Actuarial Valuation as at December 31, 2020 for Universities Academic Pension Plan

Canada Revenue Agency Registration Number: 0339572

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Empower Results®

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Executive Summary

An actuarial valuation has been prepared for the Universities Academic Pension Plan (the "Plan") as at December 31, 2020 for the primary purpose of establishing a funding range in accordance with legislative requirements for the Plan until the next actuarial valuation is performed. This section provides an overview of the important results and the key valuation assumptions which have had a bearing on these results. The next actuarial valuation for the purposes of developing funding requirements should be performed no later than as at December 31, 2023.

Summary of Principal Results

Going Concern Financial Position (000's)

	December 31, 2020	December 31, 2018
Assets	$ 5,622,000	$ 4,944,700
Liabilities	6,496,600	5,949,500
Excess/(Deficit)	**$ (874,600)**	**$ (1,004,800)**
Going concern funded ratio	**0.8654**	**0.8311**

Minimum Contribution Requirements

Considering the funding status of the Plan, the minimum member and employer contributions with effect from July 1, 2022 and those recommended at December 31, 2018 and effective July 1, 2020, both of which are in accordance with legislative requirements, are as follows:

(000's)	**December 31, 2020**	**December 31, 2018**
Estimated Normal Cost	$ 219,500	$ 215,200
As a % of capped earnings	23.31%	22.58%
Pre-1992 unfunded liability payments as a percentage of total earnings (excluding government share)	3.57%	3.04%
Post-1991 unfunded liability payments as a percentage of capped earnings	0.00%	3.24%
Minimum annual member and employer contribution effective July 1, 2022 (2020)	**26.88% of pensionable earnings[1]**	**28.86% of pensionable earnings[1]**
Government share of pre-1992 unfunded liability contributions as a percentage of total earnings	1.25%	1.25%

[1] Total earnings used for Pre-1992 unfunded liability contributions and capped earnings used for other contributions

Membership Data

	December 31, 2020	December 31, 2018
Active Members	7,804	8,151
Deferred Vested Members	2,173	2,001
Participants with Amounts Held-on-Deposit	272	286
Pensioners and Survivors	6,140	5,555

Key Assumptions

The principal assumptions to which the valuation results are most sensitive, and those assumptions which have changed since the last valuation are outlined in the following table.

Going Concern	December 31, 2020	December 31, 2018
Discount rate	5.30% per year	5.46% per year
Provision for adverse deviation	0.45%	0.97%
Inflation rate	2.25% per year	2.25% per year
Pensionable earnings	0.0% per year (2021 and 2022); 2.75% per year thereafter plus merit and promotion scale	1.00% per year (2019 and 2020); 2.75% per year thereafter plus merit and promotion scale
Mortality table	85% (100% for females) of 2014 Public Sector Canadian Pensioner Mortality with generational improvements using Scale MI-2017	85% (100% for females) of 2014 Public Sector Canadian Pensioner Mortality with generational improvements using Scale MI-2017
Retirement and Termination rates	Rates based on 2010 to 2020 experience	Rates based on 2009 to 2014 experience
Commuted value net discount rate	1.70% per year	2.44% per year
Non-retired pension partner age differential	Males three years older	Males four years older
Headcount growth	0.50% per year	0.75% per year

Section 1: Introduction

Purpose and Terms of Engagement

We have been engaged by Universities Academic Pension Plan Board of Trustees, and hereafter referred to as the Board, to conduct an actuarial valuation of the Plan, registered in Alberta, as at December 31, 2020 for the general purpose of determining the minimum and maximum funding contributions required by pension standards, based on the actuarial assumptions and methods summarized herein. Specifically, the purposes of the valuation are to:

- Determine the financial position of the Plan on a going concern basis as at December 31, 2020;
- Determine the financial position of the Plan as at December 31, 2020 on a solvency basis;
- Determine the funding requirements of the Plan as at December 31, 2020; and
- Provide the necessary actuarial certification required under the *Employment Pension Plans Act* (the *"Act"*) and the *Income Tax Act*.

The results of this report may not be appropriate for accounting purposes or any other purposes not listed above.

In accordance with the Act and the Sponsorship and Trust Agreement for the Plan, an actuarial valuation report must be filed at least once every three years; the Act further provides the regulator with the authority to request an actuarial valuation report be filed by a pension plan administrator at any time. Based on correspondence from the regulator, actuarial valuations for the Plan are currently required to be filed every two years. We understand that the Board may apply to the regulator to have the next valuation due in three years, therefore, the next required valuation will be required as at December 31, 2023, or earlier.

Summary of Changes Since the Last Valuation

The last such actuarial valuation in respect of the Plan was performed as at December 31, 2018. Since the time of the last valuation, we note that the following events have occurred:

- Going concern actuarial assumptions have been revised. The changes are summarized on page 4 and the financial impact of these changes is summarized on pages 10 to 12 of this report.
- Solvency assumptions have been revised due to general fluctuations in bond rates over the past two years. The changes affecting solvency liabilities are summarized in Appendix D of this report.
- In March 2020, the World Health Organization (WHO) declared a state of global pandemic linked to the 2019 coronavirus disease (COVID-19). So far, the COVID-19 pandemic in Canada has been accompanied by 3 successive waves of disease-related deaths. The net effect on short- and long-term mortality from COVID-19 remains uncertain at this time. Faced with this uncertainty, our view of basic mortality as well as the impact on the future progression of life expectancy remains unchanged for the moment and the mortality assumption has therefore not been revised. The impact of COVID-19 for 2020 is included in the gain and loss analysis of this valuation report; the impact for future years will be recognized in the next valuations as actual deaths will be different from that expected under our assumptions.

- The Canadian Institute of Actuaries has amended the Standards of Practice related to the determination of commuted values effective December 1, 2020. Among other things, the changes impact the interest rates and the retirement age assumption used in the determination of commuted values. Standards of Practice were also revised regarding plausible adverse scenario disclosures. These changes are reflected in this report.

Board Information and Inputs

In order to prepare our valuation, we have relied upon the following information:

- A copy of the previous valuation report as at December 31, 2018;
- A copy of the Statement of Investment Policies and Goals for the Plan;
- A copy of the funding policy for the Plan;
- Membership data compiled as at December 31, 2020 by Buck and staff of the Board;
- Asset data taken from the Plan's audited financial statements ; and
- A copy of the latest Plan text and amendments up to and including December 31, 2020.

Furthermore, our actuarial assumptions and methods have been chosen to reflect our understanding of the Board's desired funding objectives with due respect to accepted actuarial practice and regulatory constraints.

Subsequent Events

As of the date of this report, we have not been made aware of any subsequent events which would have an effect on the results of this valuation. However, the following points should be noted in this regard:

- In March and April 2021, the Board transferred its public equities portfolio from Alberta Investment Management Corporation to a passive public equity investment strategy on a temporary basis until new managers are selected following completion of an asset-liability study in 2021. While this may impact investment returns and expenses in the short-term, the assumptions developed for this report remain appropriate.
- Actual experience deviating from expected after December 31, 2020 will result in gains or losses which will be reflected in the next actuarial valuation report.
- To the best of our knowledge, the results contained in this report are based on the regulatory and legal environment in effect at the date of this report and do not take into consideration any potential changes that may be currently under review. To the extent that actual changes in the regulatory and legal environment transpire, any financial impact on the Plan as a result of such changes will be reflected in future valuations.

Section 2: Going Concern Valuation Results

Going Concern Financial Position of the Plan

The going concern valuation provides an assessment of the Plan's financial position at the valuation date on the premise that the Plan continues on into the future indefinitely.

The selection of the applicable actuarial assumptions and methods reflect the Plan's funding objectives, as communicated by the Board, actuarial standards of practice, and pension standards.

On the basis of the Plan provisions, membership data, going concern assumptions and methods, and asset information described in the Appendices, the going concern financial position of the Plan as at December 31, 2020 is shown in the following table. The results as at December 31, 2018 are also shown for comparison purposes.

Going Concern Financial Position (000's)

	December 31, 2020	December 31, 2018
Actuarial Value of Assets	**$ 5,622,000**	**$ 4,944,700**
Going Concern Liabilities		
Active and Suspended members	$ 2,797,800	$ 2,614,200
Deferred Vested members	281,700	258,900
Amounts held on deposit	2,500	2,600
Retirees members and beneficiaries	3,414,600	3,073,800
Total Liabilities	**$ 6,496,600**	**$ 5,949,500**
Excess Assets/(Unfunded Liability)	**$ (874,600)**	**$ (1,004,800)**
Going concern funded ratio	**0.8654**	**0.8311**

Under Section 38(2)(c) of the *Act* and *Update 14-05*, an actuarial valuation report must be filed once every three years unless the pension plan has a going concern funded ratio of less than 0.85 in which case annual valuation reports are required. Since the going concern funded ratio is not less than 0.85, the next valuation must be filed no later than December 31, 2023, unless required earlier by the regulator.

Since an agreement is in place whereby a portion of the pre-1992 unfunded liabilities are funded by the Government of Alberta, it is necessary to track the financial status of the benefits in respect of service pre and post January 1, 1992. The following table summarizes this split:

Financial Position – Going Concern Basis (000's)

	As at December 31, 2020		
	Pre-1992	**Post-1991**	**Total**
Actuarial Value of Assets			
Market value	$ 596,500	$ 5,181,800	$ 5,778,300
Smoothing adjustment	(22,300)	(134,000)	(156,300)
Total actuarial value of assets	**$ 574,200**	**$ 5,047,800**	**$ 5,622,000**
Actuarial Liability			
Present value of accrued benefits for:			
Active and suspended members	$ 55,400	$ 2,742,400	$ 2,797,800
Deferred vested members	4,700	277,000	281,700
Amounts held on deposit	900	1,600	2,500
Retired members and beneficiaries	1,383,400	2,031,200	3,414,600
Total Liabilities	**$ 1,444,400**	**$ 5,052,200**	**$ 6,496,600**
Actuarial Excess/(Unfunded Liability)	**$ (870,200)**	**$ (4,400)**	**$ (874,600)**
Funded Ratio	0.3975	0.9991	0.8654
Government share of unfunded liability	$ 227,400	$ 0	$ 227,400
Members' and employers' share of unfunded liability	$ 642,800	$ 4,400	$ 647,200

Going Concern Normal Cost (000's)

On the basis of the Plan provisions, membership data, going concern assumptions and methods, asset information and legislative requirement described in the Appendices, the going concern normal cost of the Plan as at December 31, 2020 is shown in the following table. The normal cost as at December 31, 2018 is also shown for comparison purposes.

	December 31, 2020	December 31, 2018
Normal Cost		
Total Normal Cost	**$ 219,500**	**$ 215,200**
Total estimated pensionable earnings (in year following valuation date)	$ 941,500	$ 952,900
Total Normal Cost		
As a % of total pensionable earnings	23.31%	22.58%

Change in Financial Position (000's)

The major components of the change in the Unfunded Liability for the period from December 31, 2018 to December 31, 2020 are summarized in the following table.

