Public Service Pension Plan
Actuarial Valuation as at December 31, 2017

Registration number: CRA 0208769

Date: June 27, 2018

George & Bell
CONSULTING

M2–601 West Broadway
Vancouver BC V5Z 4C2

Vancouver Office:
T: (604) 871-4151
Toll-free: (888) 800-1450

Whitehorse Office:
T: (867) 332-6763
Toll-free: (888) 816-1670

georgeandbell.com

Table of Contents

1. Executive Summary

Going Concern Funded Status	December 31, 2016 ($ million)	December 31, 2017 ($ million)
Going concern assets		
Market value	11,911	13,426
Asset fluctuation adjustment	(565)	(735)
Total assets	11,346	12,691
Going concern liabilities		
Best estimate liabilities	11,066	11,860
Provision for adverse deviation (PfAD)	1,423	1,585
Total liabilities	12,489	13,445
Actuarial excess (unfunded liability)	(1,143)	(754)
Funded ratio	90.8%	94.4%

Contribution Requirements	December 31, 2016 % of pensionable earnings	December 31, 2017 % of pensionable earnings
Level Rate on All Earnings		
Normal actuarial cost	15.85%	16.43%
Provision for adverse deviation (PfAD)	2.48%	2.77%
Unfunded liability payments	4.34%	3.42%
Provision for non-investment expenses	0.50%	0.50%
Total required contribution rate	23.17%	23.12%
Split Rates (Members and Employers, each)		
Earnings below YMPE	10.47%	10.47%
Earnings above YMPE	14.95%	14.95%

Key Inputs	December 31, 2016	December 31, 2017
Discount rate	5.5%	5.1%
Margin for adverse deviation	1.0%, inherent in discount rate	1.0%, inherent in discount rate
Inflation rate	2.1%	2.0%
Interest rate used for lump sums upon termination	2.2% for 10 years, 3.5% thereafter	2.6% for 10 years, 3.4% thereafter
Inflation rate used for lump sums upon termination	1.1% for 10 years, 2.2% thereafter	1.2% for 10 years, 1.8% thereafter
Mortality	Males: 2014 CPM Private Table projected with Scale CPM-B Females: 95% of 2014 CPM Private Table projected with Scale CPM-B	Males: 2014 CPM Private Table projected with Scale MI-2017 Females: 95% of 2014 CPM Private Table projected with Scale MI-2017
Number of active members	41,490	42,252
Average age of active members	44.1	44.2
Average PSPP service (actives)	9.7 years	9.6 years
Average annualized earnings (actives)	$71,194	$71,746

George&Bell CONSULTING

2. Introduction

We have been retained by the Public Service Pension Board (the "Board") of the Public Service Pension Plan (the "Plan") to conduct an actuarial valuation of the Plan as at December 31, 2017. The last complete valuation that was filed with the appropriate authorities was conducted as at December 31, 2016.

This report was prepared for its intended users, the Board, the Trustee (the President of Treasury Board and Minister of Finance), and the CRA, for the following purposes:

- to determine the funded status of the Plan as at the valuation date on a going concern basis;
- to determine the normal actuarial cost as at the valuation date;
- to determine the contribution rates that will be applicable to the Plan under the *Public Sector Pension Plans Act* and regulations (the "Act") for years after the valuation date; and
- to determine the funded status of the Plan as at the valuation date on a solvency basis.

While readers of this report may extend beyond the intended users noted above, notably Plan members, we shall not communicate the terms of our engagement or results of our work with other readers unless directed to do so by the Board. This report is not intended or necessarily suitable for purposes other than those listed above.

Changes Since the Last Valuation

The last actuarial valuation of the Plan in which contribution rates were recommended was prepared as at December 31, 2016. Since the last actuarial valuation, the following changes have occurred:

1. The Board adopted a revised Statement of Investment Policies and Procedures at its meeting of June 21, 2017 and the same was used to determine the discount rate.
2. The Board adopted a revised Funding Policy Statement effective November 10, 2017 and the same was used to determine the margin for adverse deviation and contribution rates.
3. The going concern economic assumptions were updated to reflect the changes in expected future experience.
4. The going concern mortality assumption was updated with the CIA published mortality improvement scale MI-2017 to better reflect Canadians' longevity.
5. The solvency basis was updated to reflect market conditions as at the valuation date and to follow the Canadian Institute of Actuaries' *Guidance for Assumptions for Hypothetical Wind-up and Solvency Valuations with Effective Dates between December 31, 2017 and December 30, 2018*.

