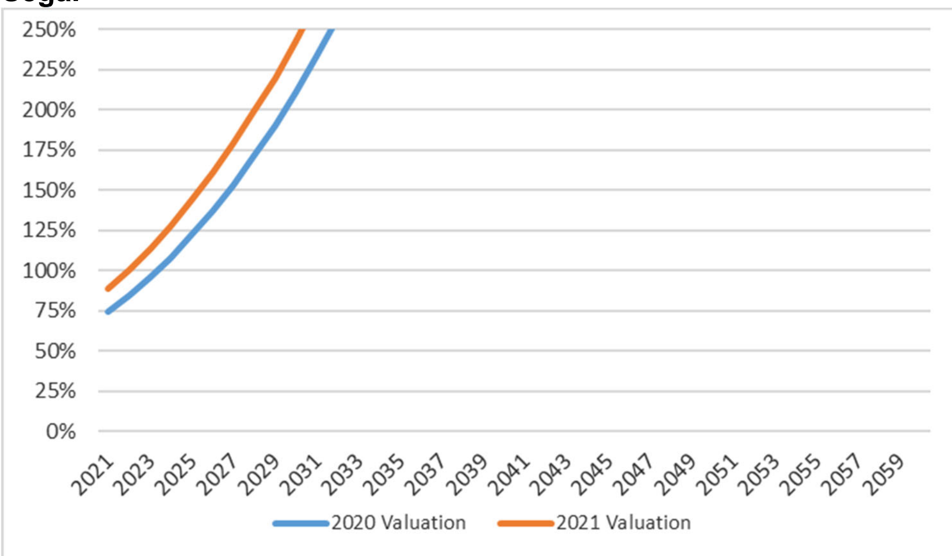
Buck



Schedule D – Comparison of Actuarial Projections

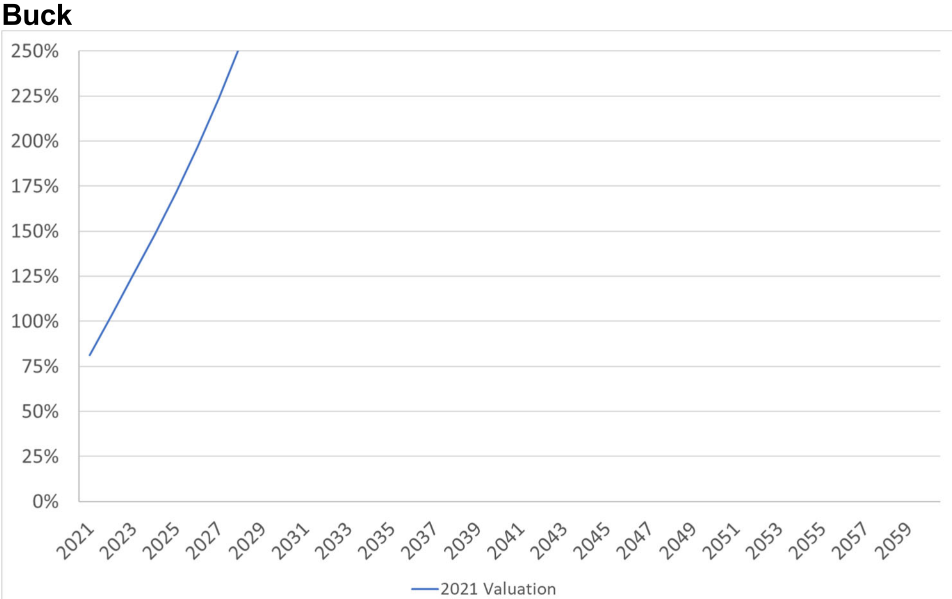
Funded Ratio – Denver Public Schools Health Care Trust Fund

Segal



The Denver Public Schools Health Care Trust Fund achieves 100% funding as of 12/31/2022, which is 1 year from the valuation date.