	Pre-92	Post-91	Total
Excess Assets/(Unfunded Liability) as at December 31, 2018	**$ (869,300)**	**$ (135,500)**	**$ (1,004,800)**
Expected interest on Excess Assets/(Unfunded Liability)	(97,500)	(15,200)	(112,700)
Special payments in inter-valuation period with interest	87,500	83,400	170,900
Excess Assets/(Unfunded Liability) as at December 31, 2020	**$ (879,300)**	**$ (67,300)**	**$ (946,600)**
Change in financial position due to experience gains/(losses)			
Gain/(loss) from investment earnings greater/lower than expected	$ 25,400	$ 124,600	$ 150,000
Gain/(loss) due to salary increases lower/greater than expected	900	32,900	33,800
Gain/(loss) due to indexation experience	9,000	13,400	22,400
Gain/(loss) due to retirement experience	1,700	7,100	8,800
Gain/(loss) due to mortality experience	(9,800)	(22,900)	(32,700)
Gain/(loss) due to termination experience	0	1,800	1,800
Gain/(loss) on contributions	0	(18,600)	(18,600)
Gain/(loss) on YMPE and maximum pension	0	(8,500)	(8,500)
Net gain/(loss) due to other experience and miscellaneous items	(700)	(16,500)	(17,200)
Excess Assets/(Unfunded Liability) After Experience Gains/(Losses) as at December 31, 2020	**$ (852,800)**	**$ 46,000**	**$ (806,800)**
Change in financial position due to assumption changes			
Change due to salary increase rates	$ 400	$ 37,000	$ 37,400
Change due to commuted value discount rate	0	(20,800)	(20,800)
Change due to new CV basis	0	1,300	1,300
Change due to interest on employee contributions	0	800	800
Change due to termination rates	0	10,400	10,400
Change due to retirement rates	500	36,300	36,800
Change due to pension partner age difference	100	5,300	5,400
Change due to discount rate 5.30%	(18,400)	(120,700)	(139,100)
Excess Assets/(Unfunded Liability) as at December 31, 2020	**$ (870,200)**	**$ (4,400)**	**$ (874,600)**

Reconciliation of Normal Cost

The total normal cost as a percentage of pensionable earnings has increased from 22.58% at December 31, 2018 to 23.31% at December 31, 2020. A reconciliation of this change is shown in the table below:

Normal cost at December 31, 2018	22.58%
Plan data and experience since previous valuation	0.39%
Change due to salary increase rates	(0.36)%
Change due to commuted value discount rate	0.32%
Change due to new CV basis	(0.01)%
Change due to interest on employee contributions	(0.02)%
Change due to termination rates	(0.13)%
Change due to retirement rates	(0.28)%
Change due to pension partner age difference	(0.03)%
Change in discount rate assumption	0.85%
Normal cost at December 31, 2020	**23.31%**

Discussion of Experience

Investment Earnings

The annualized rate of return earned by the pension fund based on the Actuarial Value of Assets for the valuation period from December 31, 2018 to December 31, 2020 was 6.9% per year (9.6% per year for the market value of assets). The assumed rate of return for going concern valuation purposes is 5.46% per year. An actual rate of return greater than the assumed rate resulted in a net actuarial gain of $150.0 million.

Current Service Contributions

The cost of benefits earned for the two-year period from December 31, 2018 to December 31, 2020 was greater than the current service contribution remitted to the Plan for the same period by $18.6 million. This loss was primarily due to the deferral of contribution rate changes from December 31, 2018 to July 1, 2020.

Membership Experience

Over the inter-valuation period, there were actuarial gains and losses as shown on page 10 due to terminations, retirements and mortality different than expected. This is due to the differences in actual versus assumed decrements shown in the following table, as well as differences in the proportion of terminating members who elected to receive a deferred pension versus a lumpsum payment and the value of lumpsum payments.

Analysis of Experience During Intervaluation Period

	Actual	Assumed
Average annual actuarial investment return, net of expenses	6.9%	5.46%
Average annual salary increase	2.0%	3.40%
Average annual YMPE increase	3.6%	2.75%
Average annual Maximum Pensionable Earnings Increase	3.6%	2.75%
Average COLA	0.9%	1.35%
Membership experience:		
Terminations from active membership	862	654.8
Retirements from active membership	617	611.2
Average age of active retirements	63.9	63.2
Deaths from non-retired membership	21	34.0
Deaths from retired membership	271	280.6

Discussion of Changes in Assumptions

Effective December 31, 2020, the following assumptions were changed:

Economic Assumption

- The salary increase assumption for 2021 and 2022 was changed to 0.0% per year plus merit and promotion from 2.75% plus merit and promotion.
- The net indexed commuted value discount rate assumption was changed to 1.70% per year from 2.44% per year.
- The interest on employee contributions was changed to 2.50% per year from 2.75% per year.
- The discount rate assumption was changed to 5.3% per year from 5.46% per year.

In combination, these changes in assumptions increased the going concern liabilities by $121.7 million and the total normal cost by $7.5 million.

Demographic and Other Assumptions

- The termination rate assumption was changed to rates based on the 2021 Experience Study from rates based on the 2015 Experience Study.
- The retirement rate assumption was changed to rates based on the 2021 Experience Study from rates based on the 2015 Experience Study.
- The pensioner partner age differential was changed to 3 years from 4 years.
- The CV basis was changed following the CIA change in standards effective December 1, 2020.

The change in assumption decreased the going concern liabilities by $53.9 million and the total normal cost by $4.2 million.

Going Concern Valuation Sensitivity Results

In accordance with the CIA Standards of Practice specific to pension plans, the table below presents the sensitivity of the going concern liabilities and the total normal cost of using a discount rate 1% lower and 1% higher than that used for the going concern valuation.

December 31, 2020			**Effect**	
(000's)			**$**	**%**
Going concern liabilities	$	6,496,600		
Going concern liabilities (discount rate – 1%)	$	7,491,200	994,600	15.3%
Going concern liabilities (discount rate + 1%)	$	5,711,700	(784,900)	(12.1%)
Normal cost	$	219,500		
Normal cost (discount rate – 1%)	$	269,200	49,700	22.6%
Normal cost (discount rate + 1%)	$	184,600	(34,900)	(15.9%)

Note that the discount rate used to determine lump sum payments upon termination for active members has been held constant in the above sensitivity testing.

Plausible Adverse Scenarios

In accordance with the Canadian Institute of Actuaries Standards of Practice specific to pension plans, below is summarized scenarios of adverse but plausible assumptions, relative to the best estimate assumptions otherwise selected for the valuation.

Interest Rate Sensitivity

The table below presents the sensitivity of the going concern position of using interest rates 1% lower than the current level. Equity risk premiums are assumed to remain unchanged, so the future return on all asset classes and the going concern discount rate both decrease by 1%. In order to calculate the impact on the Actuarial Value of Assets the decrease in interest rates only impacts fixed income assets with the shock assumed to occur immediately before the valuation date, therefore a portion of the change to market value of assets is not recognized due to the change in smoothing adjustment as shown below. Fixed income assets are assumed to be 38.4% of total assets based on asset values at the valuation date, and including 50% of the value for real estate, infrastructure and mortgages; a duration of 11.53 was considered based on relevant fixed income benchmarks.

(000's)	**Base Scenario**	**Adverse Scenario**	**Impact ($)**
Market value of assets	$ 5,778,300	$ 6,033,000	$ 254,700
Smoothing adjustment	(156,300)	(326,100)	(169,800)
Actuarial value of assets	$ 5,622,000	$ 5,706,900	$ 84,900
Going concern liabilities	6,496,600	7,491,200	994,600
Excess Assets/(Unfunded Liability)	**$ (874,600)**	**$ (1,784,300)**	**$ (909,700)**
Total Normal Cost	**$ 219,500**	**$ 269,200**	**$ 49,700**

Deterioration in Asset Value

In assessing the risk related to the deterioration in asset value we have chosen an adverse scenario equal to a 15% reduction in the non-fixed income asset values and assume no change in future return expectations. Non-fixed income assets are those assets not included as fixed-income for the interest rate sensitivity above. In order to calculate the impact on the Actuarial Value of Assets, the table below presents the sensitivity of the going concern position of using the market value of assets with a 15% reduction in non-fixed income asset values. The asset shock is assumed to occur immediately before the valuation date, therefore a portion of the change to market value of assets is not recognized due to the change in smoothing adjustment as shown below.

(000's)	**Base Scenario**	**Adverse Scenario**	**Impact ($)**
Market value of assets	$ 5,778,300	$ 5,246,200	$ (532,100)
Smoothing adjustment	(156,300)	198,400	354,700
Actuarial value of assets	$ 5,622,000	$ 5,444,600	$ (177,400)
Going concern liabilities	6,496,600	6,496,600	-
Excess Assets/(Unfunded Liability)	**$ (874,600)**	**$ (1,052,000)**	**$ (177,400)**
Total Normal Cost	**$ 219,500**	**$ 219,500**	**$ -**

Mortality Sensitivity

The table below presents the sensitivity of the going concern position of the Plan to using a mortality assumption with a 10% improvement to the base mortality rates. For the purposes of this analysis, we have used 90% of the rates of the base table used in the going concern valuation, including the assumed mortality to determine lump sum payments upon termination for active members.

(000's)	**Base Scenario**	**Adverse Scenario**	**Impact ($)**
Market value of assets	$ 5,778,300	$ 5,778,300	$ -
Smoothing adjustment	(156,300)	(156,300)	-
Actuarial value of assets	$ 5,622,000	$ 5,622,000	$ -
Going concern liabilities	6,496,600	6,633,400	136,800
Excess Assets/(Unfunded Liability)	**$ (874,600)**	**$ (1,011,400)**	**$ (136,800)**
Total Normal Cost	$ 219,500	$ 222,400	$ 2,900

Section 3: Solvency Valuation Results

Solvency Financial Position of the Plan

The solvency valuation is a financial assessment of the Plan that is required by the *Act* and is performed in accordance with requirements prescribed by that legislation. It is intended to provide an assessment of the Plan's financial position at the valuation date on the premise that certain obligations as prescribed by the *Act* are settled on the valuation date for all members. The *Act* does not require funding based on the solvency valuation results. All assumptions for the solvency valuation are listed in Appendix D.

On the basis of the Plan provisions, membership data, solvency assumptions and methods and asset information described in the Appendices, as well as the requirements of the *Act*, the solvency financial position of the Plan as at December 31, 2020 is shown in the following table. The solvency financial position of the Plan as at December 31, 2018 is shown for comparison purposes.

Solvency Financial Position (000's)

	December 31, 2020	December 31, 2018
Assets		
Market value of assets	$ 5,778,300	$ 4,830,900
Estimated wind up expenses	(3,300)	(3,200)
Solvency Assets	**$ 5,775,000**	**$ 4,827,700**
Solvency Liabilities		
Active and Suspended members	$ 5,377,100	$ 4,146,600
Deferred Vested members	499,800	382,800
Amounts held on deposit	2,500	2,600
Retirees members and beneficiaries	4,817,800	3,911,900
Total Liabilities	**$ 10,697,200**	**$ 8,443,900**
Solvency Excess/(Deficiency)	**$ (4,922,200)**	**$ (3,616,200)**
Solvency ratio	**0.5399**	**0.5717**

The financial position as at December 31, 2020 on a solvency basis split for service pre and post January 1, 1992 is as follows:

Financial Position – Solvency Basis (000's)

	As at December 31, 2020		
	Pre-1992	**Post-1991**	**Total**
Assets			
Market value of assets	$ 596,500	$ 5,181,800	$ 5,778,300
Wind-up expenses	0	(3,300)	(3,300)
Actuarial value of assets	**$ 596,500**	**$ 5,178,500**	**$ 5,775,000**
Liabilities			
Active and suspended members	$ 93,600	$ 5,283,500	$ 5,377,100
Deferred vested members	6,800	493,000	499,800
Amounts held on deposit	900	1,600	2,500
Retired members and beneficiaries	1,827,900	2,989,900	4,817,800
Total Liabilities	**$ 1,929,200**	**$ 8,768,000**	**$ 10,697,200**
Solvency excess (deficiency)	**$ (1,332,700)**	**$ (3,586,200)**	**$ (4,922,200)**
Solvency Ratio	0.3092	0.5910	0.5399

Impact of Plan Wind Up

In our opinion, the value of the Plan's assets would be less than its actuarial liabilities if the Plan were to be wound up on the valuation date.

Specifically, actuarial liabilities would exceed the market value of Plan assets by $4,922.2 million. This calculation includes a provision of $3.3 million for termination expenses that might be payable from the pension fund if the plan were wound up.

Part of this deficiency would be shared by the Government of Alberta in respect of pre-1992 service.

Solvency Valuation Sensitivity Results

In accordance with the CIA Standards of Practice specific to pension plans, the table below presents the sensitivity of the solvency liabilities to using a discount rate of 1% lower and 1% higher than that used for the solvency valuation.

		Effect	
December 31, 2020 (000's)		**$**	**%**
Solvency liabilities	$ 10,697,200		
Solvency liabilities (discount rate – 1%)	$ 12,422,900	$ 1,725,700	16.1%
Solvency liabilities (discount rate + 1%)	$ 9,377,700	$ (1,319,500)	-12.3%

Incremental Cost on a Solvency Basis

The incremental cost on a solvency basis represents the present value at December 31, 2020 of the expected aggregate change in the solvency liabilities between December 31, 2020 and the next calculation date, that is December 31, 2023. Appendix D gives more details on the calculation methodology and on assumptions.

Based on this methodology and on these assumptions, the incremental cost on a solvency basis can be found in the following table.