Details of the above changes which affect the funded status and/or future required contributions of the Plan are outlined in this report.

Terms of Engagement

This report has been prepared in accordance with the Plan's Funding Policy Statement dated November 10, 2017.

Filings

An actuarial valuation must be filed with the CRA as at the effective date of the Plan and not more than three years after the last actuarial valuation. Unless the Plan specifies otherwise, the date of each actuarial valuation must be at the Plan's fiscal year-end. If an amendment to the Plan or changes in Plan membership materially affect the required contribution rates, an actuarial valuation must be prepared.

The last actuarial valuation filed with the CRA was prepared as at December 31, 2016. The next actuarial valuation must be prepared and filed with the CRA no later than as at December 31, 2020.

We will file this report with the appropriate authorities on the Board's behalf or as otherwise instructed.

3. Actuarial Opinion

This opinion is given with respect to the Public Service Pension Plan. We conducted a valuation of the Plan as at December 31, 2017. The administrator has confirmed that, between December 31, 2017 (the effective date of the data provided) and the date of this report, no subsequent events nor any extraordinary changes to the membership that would materially affect the results of this valuation have occurred, except as indicated in this report.

In our opinion, for the purposes of this report:

- The membership data on which the valuation is based are sufficient and reliable for the purposes of the valuation.
- The assumptions are appropriate for the purposes of the valuation.
- The methods employed in the valuation are appropriate for the purposes of the valuation.

We hereby certify that, in our opinion, as at December 31, 2017:

1. With respect to the purpose of determining the Plan's funded status on a going concern basis:
   a. The Plan has a going concern unfunded liability (excess of liabilities over assets) of $754 million, based on going concern assets of $12,691 million and going concern liabilities of $13,445 million. The funded ratio is 94.4%. Going concern liabilities include a provision for adverse deviation of $1,585 million.
   b. There is no excess surplus as defined by Section 147.2(2) of the *Income Tax Act (Canada)*.
2. With respect to the purposes of determining the normal actuarial cost and contribution rates that are applicable to the Plan for years after the valuation date:
   a. The Plan's normal actuarial cost is estimated to be 19.70% of pensionable earnings. Of this cost, 16.43% is attributable to the cost of benefits accruing in the year following the valuation date, 2.77% is attributable to a provision for adverse deviation and 0.50% is attributable to a provision for non-investment expenses that are paid from the fund.
   b. Additional contributions required to fund unfunded liabilities are summarized in the following table:

Unfunded liability established	Contribution Rate (% of pensionable earnings)	Amortization Ending Date
December 31, 2011	3.42%	June 30, 2026

At the above rate, the unfunded liability is expected to be amortized 0.5 years earlier than under the schedule disclosed at the prior valuation.

c. Commencing on January 1, 2019 and continuing until the next actuarial certification, the recommended combined total member and employer contribution rate payable is 23.12% of pensionable earnings. In relation to each member and his/her employer:

- Contribution rate below YMPE: 10.47% member and 10.47% employer
- Contribution rate above YMPE: 14.95% member and 14.95% employer

3. With respect to the purpose of determining the Plan's funded status on a solvency basis:

a. The Plan has a solvency deficit of $4,960 million, determined as solvency assets of $13,400 million less solvency liabilities of $18,360 million.

b. The solvency ratio is 73.0%.

c. The liabilities of the Plan would exceed the Plan's assets by $4,960 million if the Plan was terminated and wound-up on the valuation date.

4. We are not aware of any subsequent events, that have not already been taken into consideration, that could materially affect the results of this valuation.

5. The next valuation should be conducted no later than as at December 31, 2020.

This valuation was conducted in accordance with the *Public Sector Pension Plan Act (Alberta)*. Further, the calculations have been prepared in accordance with subsection 147.2(2)(a)(iii) and (iv) of the *Income Tax Act (Canada)*.

The content herein has been prepared exclusively from a financial viewpoint. This report does not constitute a legal opinion on the rights and duties of the administrator, the Board or the members concerning the Plan.

Actuarial valuation results are estimates only and are based on assumptions and methods developed in accordance with actuarial standards of practice. Emerging experience differing from the assumptions used will result in gains or losses which will be revealed in future valuations, and which may affect future actuarial opinions.