Buck

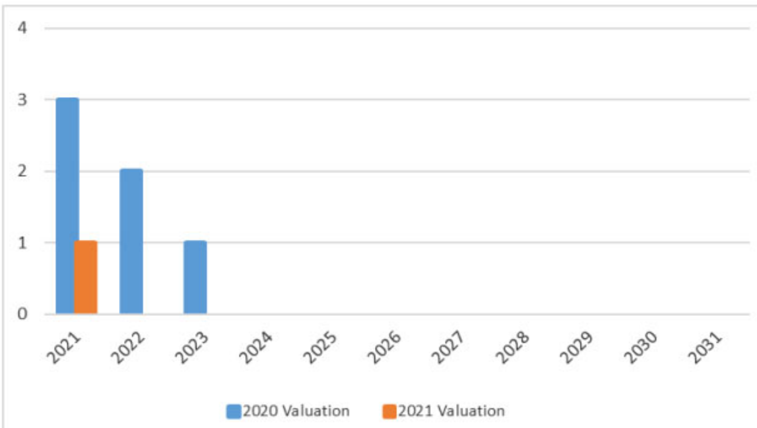


The Denver Public Schools Health Care Trust Fund achieves 100% funding as of 12/31/2022, which is 1 year from the valuation date.

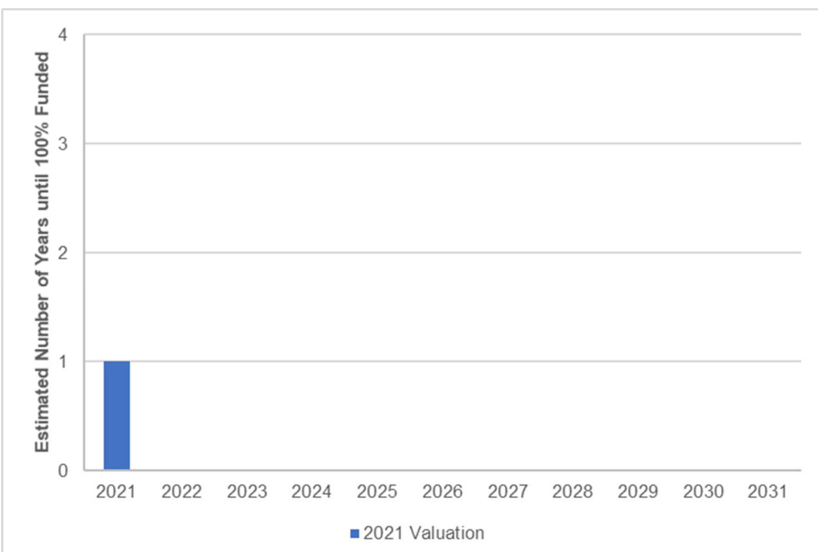
Schedule D – Comparison of Actuarial Projections

Estimated Number of Years until 100% Funded – Health Care Trust Fund

Segal



Buck



Glossary

Each proposal shall provide a glossary of all abbreviations, acronyms, and technical terms used to describe the services or products proposed. This glossary should be provided even if the terms are described or defined when first used in the proposal response.

Actuarial Accrued Liability – the difference between (i) the actuarial present value of future plan benefits, and (ii) the actuarial present value of future normal cost. Sometimes referred to as "accrued liability" or "past service liability."

Actuarial Cost Method – a mathematical budgeting procedure for allocating the dollar amount of the "actuarial present value of future plan benefits" between the actuarial present value of future normal cost and the actuarial accrued liability. Sometimes referred to as the "actuarial funding method."

Actuarial Value of Assets – value of current plan assets recognized for valuation purposes (Valuation Assets), based on the market value plus a portion of unrealized appreciation or depreciation.

Actuarially Determined Contribution – a target or recommended contribution to a defined benefit pension plan for the reporting period, determined in conformity with Actuarial Standards of Practice based on the most recent measurement available when the contribution for the reporting period was adopted.