(000's)	**2021**	**2022**	**2023**
Incremental cost on a solvency basis	$ 566,500	$ 557,800	$ 579,900

Section 4: Contribution Requirements

Contribution Requirements in Respect of the Normal Cost

The annual going concern cost of benefits in respect of service accruing after the valuation date is known as the normal cost. The following table sets out:

- The development of the rule to determine the normal cost;
- An estimate of the normal cost for the 3 year(s) following the valuation date; and
- The portion of the going concern normal cost that is to be paid by the members.

		2021		2022		2023
Total Normal Cost	**$**	**219,500**	**$**	**221,700**	**$**	**230,000**
Total pensionable earnings	$	941,500	$	950,900	$	986,600
Total Normal Cost						
As a % of pensionable earnings		23.31%		23.31%		23.31%

In the event an updated funding range in accordance with legislative requirements is not certified before December 31, 2023, the rule for determining the company normal cost contributions outlined in the above table will continue to be appropriate until the effective date of the next contribution recommendation for the Plan following the next valuation as at December 31, 2023. Adjustment to the contributions may be required once the next actuarial funding range in accordance with legislative requirements is certified.

Development of Special Payments

Due to the different funding arrangements in place for unfunded liabilities relating to service before and after January 1, 1992, the special payments for these two periods are determined separately, as shown in this section.

The amortization schedules for unfunded liabilities were developed using the going concern interest rate of 5.30% per annum compounded annually in arrears with monthly payments; total payroll increases of 1.0% through 2022 and 3.75% per annum thereafter (the assumed base salary increase plus 0.5% per annum for additional increases and 0.5% per annum headcount growth rate) have been used for the pre-1992 and post-1991 amortization schedules.

Special Payments in Respect of the Pre-1992 Unfunded Liability

Under the terms of the Plan and the *Public Sector Pension Plans Act* which, in accordance with the *Act*, remain in effect, additional contributions will be made by the Government of Alberta, plan members, and employers to eliminate the Plan's unfunded liability in respect of pre-1992 service and the benefits that were in place, as at December 31, 1991. These contributions are to be determined such that the pre-1992 unfunded liability will be eliminated on or before December 31, 2043 and will be split between the three parties as follows:

	Percent of Total
Government	1.25% of total payroll
Members and Employers	Each, 50% of remaining balance
Total	100%

The following table summarizes the previously established amortization schedules of pre-1992 going concern special payments before adjustment to reflect any gains or losses revealed in the going concern results.

				Present Value as of December 31, 2020
	Date of Last Payment	**Special Payment as % of Pensionable Earnings**	**Annual Special Payment (000's)**	**For Going Concern Valuation (000's)** [1]
Government contributions	31-Dec-2043	1.25%	$ 12,190	$ 227,400
Member contributions	31-Dec-2043	1.52%	14,820	276,500
Employer contributions	31-Dec-2043	1.52%	14,820	276,500
Total		**4.29%**	**$ 41,830**	**$ 780,400**

[1] The values in the table were developed using the going concern interest rate of 5.3% per annum compounded annually in arrears with monthly payments

As at December 31, 2020, the pre-1992 unfunded liability is $870.2 million. The following table summarizes the amortization schedules of pre-1992 going concern special payments after adjustment to reflect net losses revealed in the going concern results.

	Date of Last Payment	Special Payment as % of Pensionable Earnings	Annual Special Payment (000's)	Present Value as of December 31, 2020 For Going Concern Valuation (000's) [1]
Previously established special payments from January 1, 2021 to June 30, 2022				
Government contributions	30-June-2022	1.25%	$ 12,190	$ 17,600
Member contributions	30-June-2022	1.52%	14,820	21,400
Employer contributions	30-June-2022	1.52%	14,820	21,400
Total contributions up to June 30, 2022		**4.29%**	**$ 41,830**	
Revised special payments from July 1, 2022				
Government contributions	31-Dec-2043	1.250%	$ 12,190	$ 209,800
Member contributions	31-Dec-2043	1.785%	17,430	300,000
Employer contributions	31-Dec-2043	1.785%	17,430	300,000
Total		**4.820%**	**$ 47,050**	**$ 870,200**

The special payment schedule effective December 31, 2020, is calculated on the assumption that contribution changes take effect July 1, 2022. Until then, the existing pre-1992 contribution schedule of 4.29% of pay will remain in place. The percentage of pensionable earnings is calculated as a level percentage of pay through to the last payment date, assuming pensionable earnings grow at 1.0% through 2022 and 3.75% per annum thereafter.

Note that pre-1992 additional contributions are payable as a percentage of total unlimited earnings, whereas normal cost contributions and post-1991 unfunded liability special payments are payable as a percentage of capped pensionable earnings.

[1] The values in the table were developed using the going concern interest rate of 5.3% per annum compounded annually in arrears with monthly payments

Special Payments in Respect of the Post-1991 Unfunded Liability

Under the terms of the Plan, any unfunded liability in respect of post-1991 service shall be funded in accordance with the *Act*. Since the Plan has an unfunded liability with respect to post-91 service, special payments must be made in order to eliminate the deficiency over no more than 15 years from the date that the unfunded liability was established.

The following table summarizes previously established amortization schedules of post-1991 going concern special payments before adjustment to reflect any gains or losses due to the going concern results.

					Present Value as of December 31, 2020
	Effective Date	**End Date**	**Special Payment as % of Capped Earnings**	**Annual Special Payment (000's)**	**For Going Concern Valuation (000's)** [1]
Member contributions	31-Dec-2008	31-Dec-2021	0.765%	$ 7,200	$ 13,800
Employer contributions	31-Dec-2008	31-Dec-2021	0.765%	7,200	13,800
Member contributions	31-Dec-2008	31-Dec-2023	0.505%	4,750	13,400
Employer contributions	31-Dec-2008	31-Dec-2023	0.505%	4,750	13,400
Member contributions	31-Dec-2010	31-Dec-2025	0.225%	2,120	9,800
Employer contributions	31-Dec-2010	31-Dec-2025	0.225%	2,120	9,800
Member contributions	31-Dec-2012	31-Dec-2027	0.125%	1,180	7,500
Employer contributions	31-Dec-2012	31-Dec-2027	0.125%	1,180	7,500
Total			**3.240%**	**$ 30,500**	**$ 89,000**

[1] The values in the table were developed using the going concern interest rate of 5.3% per annum compounded annually in arrears with monthly payments

As at December 31, 2020, the post-1991 unfunded liability is $4.4 million. The following table summarizes the amortization schedules of post-1991 going concern special payments after adjustment to reflect any gains or losses due to the going concern results.

	Effective Date	End Date	Special Payment as % of Capped Earnings	Annual Special Payment (000's)	Present Value as of December 31, 2020 For Going Concern Valuation (000's) [1]
Previously established special payments up to and including June 30, 2022					
Member contributions	31-Dec-2018	30-June-2022	1.25%	$ 11,790	$ 17,100
Employer contributions	31-Dec-2018	30-June-2022	1.25%	11,790	17,100
Total contributions up to June 30, 2022			2.50%	$ 23,580	
Total			**2.50%**	**$ 23,580**	**$ 34,200**

The previously established special payments included in the above schedule up to and including June 30, 2022 have been reduced to reflect the increase in the current service cost for the plan effective January 1, 2021 which will not be implemented until July 1, 2022. The percentage of pensionable earnings is calculated as a level percentage of capped pensionable earnings through to the last payment date, assuming pensionable earnings grow at 1.0% through 2022 and 3.75% per annum thereafter.

Since the present value of post-1991 special payments from January 1, 2021 to June 30, 2022 exceeds the post-1991 unfunded liability, no further post-1991 unfunded liability contributions are required commencing on July 1, 2022.

[1] The values in the table were developed using the going concern interest rate of 5.3% per annum compounded annually in arrears with monthly payments

Excess Surplus

The *Income Tax Act* requires that any excess surplus first be applied to reduce or eliminate the company contribution requirements. Excess surplus is defined in Section 147.2(2)(d) of the *Income Tax Act*, as the portion of surplus (if any) that exceeds 25% of the going concern liabilities.

Since the Plan has an unfunded liability, there is no excess surplus and therefore it does not impact the development of the total contribution requirements.

Total Contributions

The minimum amount under the *Act* and the maximum amount, under the *ITA* that the member and employer must contribute are described in Appendix A. The member and employer contributions recommended in this valuation report are at least equal to the legislated minimum requirements and do not exceed the legislated maximum requirements.

The minimum and maximum member and employer contributions to the Plan each year, as a percentage of the applicable earnings amount, are shown in the following table.

	Minimum Required Under the *Act* (July 1, 2022 until the next contribution recommendation)	**Maximum Permitted Under the *ITA* (January 1, 2021 to December 31, 2024)**
Pre-1992 unfunded liability		
▪ Government	1.25%	1.25%
▪ Members and employers	3.57%	22.67%
Post-1991 unfunded liability	0.00%[1]	0.13%
Solvency deficiency	0.00%	108.16%
Post-1991 normal cost	23.31%	23.31%
Total		
▪ Government	1.25%	1.25%
▪ Members and employers	26.88%	154.27%

The minimum permitted under the *Act* column illustrates the minimum amount of funding that would be required for the period July 1, 2022 to the effective date of the contribution recommendation contained in the next actuarial valuation to meet the *Act's* funding requirements, expressed as a percentage of pay. The maximum permitted under the *ITA* column represents the maximum amount of funding that would be permitted under the *ITA* for the period January 1, 2021 to December 31, 2024, expressed as a level percentage of pay each year.

If the Board wishes to implement the maximum deductible member and employer contribution, it is advisable to contact the Plan's actuary before making such contributions to ensure that the contributions will be permissible and deductible and that any regulatory requirements are considered.

[1] Minimum Post-1991 unfunded liability contributions reduce to 0.0% of capped earnings effective July 1, 2022.

Based on the results of the valuation, the Board has adopted a 1.98% net reduction in total employer and member contribution rates. The total employer and member contribution rate will decrease to 26.88% effective July 1, 2022.

The new contribution rates effective July 1, 2022 are shown in the following table. Note that the employers pay matching contributions except at Athabasca University and the Banff Centre where employers contribute 1.0% more than members.

New Contribution Rates effective July 1, 2022

	Equal Share		**Employer = Members + 1%**	
	Member	**Employer**	**Member**	**Employer**
Pre-1992 unfunded liability additional contributions	1.785%	1.785%	1.785%	1.785%
Post-1991 unfunded liability amortization payments	0.00%	0.00%	0.00%	0.00%
Normal cost				
-earnings below YMPE	9.595%	9.595%	9.095%	10.095%
-earnings above YMPE	13.705%	13.705%	13.205%	14.205%
Total Contributions				
On earnings below YMPE	11.38%	11.38%	10.88%	11.88%
On earnings above YMPE, but less than pensionable salary cap	15.49%	15.49%	14.99%	15.99%
On earnings above pensionable salary cap	1.785%	1.785%	1.785%	1.785%

Note that pre-1992 additional contributions are payable as a percentage of total earnings, whereas the normal cost contributions and post-1991 unfunded liability special payments are payable as a percentage of capped pensionable earnings.

The amortization schedules for unfunded liabilities were developed using the going concern interest rate of 5.3% per annum compounded annually in arrears with monthly payments. Capped pensionable earnings are assumed to grow at 1.0% through 2022 and 3.75% per annum thereafter (the assumed base salary increase plus 0.5% per annum for additional increases and 0.5% per annum for headcount growth). Total earnings used to determine the pre-1992 additional contributions are assumed to grow at the same rates as those used for the post-1991 amortization payments.

Section 5: Actuarial Certificate

Actuarial Opinion, Advice and Certification for the Universities Academic Pension Plan

Canada Revenue Agency Registration Number: 0339572

Opinion

This actuarial certification forms an integral part of the actuarial valuation report for the Plan as at December 31, 2020. We confirm that we have prepared an actuarial valuation of the Plan as at December 31, 2020 for the purposes outlined in the Introduction section to this report and consequently:

Our advice on funding is the following:

- The Board should contribute the amounts within the range of minimum and maximum contribution amounts as outlined in Section 4 of this report, in accordance with legislative requirements.
- The next actuarial valuation for the purpose of developing funding requirements should be performed no later than as at December 31, 2023.

We hereby certify that, in our opinion:

- The contribution range as outlined in this report is expected to be sufficient to satisfy the Plan's funding requirements.
- The contribution range outlined in this report qualifies as eligible contributions under Section 147.2(2) of the *Income Tax Act.*
- The member contributions recommended in this report exceed the limits imposed by paragraph 8503(4)(a) of the *Income Tax Regulations*, however we will apply for a ministerial waiver in accordance with paragraph 8503(5) of the *Income Tax Regulations*. Upon approval by the Minister, the member contributions recommended in this report will be eligible contributions.
- For the purposes of the valuation:
  - The data on which this valuation is based are sufficient and reliable;
  - The assumptions used are appropriate; and
  - The actuarial cost methods and the asset valuation methods used are appropriate.

- This report and its associated work have been prepared, and our opinion given, in accordance with accepted actuarial practice in Canada and in compliance with the requirements outlined in subparagraphs 147.2(2)(a)(iii) and (iv) of the *Income Tax Act*.
- Notwithstanding the above certifications, emerging experience differing from the assumptions will result in gains or losses that will be revealed in subsequent valuations.

[Original Signed by John Slipp]

John Slipp, FCIA, FSA
Associate Partner

[Original Signed by Damon Callas]

Damon Y. Callas, FCIA, FSA
Senior Consultant

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September 14, 2021

Appendix A: Assets

Asset Data

The Plan's assets are held in trust by the Board and invested by Alberta Investment Management Corporation (AIMCo), Beutel Goodman and Fiera Capital. In March and April 2021, the Board transferred its public equities portfolio from AIMCo to a passive public equity investment strategy on a temporary basis until new managers are selected following completion of an asset-liability study in 2021. The asset information presented in this report is based on the financial statements of the pension fund prepared by the Board.

Tests of the sufficiency and reliability of the asset data were performed and the results were satisfactory. The tests included:

- A reconciliation of actual cash flow with expected cash flow from the previous actuarial report; and
- A reconciliation of any anticipated benefit payments (for retirees, terminated, or deceased members) against the financial statements of the pension fund for confirmation of payments.

Market Value of Assets

The following is a summary of the composition of the Plan's assets by asset type as reported in the Plan's financial statements as at December 31, 2020. For comparison purposes, the composition at the previous valuation date of December 31, 2018 is also shown.

(000's)	**December 31, 2020**	**December 31, 2018**
Invested Assets	$ 5,756,437	$ 4,808,357
Net receivables and payables	21,817	22,590
Market Value	**$ 5,778,254**	**$ 4,830,947**

Asset Allocation

The following is a summary of the allocation of the Plan's invested assets:

	December 31, 2020		December 31, 2018	
(000's)	**Fair Value ($)**	**%**	**Fair Value ($)**	**%**
Interest-bearing securities				
Cash and short-term securities	12,590	0.2	20,381	0.4
Bonds and mortgages	1,545,176	26.9	1,372,157	28.5
Real return bonds	407,392	7.0	336,505	7.0
	1,965,158	**34.1**	**1,729,043**	**35.9**
Equities				
Canadian public equities	688,767	12.0	544,368	11.3
Foreign public equities	1,546,318	26.9	1,418,841	29.5
Emerging markets equities	422,030	7.3	344,027	7.2
	2,657,115	**46.2**	**2,307,236**	**48.0**
Alternative investments				
Real estate	387,286	6.7	424,859	8.8
Private equity	325,279	5.7	80,695	1.7
Infrastructure and private debt/loans	366,718	6.4	183,091	3.8
Timberland	33,050	0.6	42,556	0.9
	1,112,333	**19.4**	**731,201**	**15.2**
Strategic opportunities and currency overlays	**21,831**	**0.3**	**40,877**	**0.9**
Total Invested Assets	**5,756,437**	**100.0**	**4,808,357**	**100.0**

Target Asset Mix

The target asset mix of the Plan is contained in the Plan's Statement of Investment Policies and Procedures and is as follows:

Asset Class	Benchmark	Long-term Policy Weight	Allowable Range
Fixed Income			
Cash and Short-term	FTSE Canada 91 Day T-bill Index	0.0%	0%-1%
Universe Bonds	FTSE Canada Universe Bond Index	11.5%	8%-14%
Long Duration Bonds	FTSE Canada Overall Long Term Bond Index	11.5%	8%-14%
Mortgages	FTSE 60% Short Term / 40% Mid Term Bond Index + 75 bps	5.0%	3%-7%
Real Rate of Return Bonds	FTSE Canada Real Return Bond Index	7.0%	5%-9%
		35.0%	**26%-41%**
Equities			
Canadian Equities	S&P/TSX Capped Composite Index	12.0%	10%-20%
Global Equities	MSCI World Total Return Net Index	26.0%	22%-31%
Emerging Markets Equities	MSCI Emerging Markets Net Index	7.0%	5%-9%
		45.0%	**40%-60%**
Alternatives			
Real Estate	MSCI/REALPAC Canadian All Property Index	8.0%	5%-11%
Private Equity	CPI + 650 bps	5.0%	0%-7%
Infrastructure	CPI + 600 bps	7.0%	3%-9%
Timberland	CPI + 400 bps	0.0%	0%-1%
		20.0%	**12%-25%**
Total Investments		**100.0%**	

Reconciliation of Changes in Market Value of Assets

The table below reconciles changes in the market value of assets between December 31, 2018 and December 31, 2020.

(000's)	Jan 1, 2019 to Dec 31, 2019	Jan 1, 2020 to Dec 31, 2020
Market Value of Assets, Beginning of Plan Year	**$ 4,830,947**	**$ 5,477,268**
Contributions During Plan Year		
Employer	$ 134,446	$ 133,430
Member	133,400	132,421
Prior service	2,237	687
Government	12,191	12,587
Total	**$ 282,274**	**$ 279,125**
Benefit Payments During Plan Year		
Non-retired members[1]	$ 30,403	$ 41,923
Retired members	251,857	263,902
Total	**$ 282,260**	**$ 305,825**
Fees/Expenses		
Investment fees/expenses	$ 29,931	$ 28,052
Non-investment fees/expenses	2,200	2,292
Total	**$ 32,131**	**$ 30,344**
Investment Income	**$ 678,438**	**$ 358,030**
Market Value of Assets, End of Plan Year	**$ 5,477,268**	**$ 5,778,254**
Rate of return, net of fees/expenses	**13.4%**	**6.0%**

[1] Includes members who have terminated employment or died

Development of Actuarial Value of Assets

The method to determine the actuarial value of assets is described in Appendix C. The development of the actuarial value of assets as of December 31, 2020 is shown below:

Actuarial Value of Assets (Three-Year Average Market Value) ($ millions)

	Pre-1992	Post-1991	Total
Market value at January 1, 2019	**$ 655.8**	**$ 4,175.1**	**$ 4,830.9**
Contributions	40.5	241.7	282.3
Benefit Payments & Expenses	(133.7)	(150.7)	(284.5)
Assumed Investment Income (at 5.46% per annum)	33.3	230.5	263.8
Projected value at December 31, 2019	595.9	4,496.7	5,092.6
Contributions	42.5	236.6	279.1
Benefit Payments & Expenses	(132.8)	(175.3)	(308.1)
Assumed Investment Income (at 5.46% per annum)	30.1	247.3	277.4
Projected value at December 31, 2020 (A)	**$ 535.7**	**$ 4,805.3**	**$ 5,341.0**
Market value at January 1, 2020	**$ 647.8**	**$ 4,829.5**	**$ 5,477.3**
Contributions	42.5	236.6	279.1
Benefit Payments & Expenses	(132.8)	(175.3)	(308.1)
Assumed Investment Income (at 5.46% per annum)	32.9	265.5	298.4
Projected value at December 31, 2020 (B)	**$ 590.4**	**$ 5,156.3**	**$ 5,746.6**
Market Value of Assets at December 31, 2020 (C)	**$ 596.5**	**$ 5,181.8**	**$ 5,778.3**
Actuarial Value of Assets at December 31, 2020			
Smoothed Market Value (average of A, B, and C)	$ 574.2	$ 5,047.8	$ 5,622.0
Minimum actuarial value (90% of market value)	536.9	4,663.6	5,200.4
Maximum actuarial value (110% of market value)	656.2	5,699.9	6,356.1
Capped Actuarial Value of Assets	**$ 574.2**	**$ 5,047.8**	**$ 5,622.0**

Appendix B: Membership Data

Source of Data

This valuation was based on member data provided by Buck and staff of the Board as of December 31, 2020. Tests of the sufficiency and reliability of the member data were performed and the results were satisfactory. The tests included:

- A reconciliation of membership status against the membership status at the last valuation. This test was performed to ensure that all members were accounted for. A summary of this reconciliation follows on the next page;
- A reconciliation of birth, hire, and participation dates against the corresponding dates provided for the last valuation to ensure consistency of data;
- A reconciliation of credited service against the corresponding amount provided for the last valuation to ensure that no member accrued more than 2 years of credited service from December 31, 2018;
- A reconciliation of pensionable earnings against the corresponding amounts provided for the last valuation to identify any unusual increases or decreases;
- A reconciliation of accrued benefits against the corresponding amounts provided for the last valuation to identify any unusual benefit accruals;
- A reconciliation of any stated benefit payments since December 31, 2018 (for retired, terminated, or deceased members) against the financial statements of the pension fund for confirmation of the payments; and
- A reconciliation of inactive member benefit amounts against the corresponding amounts provided for the last valuation to ensure consistency of data.

The following information was missing, and assumptions were made as follows with respect to such missing data:

- Annualization of Pensionable Earnings: Since the data provided did not include annualized earnings for some members, earnings were annualized using actual earnings and in-year service where required. Annualized earnings for the first year after the valuation date (2021) were increased by an assumed rate of 0.0% plus Seniority, Merit and Promotion from those provided for 2020.
- Earnings: If earnings were available for 2015 to 2019, the most recent data was utilized and increased to 2020 using the salary increase assumptions from the previous valuation. If earnings were not available, the average salary for the group was used.
- Service Ratios: If the service ratio was blank we assumed a service ratio of 1.0.
- Detail in Financial Information: Due to the nature of the financial information, it was not possible to trace the refunds individually for some terminating members. The potential effect of this data omission was immaterial to the overall results of the valuation; however, it could have a small impact on the gain/loss analysis.
- Pension Amounts: For members included in active member data with termination dates before the valuation date we have calculated the value of benefits based on available active member data.
- Pension Amounts for Pensioners: Current pension amounts in-pay were provided by staff of the Board, and included actual pension indexing up to January 1, 2021. Any incomplete data was supplemented with the pensioner data provided by Buck.

A copy of the administrator certification certifying the accuracy and completeness of the member data (and the Plan provisions summarized in this report) is included in Appendix G of this report.

Membership Summary

The table below reconciles the number of members as of December 31, 2020 with the number of members as of December 31, 2018 and the changes due to experience in the period.