Asset Liability Modeling (ALM) – a method of matching liability cash flows with investments that produce similar cash flows to minimize the volatility of the unfunded actuarial accrued liability resulting from market risk.

Associate of the Society of Actuaries (ASA) – intermediate achieved designation in the Society of Actuaries (SOA), the world's largest actuarial professional organization.

Chartered Financial Analyst (CFA) – designation provided by the CFA Institute which leads the investment profession globally by promoting the highest standards of ethics, education, and professional excellence for the ultimate benefit of society.

Enrolled Actuary (EA) – actuarial credential issued by the Internal Revenue Service

Fellow of the Conference of Consulting Actuaries (FCA) – a select group of the Conference of Consulting Actuaries' most respected and accomplished content experts and thought partners.

Fiduciary Net Position – The fiduciary net position is the market value of the assets of the trust dedicated to the defined benefit provisions.

Fellow of the Society of Actuaries (FSA) – highest achieved designation in the Society of Actuaries (SOA), the world's largest actuarial professional organization.

FRM – Buck's Financial Risk Management practice.

Governmental Accounting Standards Board (GASB) – the independent, private- sector organization that establishes accounting and financial reporting standards for U.S. state and local governments that follow Generally Accepted Accounting Principles (GAAP).

GEMS® – Economic Scenario Generator used for stochastic modeling to assist with setting assumptions and performing ALM studies.

Member of the American Academy of Actuaries (MAAA) – a member of the American Academy of Actuaries which is the one actuarial association representing actuaries from all practice areas. They are a unified voice of U.S. actuaries and dedicate themselves to fostering the highest standards of professionalism and sound public policy.

National Association of State Retirement Administrators (NASRA) – a non-profit association whose members are the directors of the nation's state, territorial, and largest statewide public retirement systems. NASRA members oversee retirement systems that hold more than two-thirds of the $5.08 trillion held in trust for nearly 15 million working and 11 million retired employees of state and local government.

National Conference on Public Employee Retirement Systems (NCPERS) – the largest trade association for public pensions, representing approximately 500 plans, plan sponsors, and other stakeholders throughout the United States and Canada.

National Conference on Teacher Retirement (NCTR) – is constituted as an independent association dedicated to safeguarding the integrity of public retirement systems in the United States and its territories to which teachers belong and to promoting the rights and benefits of all present and future members of the systems.

Normal Costs (Service Cost) – the annual cost assumed, under the actuarial funding method, for current and subsequent plan years. Sometimes referred to as "current service cost." Any payment toward the unfunded actuarial accrued liability is not part of the normal cost.

Other Post-employment Benefits (OPEB) – benefits (such as death benefits, life insurance, disability, and long-term care) that are paid in the period after employment and that are provided separately from a pension plan, as well as healthcare benefits paid in the period after employment, regardless of the manner in which they are provided. OPEB does not include termination benefits or termination payments for sick leave.

ORSC – Ohio Retirement Study Council

Post-retirement Annuity Adjustment – postemployment cost of living adjustment (COLA) intended to adjust benefit payments for the effects of inflation.

Present Value of Future Benefits – projected benefit payments discounted to reflect the expected effects of the time value (present value) of money and the probabilities of payment.

PSERS – Pennsylvania School Employees Retirement System

PSR – Buck's Public Sector Retirement practice.

Qualified 401(k) Administrator (QKA) – leading certification for retirement plan professionals which demonstrates one's expertise in the duties of a retirement plan administrator and attests that the holder possesses the knowledge and skills required to implement and administer defined contribution retirement plans.

RFP – Request for Proposal

SERS – School Employees Retirement System of Ohio

Total OPEB Liability (TOL) – the portion of the actuarial present value of projected benefit payments that is attributed to past periods of employee service in conformity with the requirements of GASB Statement Number 74 and 75.