	Active and Suspended Members	Deferred Vested Members	HODs	Pensioners and Survivors	Total
Members, December 31, 2018	**8,151**	**2,001**	**286**	**5,555**	**15,993**
Changes due to:					
New entrants	1,117	0	0	0	1,117
Termination					
Non-vested	0	0	0	0	0
Deferred vested	(443)	443	0	0	0
Lump sum	(419)	(122)	(12)	0	(553)
Death					
No further benefits	0	0	0	(144)	(144)
Lump sum	(13)	(1)	0	(2)	(16)
Surviving beneficiary	(5)	(2)	0	(125)	(132)
New beneficiary	0	0	0	132	132
Expiry of Guarantee period	0	0	0	(4)	(4)
Retirement	(617)	(114)	0	731	0
Return to active	35	(34)	0	(1)	0
Data correction	(2)	2	(2)	(2)	(4)
Net change	(347)	172	(14)	585	396
Members, December 31, 2020	**7,804**	**2,173**	**272**	**6,140**	**16,389**

Active and Suspended Members

	December 31, 2020	December 31, 2018
Number	7,804	8,151
Average age	49.4	48.9
Average credited service	10.7	10.0
Total expected 2021 (2019) unlimited earnings for members with a normal cost	$ 975,291,927	$ 995,109,662
Total expected 2021 (2019) capped earnings for members with a normal cost	$ 941,468,653	$ 952,857,709
Total expected 2021(2019) annualized capped earnings for all members	$ 961,819,196	$ 976,718,093
Average expected 2021 (2019) annualized capped earnings for all members	$ 123,247	$ 119,828
Average expected 2021 (2019) annualized capped earnings for members with normal cost	$ 123,633	$ 120,137
Proportion female	49.5%	49.2%

Active and Suspended Members – Pre-1992 Service

	December 31, 2020	December 31, 2018
Number	275	415
Average age	63.8	62.7
Average pre-1992 pensionable service	3.8	4.3
Average expected 2021 (2019) annualized unlimited earnings for all members	$ 192,046	$ 184,378
Proportion female	27.6%	29.2%

Deferred Vested Members

	December 31, 2020	December 31, 2018
Number	2,173	2,001
Average age	49.6	49.4
Average annual pension	$ 8,327	$ 8,652
Average annual pre-1992 pension[1]	$ 140	$ 250
Proportion female	51.3%	50.4%

[1] Average over all deferred members; 44 deferred members have pre-1992 pension (65 at December 31, 2018)

Participants with Amounts Held-on-Deposit

	December 31, 2020	December 31, 2018
Number	272	286
Average age	60.5	58.9
Average contributions with interest	$ 9,130	$ 9,393
Proportion female	49.3%	49.7%

Pensioners and Survivors

	December 31, 2020	December 31, 2018
Number	6,140	5,555
Average age	74.0	73.8
Average annual Pension	$ 44,293	$ 44,167
Average years since retirement	$ 12.6	$ 12.5
Proportion female	41.6%	40.7%

Pensioners and Survivors – Pre-1992 Pension

	December 31, 2020	December 31, 2018
Number	3,786	3,783
Average age	78.0	76.9
Average annual pre-1992 pension	$ 34,589	$ 34,980
Average years since retirement	$ 16.7	$ 15.8
Proportion female	33.3%	34.0%

Active and Suspended Membership Distribution

The following table provides a detailed summary of the active and suspended membership at the valuation date by years of credited service and by age group using expected average annualized capped 2021 earnings. For privacy reasons, average earnings is not shown for groups with one member.

Age	< 5	5–10	10–15	15–20	20–25	25–30	30–35	>=35	Total
< 25	5								5
Avg. earnings	$ 88,487								$ 88,487
25–30	102	3							105
Avg. earnings	$ 76,684	$ 86,017							$ 76,951
30–35	370	62	2						434
Avg. earnings	$91,138	$97,868	$134,174						$92,298
35–40	614	280	37	1					932
Avg. earnings	$95,540	$108,952	*	*					$100,176
40–45	510	409	251	40					1,210
Avg. earnings	$100,564	$111,141	$127,091	$123,212					$110,390
45–50	329	315	439	208	27				1,318
Avg. earnings	$104,586	$114,819	$127,402	$139,196	$145,272				$120,927
50–55	243	252	313	364	172	11	1		1,356
Avg. earnings	$109,838	$118,676	$127,102	*	$157,533	$144,765	*		$130,430
55–60	194	163	241	263	267	76	17		1,221
Avg. earnings	$108,172	$120,691	*	$145,467	$158,504	$167,180	*		$137,024
60–65	92	98	149	154	163	86	90	11	843
Avg. earnings	$114,089	$127,602	$139,806	$148,944	$158,872	$166,138	$167,642	$170,180	$146,991
>=65	32	23	57	75	57	37	60	39	380
Avg. earnings	$108,668	$125,891	$146,210	$153,552	$162,566	$168,535	$171,459	$175,032	$154,840
Total	**2,491**	**1,605**	**1,489**	**1,105**	**686**	**210**	**168**	**50**	**7,804**
Avg. Capped Earnings	**$99,555**	**$114,291**	**$128,830**	**$143,290**	**$158,165**	**$165,818**	**$167,889**	**$173,964**	**$123,247**

Pre-1992 Active and Suspended Membership Distribution

The following table provides a detailed summary of the active and suspended membership who have pre-1992 service at the valuation date by years of pre-1992 credited service and by age group using expected average annualized 2021 earnings. For privacy reasons, average earnings are not shown for groups with one member.

	Years of Pre-1992 Credited Service				
Age	**< 5**	**5–10**	**10–15**	**15–20**	**Total**
50–55	2				2
Avg. earnings	$ 133,267				$ 133,267
55–60	35	2			37
Avg. earnings	$ 182,268	$ 116,948			$ 187,737
60–65	98	24	1		123
Avg. earnings	$ 184,584	*	*		$ 190,811
>=65	61	36	15	1	113
Avg. earnings	$ 193,599	$ 204,682	*	*	$ 198,787
Total Count	**196**	**62**	**16**	**1**	**275**
Avg. Capped Earnings	**$ 186,452**	*****	**$ 204,435**	*****	**$ 192,046**

Pensioner/Survivor Membership Distribution

The following table shows the distribution by pensioner age and pension partner age for the pensioners and survivors in receipt of monthly pension payments. For privacy reasons, average pension amounts are not shown for groups with one member.

Age		Pension Partner Age						No Pension Partner	Total
		< 55	55–65	65–75	75–85	85–95	>=95		
< 55	Count							8	8
	Average Pension							$6,922	$ 6,922
	Average of J&S%							N/A	
55–60	Count	31	141	25	2			69	268
	Average Pension	$26,795	$31,061	$27,809	$14,221			$23,436	$28,175
	Average of J&S%	0.93	0.83	0.85	0.67			N/A	
60–65	Count	31	314	164	13	1		196	719
	Average Pension	*	$36,013	$30,769	$35,469	*		$29,053	$32,891
	Average of J&S%	0.85	0.89	0.86	0.80	0.67		N/A	
65–70	Count	21	196	568	55	1	1	359	1,201
	Average Pension	$35,824	$42,139	$39,169	$43,301	*	*	$36,820	$39,066
	Average of J&S%	0.83	0.82	0.86	0.81	1.00	0.67	N/A	
70–75	Count	14	88	590	184	8	1	375	1,260
	Average Pension	$52,062	*	$49,797	$43,397	$31,108	*	$44,281	$46,811
	Average of J&S%	0.91	0.85	0.85	0.85	0.88	0.67	N/A	
75–80	Count	5	37	258	437	14		367	1,118
	Average Pension	$65,732	$55,275	$53,935	$56,256	$48,565		$45,731	$52,179
	Average of J&S%	0.74	0.85	0.82	0.84	0.86		N/A	
80–85	Count	2	12	67	330	46	2	325	784
	Average Pension	$58,661	$52,283	$49,757	$55,189	$55,324	$57,548	$47,415	$51,480
	Average of J&S%	0.84	0.84	0.79	0.82	0.84	0.84	N/A	
85–90	Count	1	2	8	117	104	6	240	478
	Average Pension	*	*	*	$54,407	$52,290	$47,496	$43,954	$48,605
	Average of J&S%	1.00	0.67	0.71	0.86	0.88	0.95	N/A	
90–95	Count		1		9	59	9	153	231
	Average Pension		*		*	$45,749	$46,455	$42,551	$43,404
	Average of J&S%		0.67		0.85	0.93	0.93	N/A	
>=95	Count			1	1	8	11	52	73
	Average Pension			*	*	$33,704	$32,634	$40,936	$38,984
	Average of J&S%			0.67	0.67	0.88	0.91	N/A	
Total	**Count**	**105**	**791**	**1,681**	**1,148**	**241**	**30**	**2,144**	**6,140**
	Average Pension	**$37,470**	**$38,790**	**$44,701**	**$52,660**	**$49,413**	**$42,091**	**$ 41,311**	**$ 44,293**
	Average of J&S%	**0.87**	**0.86**	**0.84**	**0.83**	**0.88**	**0.90**	**N/A**	

Pre-1992 Pensioner/Survivor Membership Distribution

The following table shows the distribution by pensioner age and pension partner age for the pensioners and survivors in receipt of monthly pre-1992 pension payments. For privacy reasons, average pension amounts are not shown for groups with one member.

Age		Pension Partner Age						No Pension Partner	Total
		< 50	50–60	60–70	70–80	80–90	>=90		
55–60	Count	1	13	7	2			5	28
	Average Pension	*	$ 5,216	$ 3,984	*			$ 16,790	$ 7,599
	Average of J&S%	1.00	0.87	0.81	1.00			N/A	
60–65	Count	6	21	68	7			41	143
	Average Pension	$6,245	$11,939	$11,951	$11,169			$ 14,238	$ 12,327
	Average of J&S%	0.78	0.89	0.84	0.86			N/A	
65–70	Count	4	27	209	86	4		151	481
	Average Pension	$10,450	$19,227	$18,104	$22,133	$12,736		$ 19,680	$ 19,274
	Average of J&S%	0.92	0.82	0.83	0.84	0.75		N/A	
70–75	Count	3	28	131	320	17	1	219	719
	Average Pension	*	$28,061	$26,478	$32,186	$23,326	*	$ 29,298	$ 29,828
	Average of J&S%	0.89	0.92	0.82	0.83	0.79	0.67	N/A	
75–80	Count	2	11	66	461	69	4	291	904
	Average Pension	$28,108	$33,745	$34,436	$40,175	$37,786	$29,891	$ 34,963	$ 37,746
	Average of J&S%	0.84	0.88	0.81	0.83	0.81	0.84	N/A	
80–85	Count	2	5	23	187	202	12	307	738
	Average Pension	$42,870	$31,291	$36,723	$42,693	$44,952	$43,613	$ 39,757	$ 41,842
	Average of J&S%	0.84	0.87	0.81	0.80	0.84	0.84	N/A	
85–90	Count		1	6	25	178	26	238	474
	Average Pension		*	$34,325	*	$49,411	$45,662	$ 39,728	$ 43,727
	Average of J&S%		1.00	0.67	0.76	0.88	0.90	N/A	
90–95	Count				1	36	39	153	229
	Average Pension				*	$42,410	*	$ 41,393	$ 42,562
	Average of J&S%				1.00	0.91	0.93	N/A	
>=95	Count				2		18	50	70
	Average Pension				$45,047		$35,057	$ 41,271	$ 39,781
	Average of J&S%				0.67		0.91	N/A	
Total	**Count**	**18**	**106**	**510**	**1091**	**506**	**100**	**1,455**	**3,786**
	Average Pension	**$16,236**	**$20,662**	**$22,385**	**$36,662**	**$44,382**	**$43,113**	**$ 34,562**	**$ 34,589**
	Average of J&S%	**0.85**	**0.88**	**0.82**	**0.83**	**0.85**	**0.90**	**N/A**	

Deferred Vested Membership Distribution

Annual pension amounts shown for deferred vested members are the amounts payable without adjustment for early or postponed retirement, but include cost of living adjustments granted up to January 1, 2021.

Age			
<=30	Count		22
	Average pre-92 pension	$	0
	Average total pension	$	1,333
30–35	Count		98
	Average pre-92 pension	$	0
	Average total pension	$	2,275
35–40	Count		234
	Average pre-92 pension	$	0
	Average total pension	$	4,066
40–45	Count		298
	Average pre-92 pension	$	0
	Average total pension	$	5,641
45–50	Count		431
	Average pre-92 pension	$	0
	Average total pension	$	8,018
50–55	Count		490
	Average pre-92 pension	$	0
	Average total pension	$	10,668
55–60	Count		320
	Average pre-92 pension	$	10
	Average total pension	$	11,594
60–65	Count		190
	Average pre-92 pension	$	540
	Average total pension	$	9,890
65–70	Count		81
	Average pre-92 pension	$	2,170
	Average total pension	$	10,728
>=70	Count		9
	Average pre-92 pension	$	2,625
	Average total pension	$	7,566
Total	**Count**		**2,173**
	Average pre-92 pension	**$**	**140**
	Average total pension	**$**	**8,327**

Appendix C: Going Concern Assumptions and Methods

Assumptions and Methods

A member's entitlements under a pension plan are generally funded during the period over which service is accrued by the member. The cost of each member's benefits is allocated in some fashion over the member's service. An actuarial valuation provides an assessment of the extent to which allocations relating to periods prior to a valuation date (often referred to as the actuarial liabilities) are covered by the plan's assets.

The going concern valuation provides an assessment of a pension plan on the premise that the plan continues on into the future indefinitely based on assumptions in respect of future events upon which a plan's benefits are contingent and methods that effectively determine the way in which a plan's costs will be allocated over the members' service. The true cost of a plan, however, will emerge only as experience develops, investment earnings are received, and benefit payments are made.