Unfunded Actuarial Accrued Liability (UAAL) – the difference between the Actuarial Accrued Liability and the Actuarial Value of Assets.

Cost Information

The pricing summary should include a breakdown of costs per element listed under Scope of Audit, including: personnel costs (including hourly rates and estimated hours for professional and clerical staff assigned to the audit); travel and lodging; data processing costs; materials, and any other potential costs. The cost estimates in the pricing summary must include all necessary charges to complete the audit and must be a “not to exceed” figure.

The services requested will be for the performance of an actuarial audit for the primary purpose of an independent verification and analysis of the assumptions, procedures, and methods used by the SERS consulting actuary, as applicable, for:

- Report on the Annual Basic Benefits Valuation of the School Employees Retirement System of Ohio, prepared as of June 30, 2023;
- School Employees Retirement System Experience Study Five-Year Period Ending June 30, 2020; and
- Report on the Retiree Health Care Valuation of the School Employees Retirement System of Ohio, prepared as of June 30, 2023, including GASB Statement 74 disclosures.

The total, not-to-exceed, fee to complete the full Scope of Audit services, as listed in the RFP and broken down per element below, is **$118,800**.

Item (Element)	Detail	Proposed Fee
Data Validity	Assessment of the validity, completeness, and appropriateness of SERS' structure and funding objectives of the demographic and financial information used by the consulting actuary in the valuation of SERS.	$12,500
Actuarial Valuation Method and Procedures	Assessment of whether the consulting actuary’s valuation method and procedures are reasonable and consistent with generally accepted actuarial standards and practices, appropriate for SERS’ structure and funding objectives, and are applied as stated by the actuary. If deviations from accepted standards are found during the audit, the Contractor should obtain the rationale for the deviations and determine their effects, including their monetary impact.	$15,000
Actuarial Valuation Assumptions	Assessment of whether the actuarial valuation assumptions are reasonable and consistent with generally accepted actuarial standards and practices, are reasonable based on SERS experience, and are appropriate for SERS’ structure and funding objectives. The assumptions evaluated should include both demographic and economic assumptions, such as mortality, retirement, separation rates, levels of pay adjustments, rates of investment return, and disability factors. As part of this assessment, the Contractor should consider and specifically address whether actual experience is appropriately evaluated in experience studies conducted by the consulting actuary at least every five years and whether recent changes in assumptions are appropriate, reasonable, and supported by the experience studies. Also, the Contractor should review the gain/loss analyses from the last four actuarial valuation reports.	$11,000

Item (Element)	Detail	Proposed Fee
Parallel Valuation	Perform parallel valuations of pension benefits as of June 30, 2023, and of retiree health care benefits as of June 30, 2023, using the validated member census data and the same actuarial assumptions.	$60,800
Recommendations	If the Contractor recommends assumption adjustments to more accurately reflect present and future assets, liabilities, and costs of SERS, the Contractor should provide detailed rationale for your recommendations and describe the general effect on SERS' condition resulting from the proposed changes in assumptions.	$10,000
Review of Health Care	Assessment of whether the system appropriately and consistently determines retiree contributions to health care and whether the implementation of the SERS' health care policies differ from those determinations.	$9,500
Updates	Throughout audit process, keep ORSC informed by email, phone calls, and virtual meetings regarding status updates of the actuarial audit, at least monthly.	Included
Final report and presentation	The final report will include, at a minimum: a description of the work performed, an executive summary, and findings and recommendations. The key findings and recommendations will be organized in a manner that clearly identifies to whom they are primarily directed (e.g., the Legislature, SERS Board, and ORSC). Buck will provide a digital and 25 bound copies of the final report to SERS and a digital and 25 bounds of the final report to the ORSC not later than one week after the completion of the final report and shall separately present this report, in person, to both the ORSC and the SERS Board.	Included
TOTAL, not-to-exceed, FEE		**$118,800**