This appendix summarizes the going concern assumptions and methods that have been used for the going concern valuation of the Plan at the valuation date. The going concern assumptions and methods have been chosen to reflect our understanding of the Plan's funding objectives with due respect to accepted actuarial practice and regulatory constraints. For purposes of this valuation, the going concern methods and assumptions were reviewed and changes as indicated were made.

The actuarial assumptions and methods used in the current and previous valuations are summarized below and described on the following pages.

	December 31, 2020	**December 31, 2018**
Economic Assumptions		
Discount rate	5.30% per year	5.46% per year
Inflation rate	2.25% per year	Same
Productivity increases	0.50% per year	Same
Merit increases	See Table C	Same
Increases in pensionable earnings	0.0% at January 1, 2021 and January 1, 2022 and 2.75% per year thereafter	1.0% at January 1, 2019 and January 1, 2020 and 2.75% per year thereafter
Increases in year's maximum pensionable earnings (“YMPE”)	2.75% per year	Same
Increases in maximum pension limit	$3,245.56 in 2021; then 2.75% per year	$3,025.56 in 2019; then 2.75% per year
Interest on member contributions	2.50% per year	2.75% per year
Investment expenses	0.56% per year (taken into account in the discount rate assumption)	0.42% per year (taken into account in the discount rate assumption)
Non-investment expenses	0.05% per year (taken into account in the discount rate assumption)	Same
Margin for adverse deviation	Included above as 0.45% reduction to discount rate	Included above as 0.97% reduction to discount rate

	December 31, 2020	December 31, 2018
Demographic Assumptions		
Mortality table	85% (100% for females) of 2014 Public Sector Canadian Pensioner Mortality Table with generational improvements using Scale MI-2017 (sex-distinct rates)	Same
Retirement rates	Rates based on 2010 to 2020 experience (Table A following)	Rates based on 2009 to 2014 experience
Termination rates	Rates based on 2010 to 2020 experience (Table B following)	Rates based on 2009 to 2014 experience
Disability rates	None	Same
Proportion married		
Non-retired proportion with pension partner	80%	Same
Non-retired pension partner age differential	Males three years older	Males four years older
Retired members	Actual relationship status and ages are used	Same
Termination option election		
Deferred pension	60%	Same
Lump sum	40%	Same
Net lump sum interest rate	1.70% per year	2.44% per year
Headcount growth	0.50%	0.75%
Margin for adverse deviation	None	Same
Methods		
Actuarial cost method	Projected unit credit	Same
Asset valuation method	Market value of assets smoothed over three years	Same

Table A—Retirement Rates

Sample age and service based retirement rates are in accordance with the following table:

Age	0	5	10	15	20	23	>=26
55	10%	8%	4%	2%	2%	5%	15%
57	9%	6%	4%	4%	4%	4%	6%
59	12%	9%	4%	4%	4%	4%	8%
60	16%	10%	7%	7%	4%	5%	11%
61	13%	7%	4%	4%	9%	9%	9%
63	10%	15%	8%	8%	8%	8%	10%
64	17%	17%	11%	11%	11%	11%	10%
65	15%	15%	15%	15%	15%	15%	21%
67	15%	15%	15%	15%	15%	15%	15%
68	55%	55%	55%	55%	55%	55%	55%
69	100%	100%	100%	100%	100%	100%	100%

Deferred participants are assumed to retire at age 55 or six months following the valuation date, if older.

Table B—Termination Rates

Sample age and service rates for males and females used in this valuation are shown in the following table:

	Male		Female	
Age	Select Period (First 5 Years)	Ultimate Period (After 5 Years)	Select Period (First 5 Years)	Ultimate Period (After 5 Years)
<=24	20.0%	5.0%	23.0%	9.0%
25	20.0%	5.0%	22.0%	9.0%
30	10.0%	9.0%	15.0%	8.0%
35	9.0%	8.0%	10.0%	7.0%
40	9.0%	3.0%	8.0%	3.0%
45	9.0%	2.0%	10.0%	2.0%
50	11.0%	2.0%	11.5%	3.0%
55	0.0%	0.0%	0.0%	0.0%

Table C—Merit and Promotion Scale

Service-based merit and promotion rates are shown in the following table:

Service	Rates
<=14	3.0%
15-24	1.5%
>=25	1.0%

Justification of Actuarial Assumptions and Methods

Margins for Adverse Deviations

Margins for conservatism or provisions for adverse deviation have been built into the going concern assumptions where appropriate.

The margins have been chosen so as to balance the need for financial security for existing Plan members against overly conservative contribution requirements that potentially result in intergenerational inequity among members and unnecessary financial strain on the Plan sponsor.

The actuary has discussed the Plan's experience with the Board and compared it to the expected experience. This review indicates that there is a need for use of margins for adverse deviations. The margins for adverse deviations incorporated in the assumptions reflect this review and the Board's desire to maintain safety cushions. The actuary has discussed with the Board the implications of incorporating margins for adverse deviations and the Board is fully cognizant and supports incorporating margins for adverse deviations.

The going concern assumptions do not include margins for adverse deviations, except as noted below.

Economic Assumptions

Discount Rate

The overall expected return was developed using best-estimate returns for each major asset class in which the pension fund is invested. A Monte Carlo simulation is performed over 30 years where the portfolio returns are projected assuming annual rebalancing. The results are used to develop an overall best-estimate rate of return for the entire pension fund. Gains from rebalancing and diversification are implicit to this return.

The overall expected return has been established based on the Board's investment policy and its funding policy and objectives. There may be some barriers to achieving this return such as inflation higher than expected, asset returns lower than expected, and assets and liabilities that are mismatched.

The following table lays out the adjustments that have been made to the overall expected rate of return in order to arrive at our going concern discount rate assumption:

Development of Discount Rate				
Overall expected return				5.86%
Non-investment expenses				(0.05)%
Investment expenses				
Passive	(1)	(0.06)%		
Actively managed	(2)	(0.50)%		
			(1)+(2)	(0.56)%
Additional returns due to active management				0.50%
Margin for adverse deviations				(0.45)%
Rounded Discount Rate				**5.30%**

Inflation Rate

The inflation rate assumption reflects our best estimate of future inflation considering current economic and financial market conditions.

Productivity Increases

The productivity increase assumption reflects our best estimate of future increases considering current economic and financial market conditions, and is consistent with historical real economic growth.

Merit Increases

We assume rates of increase as a result of individual employee merit and promotion based on a scale which varies by service as shown in Table C above. The merit and promotion scale is based on Plan experience over the years 2009 to 2014 and input from the staff of the Board.

Increases in Pensionable Earnings

To reflect anticipated short-term salary budgets, we have assumed pensionable earnings will increase at 0.0% per annum at January 1, 2021 and January 1, 2022. The assumption for long-term increases in pensionable earnings reflects the assumed rate of inflation, plus allowances for the effect of productivity growth and individual merit. An allowance for seniority, merit and promotion (“SMP) has also been included in the pensionable earnings increase assumption for all years.

Total Payroll

In order to determine contribution rates for amortization of the unfunded liabilities as a percentage of earnings, it is necessary to make an assumption for the total payroll growth under the Plan. For this purpose, we have used the same increases for inflation and general wage increases as are used for individual member pensionable earnings. We have also included additional increases to average pensionable earnings of 0.5% per annum based on historical average increases under the Plan from 2003 to 2020 in excess of Canadian average wage increases, and a provision for estimated headcount growth of 0.5% per annum. The assumption for the total payroll growth to be used for calculating the present value of pre-1992 additional contributions from January 1, 2021 to December 31, 2043 used the

same increases as for the post-1991 amortization. The resulting total payroll increase rates that were used to determine contribution rates associated with unfunded liabilities of the plan are as follows:

Pre-1992: 1.0% at January 1, 2021 and January 1, 2022, and 3.75% per year thereafter

Post-1991: 1.0% at January 1, 2021 and January 1, 2022, and 3.75% per year thereafter

The construction of this assumption is similar to that used for the previous valuation though population growth was reduced from 0.75% per annum in the previous valuation.

Increases in YMPE

As the benefits paid to a member from the Plan are dependent on the future YMPE, it is necessary to make an assumption regarding the future increases in the YMPE.

The assumed increase in the YMPE reflects the assumed rate of inflation plus the productivity increase assumption.

Increases in the Maximum Pension Limit

Pensions are limited to the maximum limits under the *Income Tax Act*. The *Income Tax Act* specifies both a dollar limit, and in addition pensions cannot exceed 2% of indexed highest average compensation per year of credited service. The assumed increase in the dollar limit reflects the assumed rate of inflation plus the productivity increase assumption.

Interest on Member Contributions

Interest is credited on member contributions with the rate credited by chartered banks on five-year personal fixed term deposits. The assumption for interest on member contributions reflects our expected increase in these rates, and is consistent with historical rates.

Expenses

Since the discount rate has been established net of all expenses, no explicit assumption is required. The provision for expenses in the development of the discount rate reflects our best estimate, based on average expenses over the four years preceding the valuation date.

Demographic Assumptions

Mortality

At the current valuation, we are using the 2014 Public Sector Canadian Pensioner Mortality Table, with adjustments factors based on analysis undertaken in conjunction with the December 31, 2014 valuation; theses adjustments are consistent with pension size adjustments as described in the 2014 Canadian pensioner mortality study.

In 2017, the CIA released a research paper introducing a new Mortality Improvement Scale (MI-2017) and subsequently published an Education Note stating that both the MI-2017 and CPM-B Scales "constitute broad and relevant mortality improvement studies for the Canadian population." MI-2017 projection scale has been adopted for the purposes of this valuation since this scale takes into account a broader thinking on mortality improvements.

Retirement

Retirement rates are typically developed taking into account the past experience of the Plan. Accordingly, the rates of retirement for active participants have been developed based on a review of plan experience for the years 2010 to 2020. These rates are considered best-estimate rates of retirement based on the plan provisions. These rates have changed from the previous valuation which were based on plan experience for the years 2009 to 2014.

As in the previous valuation, all participants in receipt of disability benefits from an employer's approved long-term disability plan are assumed to continue to be disabled until termination or retirement. As such, they are included as active participants.

Based on Plan provisions which provide for an unreduced or subsidized early retirement reduction as early as age 55, deferred participants are assumed to retire at age 55 or six months following the valuation date if already older than 55.

Termination of Employment

The termination rates were developed based on a review of Plan experience from the years 2010 to 2020. These rates have changed from the previous valuation which were based on a plan experience for the years 2009 to 2014. Consequently, the termination rates are considered to be best estimate.

Option Elections on Termination

We have assumed that a portion of members will elect a deferred annuity, while others will elect a commuted value transfer or cash on termination. The proportion of members assumed to elect a transfer value is based on the proportion of liabilities settled by lumpsum transfer over the past four valuation periods (from 2013 – 2020). In recognition of the lower prevailing discount rates and to determine commuted values, we have employed a different discount rate basis used to calculate termination benefits for those that elect a lump-sum transfer value.

Disability

If an active Plan member becomes disabled, contributory service continues to accrue until unreduced pension commencement age, but employee contributions are waived. Since this benefit is substantially the same as the benefit that accrues to an active member, no disability assumption was used. Use of an

actual disability assumption in this case would reduce liabilities slightly, so a nil disability incidence assumption represents a small element of conservatism. The disability assumption has very little impact on the valuation results.

Proportion of Members with Pension Partners and Pension Partner Age Differential

These assumptions are relevant to the valuation of benefits since there is a subsidized joint and survivor benefit available for members with a spouse. The proportion of members who will have a spouse, and the pension partner age difference is based on actual plan retirements over the past ten years.

As with the previous valuation, we assumed that 80% of participants would have a pension partner at the relevant time. All pension partners are assumed to be the opposite gender of the participant, with male partners assumed to be three years older than their female partners. The remaining 20% of participants were assumed to have no pension partner. While the definition of pension partner includes same-sex relationships, this assumption adequately provides for all such contingencies. For the previous valuation, male partners were assumed to be four years older than their female partners.

Other

Actuarial Cost Method

An actuarial cost method is a technique used to allocate in a systematic and consistent manner the expected cost of a pension plan over the years of service during which Plan members earn benefits under the Plan. By funding the cost of a pension plan in an orderly and rational manner, the security of benefits provided under the terms of the Plan in respect of service that has already been rendered is significantly enhanced.

The projected unit credit actuarial cost method has been used for this valuation. Under this method, the actuarial present value of benefits in respect of service prior to the valuation date, but based on pensionable earnings projected to retirement, is compared with the actuarial asset value, revealing either a surplus or an unfunded actuarial liability.

With respect to service after the valuation date, the expected value of benefits for service in the year following the valuation date (i.e., the normal cost) net of any required employee contributions is expressed as a percentage of the expected value of participating payroll for that year. The employer normal cost contributions are determined each year by applying this percentage to the actual participating payroll for the year.

When calculating the actuarial present value of benefits at the valuation date, the present value of all retirement, withdrawal and preretirement death benefits are included. For each member, the retirement, withdrawal and preretirement death benefits for a particular period of service are first projected each year into the future taking into account future vesting, early retirement entitlements and minimum pension/value entitlements. These projected benefits for each future year are then capitalized, multiplied by the probability of the member leaving the Plan in that year and discounted with interest and survivorship to the valuation date. The actuarial present value of benefits for the particular period of service is then determined by summing the present values of these projected benefits.

The pattern of future contributions necessary to pre fund future benefit accruals for any one particular individual will increase gradually as a percentage of their pensionable earnings as the individual approaches retirement. For a stable population (i.e., one where the demographics of the group remain constant from year to year), the normal cost will remain relatively level as a percentage of payroll. The projected unit credit actuarial cost method therefore allocates contributions among different periods in an orderly and rational manner for a stable population group.

In the event of future adverse experience, contributions in addition to the normal cost calculated under the projected unit credit actuarial cost method may be required to ensure that the Plan's assets are adequate to provide the benefits. Conversely, favourable experience may generate surplus which may serve to reduce future contribution requirements.

Asset Valuation Method

The actuarial value of assets is a smoothed market value and is calculated as the average of the market value of invested assets at the valuation date and the two market values from preceding calendar year-ends accumulated to the valuation date. The accumulated market values at the end of each year equal the sum of:

- the appropriate (accumulated or actual) market value at the beginning of the year;

- the net contributions during the year (calculated as contributions less benefit payments plus net transfers); and

- the assumed investment return (determined as the going-concern liability discount rate applicable to the most recent funding valuation prior to the particular year).

To ensure that the asset valuation method develops an asset value that appropriately tracks market value over time, the calculated actuarial value of assets is adjusted, if necessary, so that it falls within 10% of the market value of assets (“10% corridor”).

This asset valuation method is unchanged from the previous valuation.

Other Methodologies

We have prepared a list of additional assumptions and methods used in the valuation of the Plan. This list is intended to assist users of this report in understanding the specific benefits valued. Small differences in methods and assumptions in a plan of this size can sometimes have effects in the millions of dollars. Appendix B of the report deals with data omissions so they will not be repeated here.

- It is administrative practice for the Plan that indexation of deferred and immediate pensions commences January 1 of the year following termination or retirement;
- Normal cost contributions are based on pensionable earnings below the maximum earnings limit described earlier in this report;
- The pensionable earnings for calculating normal cost percentage is nil for participants with 35 years of combined pensionable service;
- For deferred benefits on termination (post-1991 service), the pensions were deferred to 55 with the early reduction factor calculated from the earlier of age 60 and the attainment of 80 points. Deferred vested members over age 55 at the valuation date were assumed to retire six months following the valuation date.

Appendix D: Solvency Assumptions and Methods

Valuation Assumptions

	December 31, 2020	December 31, 2018
Economic Assumptions		
Discount rate		
Transfer value basis —*Without indexation*	1.40% per year for 10 years; 2.90% per year thereafter	3.20% per year for 10 years; 3.40% per year thereafter
Annuity purchase basis —*Without indexation*	2.40% per year	3.20% per year
Duration used to determine annuity purchase basis	9.85	11.19
Transfer value basis —*With indexation*	1.00% per year for 10 years; 1.68% per year thereafter	2.3% per year for 10 years; 2.4% per year thereafter
Annuity purchase basis —*With indexation*	0.40% per year	1.30% per year
Income Tax Act dollar limit	$3,245.56 per year	$3,025.56 per year
Demographic Assumptions		
Mortality table		
Annuity purchase basis	2014 Canadian Pension Mortality Table with generational improvements using CPM Scale B[1] (sex-distinct rates)	Same
Transfer value basis	85% (100% for females) of 2014 Public Sector Canadian Pensioner Mortality Table with generational improvements using Scale MI-2017[2] (sex-distinct rates)	85% (100% for females) of 2014 Public Sector Canadian Pensioner Mortality Table with generational improvements using CPM Scale B[2] (sex-distinct rates)
Termination rates	Not applicable	Same

[1] No preretirement mortality was applied

	December 31, 2020	December 31, 2018
Retirement age		
Active and deferred vested members settled by purchase of annuities	100% immediate retirement if at least age 55 at valuation date; otherwise 100% at age 55	Same
Active and deferred vested members settled by lump-sum transfer	50% at age 55 and 50% at earliest unreduced retirement date	100% at age 55
Retired members and beneficiaries	Not applicable	Same
Termination of employment	Terminate with full vesting	Same
Relationship status		
Non-retired pension partner proportion	80%	Same
Non-retired pension partner age differential	Males three years older	Males four years older
Retired members	Actual relationship status and ages are used	Same
Other		
Wind up expenses	$3,300,000	$3,200,000
Actuarial cost method	Unit credit	Same
Asset valuation method	Market value of assets adjusted to reflect contributions, benefit payments, transfers and fees/expenses in transit as of the valuation date	Same
Incremental Cost		
The assumptions for the expected benefit payments and decrement probabilities, service accruals, and projected changes in benefits and/or pensionable earnings	Same as going concern	Same

Based on the CIA's Guidance and information such as pension legislation, Plan provisions and Plan experience, we have made the following assumptions regarding how the Plan's benefits would be settled on Plan wind up:

	Percent of Liability Assumed to be Settled By Purchase of Annuities	Percent of Liability Assumed to be Settled By Lump-Sum Transfer
Active Members		
Not retirement eligible	40%	60%
Retirement eligible	100%	0%
Deferred Vested Members		
Not retirement eligible	40%	60%
Retirement eligible	100%	0%
Retired Members and Beneficiaries	100%	0%

Postulated Scenario

The postulated scenario is the assumption of immediate termination of employment for the active group at the valuation date. Therefore, no allowance for future salary increases or demographic experience are reflected.

Benefits Valued

	Benefit
Vesting	We have treated all accrued benefits as vested on Plan wind up.
Post-valuation Date Benefit Increases	Benefits are based on the average earnings and service at the valuation date.
Indexing	According to Plan provisions, the benefits to which a member would be entitled if the Plan was terminated on the valuation date would include pension indexing of 60% of Alberta CPI. This indexing rate has been accounted for in the With Indexation discount rates summarized earlier in this Section.

Justification for Valuation Assumptions

We have set the aforementioned assumptions based on guidance prepared by the CIA Committee on Pension Plan Financial Reporting ("PPFRC") in Educational Note – Assumptions for Hypothetical Wind-Up and Solvency Valuations with Effective Dates between December 31, 2020 and December 30, 2021 ("CIA Guidance") released on March 10, 2021.

For benefit entitlements that are expected to be settled by lump-sum transfer, we based the assumptions on Section 3500 (Pension Commuted Values) of the CIA Standards of Practice, as updated effective December 1, 2020, using rates corresponding to a valuation date of December 31, 2020.

For benefit entitlements that are expected to be settled by purchase of annuities, we based the assumptions on information compiled by the PPFRC from insurance companies active in the group annuity market as described in the educational note.

Mortality Table

The derivation of the discount rate above is in conjunction with CPM2014 in accordance with the CIA Guidance.

Termination Rates

All participants who are actively employed on the valuation date are assumed to terminate their employment on this date and subsequently retire from the Plan in accordance with the retirement age assumption summarized below.

Retirement Rates

For benefits assumed to be settled by the purchase of annuities, non-retired members are assumed to retire at age 55, or immediately if older than 55, and receive a pension in accordance with the terms of the Plan and the member's age and continuous service. For benefits assumed to be settled by lump-sum transfer, 50% of members are assumed to retire at age 55 and 50% of members are assumed to retire at the earliest unreduced retirement date

Preretirement Mortality

We have made no allowance for preretirement mortality. The impact of including such an assumption would not have a material impact on the valuation, since the value of the death benefit is approximately equal to the value of the accrued pension.

Pensionable Earnings

To estimate active and disabled members' best average earnings, we have used actual historical member earnings.

Assumptions Not Needed

The following are not relevant to the solvency valuation:

- Increases in pensionable earnings;
- Increases in Year's Maximum Pensionable Earnings;

- Increases in *Income Tax Act* maximum pension limit; and
- Disability rates.

Estimated Wind Up Expenses

Plan wind up expenses would normally include such items as fees related to preparation of the actuarial wind up report, fees imposed by a pension supervisory authority, legal fees, administration, custodial and investment management expenses.

Calculation of Special Solvency Payments

Pursuant to the *Employment Pension Plans Regulation* Amendment 245/2003, the Plan is exempt from making solvency deficiency payments, with effect from January 1, 2003 so it is not necessary to calculate solvency special payments.

Actuarial Cost Methods

Unit credit (accrued benefit) cost method as prescribed.

Asset Valuation Method Considerations

Assets for solvency purposes have been determined using market value with adjustments for:

- In-transit items at the valuation date; and
- Expenses for Plan termination as outlined above.

Incremental Cost

The incremental cost represents the present value, at the calculation date (time 0), of the expected aggregate change in the liabilities between time 0 and the next calculation date (time t), adjusted upwards for expected benefit payments between time 0 and time t.

An educational note was published in December 2010 by the CIA Committee on PPFRC to provide guidance for actuaries on the calculation of this information.

The calculation methodology can be summarized as follows:

- The present value at time 0 of expected benefit payments between time 0 and time t, discounted to time 0,

  plus

- Projected liabilities at time t, discounted to time 0, allowing for, if applicable to the pension plan being valued:
  - expected decrements and related changes in membership status between time 0 and time t,
  - accrual of service to time t,
  - expected changes in benefits to time t,
  - a projection of pensionable earnings to time t,

  minus

- The liabilities at time 0.

The projection calculations take into account the following assumptions and additional considerations:

- The assumptions for the expected benefit payments and decrement probabilities, service accruals, and projected changes in benefits and/or pensionable earnings would be consistent with the assumptions used in the pension plan's going concern valuation.
- The assumptions used to calculate the projected liability at time t are consistent with the assumptions for the liabilities at time 0, assuming that interest rates remain at the levels applicable at time 0, that the select period is reset at time t for interest rate assumptions that are select and ultimate and that the Standards of Practice for the calculation of commuted values and the guidance for estimated annuity purchase costs in effect at time 0 remain in effect at time t.
  - Active and inactive Plan members as of time 0 are considered in calculating the incremental cost.

Appendix E: Summary of Plan Provisions

This funding valuation was based on Plan design information provided by the Board as of December 31, 2020. The following is a summary of the main provisions of the Plan.

Effective Date	Effective January 1, 2001 the Universities Academic Pension Plan became a non-statutory pension plan subject to and registered under the *Act*. Prior to January 1, 2001 the plan was governed by the Alberta *Public Sector Pension Plans Act* and the *Universities Academic Pension Plans Act* (before 1993). The Plan is also registered under the *Income Tax Act*. The Plan now operates under a Sponsorship and Trust Agreement signed by the Plan Sponsors. A complete description of the Plan can be found in the Sponsorship and Trust Agreement, and a summary of Plan provisions relevant to the valuation and extrapolation is included in this Appendix.
Jurisdiction of Registration	Alberta.
Eligibility for Membership	Open to full- and part-time employees who meet the criteria specified in the Plan.
Vesting	Vesting of benefits for all service is as follows: ▪ Members who terminate before January 1, 2001 are vested with five years of pensionable service. ▪ Members who terminate on or after January 1, 2001 and before September 1, 2014 are vested with at least two years of Continuous Plan Membership. ▪ Members who terminate on or after September 1, 2014 are immediately vested.
Normal Retirement Eligibility	Normal retirement date is the June 30th following the member's 65th birthday.
Benefit	Annual pension payable in equal monthly installments calculated as the sum of the following: a) for each year of pensionable service prior to January 1, 1992, 2.0% of the member's highest average salary; plus

b) for each year of pensionable service in 1992 and 1993, 2.0% of the member's highest average capped salary; plus

c) for each year of pensionable service after December 31, 1993, 1.4% of the lesser of the highest average capped salary and the average YMPE plus 2.0% of the excess of the highest average capped salary over the average YMPE, if any, plus a bridge benefit of 0.6% of the lesser of the highest average capped salary and the average YMPE, payable to age 65.

Highest average pensionable salary is the participant's average annual salary in the five consecutive years of pensionable service in which such average is the highest, and the average YMPE is the average of the Year's Maximum Pensionable Earnings under the Canada Pension Plan in the years used to determine the member's highest average pensionable salary.

Early Retirement

From active service

Eligibility	Age 55 with full vesting.
Benefit	For service after December 31, 1993, if a member commences pension payments prior to the normal retirement date, then the pension payable to the member will be equal to the normal retirement pension, reduced by an early retirement factor as described below. The early retirement factor is 3.0% for each year by which the member's retirement date precedes the earliest of: a) age 60; and b) the day on which the member would have completed 80 points of age plus pensionable service (with no service after the date of termination). If a member is vested and retires after attaining age 60 or 80 points as described above, no reduction is applied. In addition, a member who retires before the normal retirement date will receive a bridge benefit for each year of pensionable service after December 31, 1993 equal to 0.6% of the lesser of the highest average capped salary and the average YMPE, reduced by the early retirement factor described above, and payable to age 65. For service prior to January 1, 1994 the early retirement pension is equal to the unreduced normal retirement pension.

Postponed Retirement

Eligibility	Any time after normal retirement date and before December 31 of the year in which the member attains age 69. A member who terminates or retires prior to age 69 may defer pension commencement.
Benefit	Normal retirement benefit accrued to postponed retirement date. When pension commencement is deferred past a member's date of termination, the pension with respect to pre-1994 service is actuarially increased for commencement after age 55 (actuarial increase for commencement after age 65 for post-1993 service).

Termination of Employment

Pre-1994 service

Eligibility	Members are fully vested.
Benefit	a) the member will receive a deferred pension, or b) a refund or transfer of the commuted value of the member's accrued pension plus excess contributions, or c) a refund or transfer of the member's and employer's contributions with interest.

Post-1993 service

Eligibility	Members are fully vested.
Benefit	a) the member will receive a deferred pension, or b) a transfer of the commuted value of the member's accrued pension plus excess contributions, or c) a transfer of 175% of the member's contributions with interest.

Pre-retirement Death

Pre-1994 service

Eligibility	Members are fully vested upon death.
Benefit	No pension partner: The beneficiary or estate will receive the commuted value of the member's accrued pension plus excess contributions or the member's and employer's contributions with interest. Pension partner: The pension partner will receive a lifetime survivor pension as if the member had retired on the day before death and elected a joint and survivor 100% pension, or a refund of the member's and employer's contributions with interest.

Post-1993 service

Eligibility	Members are fully vested.
Benefit	No pension partner: The beneficiary or estate will receive the commuted value of the member's accrued pension plus excess contributions or 175% of the member's contributions with interest. Pension partner: The pension partner will receive a lifetime survivor pension as if the member had retired on the day before death and elected a joint and survivor 100% pension plus excess contributions, or – a transfer of the commuted value of the member's accrued pension plus excess contributions, or – a transfer of 175% of the member's contributions with interest.

Post-retirement Death

Pre-1994 service

Benefit	The normal form of pension is payable for life and guaranteed for 15 years in any event.

Post-1993 service

Benefit	If the member has a pension partner at retirement, the normal form of pension provides a survivor benefit equal to 2/3 of the member's accrued pension that would be paid, had the member continued to live. The normal form of pension for a member without a pension partner at retirement is payable for life and guaranteed for ten years in any event. A different form of pension may be elected at retirement in an actuarially equivalent amount.

Disability

Eligibility	Qualification for benefits under employer-sponsored long-term disability plan.
Benefit	For members who are receiving benefits under the LTD plan, participation in the Plan continues, but no pension is payable concurrently with the benefit paid under the LTD plan. For members who are not receiving benefits under the LTD plan, are permanently and totally disabled, and vested, they are entitled to receive an immediate unreduced pension based on pensionable service and salary to the date of the disability. If the member is partially disabled, the pension is reduced in accordance with the Plan.

Earnings during disability are deemed to be at the same level as in effect just prior to disability, with subsequent wage increases applicable for that member's class.

Contributions

Members and employers contribute the entire cost of the benefits accruing for future benefits as well as the amortization of deficiencies related to post-1991 service in accordance with the *EPPA*. An agreement is in place whereby the Government of Alberta contributes 1.25% of total payroll towards the pre-1992 unfunded liability until the pre-1992 unfunded liability is eliminated, or December 31, 2043 if earlier. The members and employers contribute the remaining amounts calculated as necessary to eliminate the unfunded liability by December 31, 2043.

Maximum Benefit

Effective January 1, 1992, and only in respect of pensionable service after 1991, pensionable earnings for service in 1992 and 1993 are limited to 50 times the defined benefit annual maximum pension limit for the year under the *ITA.* Pensionable earnings for post 1993 service are limited to 50 times the defined benefit annual maximum pension limit plus 0.6% of the YMPE for the year under the *ITA.*

For years after 2013, the limit is as follows:

Year	$ Limit 1992-1993 Svc	$ Limit Post-93 Svc
2014	138,500	154,250
2015	140,945	157,025
2016	144,500	160,970
2017	145,722	162,312
2018	147,222	163,992
2019	151,278	168,498
2020	154,611	172,221
2021	162,278	180,758
2022+	Indexed to Average Industrial Wage	Indexed to Average Industrial Wage

Cost-of-Living Increases

Cost-of-living increases based on 60% of the Alberta CPI apply to both deferred pensions and pensions-in-payment.

Definitions

Pensionable earnings

The participant's actual salary limited to the amount in any year after 1992 which results in the maximum defined benefit for that year under the *Income Tax Act Regulations*.

Credited interest

Prior to 1994, participants' contributions were accumulated at the rate of 4% per annum, compounded semi-annually. After 1993, the rate of interest credited to participants' contributions was changed to the average yield of 5-year

	personal fixed term chartered bank deposits (CANSIM series V122515) over the most recent 12-month period, calculated as of the first day of the calendar year.
Pensionable service	Combined pensionable service, as defined under the provisions of the Plan, cannot exceed 35 years. Combined pensionable service (service in the Plan plus pensionable service in the Public Service Pension Plan) is used to determine eligibility for benefits, vesting and determination of highest average salary.

A copy of the administrator certification certifying the accuracy and completeness of the Plan provisions summarized in this report is included in Appendix G of this report.

Appendix F: Glossary of Terms

- The **actuarial value of assets** is the asset value used for going concern valuation purposes. Smoothing methods are sometimes used to smooth investment gains and losses over a certain period.
- The **estimated wind up expenses** is an estimate of the administrative and other expenses expected to be charged against the pension fund if the Plan were to terminate on the valuation date.
- The **excess assets/(unfunded liability)** is the difference between the actuarial value of assets and the going concern liabilities.
- The **going concern funded ratio** compares the actuarial value of assets to the going concern liabilities for the purposes of Section 38(2)(c) of the *Act* and *Update 14-05* to determine the latest effective date of the next required valuation.
- The **going concern liabilities** are the actuarial present value of benefits earned in respect of service prior to the valuation date. The going concern liabilities are calculated using the going concern assumptions and methods summarized in Appendix C of this report.
- The **going concern position** is the difference between the actuarial value of assets and the going concern liabilities.
- The **maximum deductible employer contribution** refers to an eligible contribution pursuant to Section 147.2(2) of the *Income Tax Act*. Under Subsection 8502(b) of the Regulations to the *Income Tax Act*, each employer contribution made after 1991 in respect of a defined benefit provision of a registered pension plan must be such eligible contribution.

  In an employer ’s fiscal year, the following contributions are eligible under Section 147.2 of the *Income Tax Act*.

  – The employer normal cost, eligible under Section 147.2(2) subject to certification by the actuary and approval by the Canada Revenue Agency; plus

  – Special payments eligible under Section 147.2(2) up to the amount of the unfunded liability or the solvency deficiency, whichever is greater, subject to certification by the actuary and approval by the Canada Revenue Agency; less

  – Required application of excess surplus.

  The employer normal cost and special payments for this Plan will be deductible under Section 147.2(2) of the *Income Tax Act*, subject to the approval of the Canada Revenue Agency.

  Note that contributions to a Plan are still permissible and deductible if there is an excess surplus, providing there is simultaneously a solvency deficiency in the Plan or the contributions are required as minimum contributions under provincial legislation, pursuant to Subsections 8516(2) and (3) of the Regulations to the *Income Tax Act*.

  One restriction under the *Income Tax Act* is that if there is an excess surplus, and a solvency deficiency, the maximum deductible contribution is restricted to the full amount of the deficiency without allowance for interest or any other contributions such as company normal cost and/or transfer deficiency payments.

  In order to be deductible in a given fiscal year, employer contributions must be made not later than 120 days after the end of the fiscal year.

- The **minimum required employer contribution** for each plan year is equal to:
  - The employer normal cost; plus
  - Special payments toward amortizing any unfunded liability over 15 years from the date on which the unfunded liability was established; plus
  - Special payments toward amortizing any pre-1992 unfunded liability over the period ending December 31, 2043; less
  - Required application of excess surplus; less
  - Permitted application of excess assets.

  In order to satisfy the requirements of the *Employment Pension Plans Act* and its Regulations, contributions to the fund must be made in accordance with the following rules:
  - Required member contributions (if any) must be remitted to the pension fund within 30 days following the month in which the contributions were received from the member or deducted from his or her remuneration.
  - Employer contributions must be remitted to the pension fund within 30 days after the end of the month for which the contributions are payable.
- **Solvency assets** are the market value of pension fund assets adjusted to reflect contributions, benefit payments, transfers and fees/expenses in-transit at the valuation date, less an allowance for estimated wind up expenses.

  The **solvency liabilities** are the actuarial present value of benefits earned in respect of service prior to the valuation date determined as if the Plan were wound up on the valuation date The solvency liabilities are determined using benefit entitlements on the assumption that the Plan has neither excess assets nor a deficit. The solvency liabilities are calculated using the solvency valuation assumptions summarized in Appendix D of this report.
- The **solvency position** is the difference between the solvency assets and the solvency liabilities.
- The **solvency ratio** compares the solvency assets to the solvency liabilities. If the solvency ratio is less than 1.00, lump-sum transfer from the pension fund under the *Employment Pension Plans Act* are limited to the commuted value of the member's pension multiplied by the solvency ratio. The administrator may transfer the entire commuted value if the administrator is satisfied that an amount equal to the transfer deficiency has been remitted to the pension fund or other certain conditions are met.
- The **special payments** are payments required to liquidate the unfunded liability:
  - The going concern special payments are payments required to liquidate the unfunded liability, with interest at the going concern valuation discount rate, by equal monthly instalments over a period of 15 years on the valuation date of the report in which the going concern unfunded liability was determined. The going concern special payments are determined by calculating the level percentage of pensionable earnings commencing 18 months following the valuation date and continuing for 13.5 years (15 years after the valuation date). Pre-1992 unfunded liabilities for the Plan are amortized over the period ending December 31, 2043 as shown in Section 4.
- The **total normal cost** is the actuarial present value of benefits expected to be earned in respect of service for each year starting on the valuation date. The total normal cost is calculated using the going concern valuation assumptions and methods summarized in Appendix C of this report.

Appendix G :Administrator Certification

With respect to the Universities Academic Pension Plan, forming part of the actuarial report as at December 31, 2020, I hereby certify that, to the best of my knowledge and belief:

- The asset data provided or made available to the actuary is complete and accurate;
- The membership data and subsequent query answers provided or made available to the actuary are complete and accurate for all persons who are entitled to benefits under the terms of the Plan in respect of service up to the date of the valuation;
- The Plan provisions contained in Appendix E is an accurate summary of the Plan provisions;
- The actuary has been notified of all relevant events subsequent to the valuation measurement date; and
- The terms of engagement contained in Section 1 of this report are accurate and reflect the plan administrator's direction.

Chris Schafer	Director Finance and Administration
Name (print) of Authorized Signatory	Title
[Original Signed by Chris Schafer]	3 September 2021
Signature	Date

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