This report has been prepared, and our opinions given, in accordance with accepted actuarial practice in Canada.

We would be pleased to discuss any questions the user may have regarding the valuation.

[Original Signed By]

Gregory M. Heise
Fellow, Canadian Institute of Actuaries

[Original Signed By]

Jian Zhang
Fellow, Canadian Institute of Actuaries

George & Bell Consulting Inc.
June 27, 2018

4. Going Concern Valuation Results

4.1 Going Concern Funded Status

The following table describes the Plan's funded status on a going concern basis. The going concern liabilities are based on the benefits earned up to the valuation date assuming the Plan continues indefinitely.

Going Concern Funded Status	December 31, 2016 ($ million)	December 31, 2017 ($ million)
Going concern assets		
Market value	11,911	13,426
Asset fluctuation adjustment	(565)	(735)
Total assets	11,346	12,691
Going concern liabilities		
Active members	5,653	5,958
Retirees & beneficiaries	5,314	5,841
CPS suspended members	844	917
Deferred members	662	712
Hold on deposit members	16	17
Total liabilities	12,489	13,445
Actuarial excess (unfunded liability)	(1,143)	(754)
Funded ratio	90.8%	94.4%

4.2 Reconciliation of Going Concern Funded Status

The following table reconciles the change in the going concern funded status over the course of the inter-valuation period.

Reconciliation of Going Concern Funded Status	($ million)
Actuarial excess (unfunded liability) at December 31, 2016	(1,143)
Expected interest	(63)
Special payments	290
Expected actuarial excess (unfunded liability) at December 31, 2017	(916)
Gain / (loss) on investments	576
Asset Fluctuation Adjustment	(134)
Experience gains and losses	
Salary experience	19
Retirement experience	16
Termination experience	5
Mortality experience	9
Gain from COLA	23
Interest on employee contributions	20
Miscellaneous	(2)
Total	90
Contribution rates and ITA maximum	68
Assumption changes	
Changes in economic assumptions	
Decrease in inflation assumption and related best estimate discount rate reduction from 6.5% to 6.4%	(74)
Impact on other inflation-related assumptions (salary increases, contribution interest rate, etc.)	28
Decrease in best estimate discount rate from 6.4% to 6.1%	(410)
Change in salary assumption	120
Change in lump sum basis	30
Change in mortality improvement scale	(51)
Change due to margin for adverse deviation	(81)
Total	(438)
Actuarial excess (unfunded liability) at December 31, 2017	(754)

4.3 Reconciliation of Normal Actuarial Cost Rate

The table below identifies the main components of the changes in the normal actuarial cost rate (the rate of pensionable earnings reflecting the cost of current service benefits accruing under the Plan) from the prior valuation to this valuation. For purposes of this reconciliation, included in the normal actuarial cost rates are the provision for adverse deviation and provision for non-investment expenses.

	% of pensionable earnings
Normal actuarial cost rate at December 31, 2016	18.83%
Programming/data changes	0.35%
New data and demographic changes	0.45%
New contribution rates	(0.49%)
Inflation to 2.0%, and related best estimate discount rate and COLA	0.18%
Inflation to 2.0%, and other related changes (e.g. salaries, YMPE, etc.)	(0.13%)
Best estimate discount rate from 6.4% to 6.1%	0.69%
Salary increase assumption	(0.40%)
Lump sum discount rate and mortality	(0.12%)
Mortality improvement scale update	0.05%
Change due to margin for adverse deviation	0.29%
Normal actuarial cost rate at December 31, 2017	19.70%

4.4 Discount Rate Sensitivity

As the assumed discount rate has a significant impact on the Plan's liabilities, accepted actuarial practice requires that the impact on the going concern liabilities and normal actuarial cost of a 1.0% decrease in the assumed discount rate be disclosed. The following table shows the effect of a 1.0% decrease in the discount rate:

Funded Status and Normal Actuarial Cost – December 31, 2017	5.1% Discount Rate ($ million)	4.1% Discount Rate ($ million)
Going concern assets	12,691	12,691
Going concern liabilities	13,445	15,469
Actuarial excess (unfunded liability)	(754)	(2,778)
Funded ratio	94.4%	82.0%
Normal actuarial cost (excluding expenses)		
% of pensionable earnings	19.20%	23.04%

5. Solvency Valuation Results

5.1 Solvency Funded Status

A solvency valuation is required by the Act to assess the Plan's funded status should it wind-up on the valuation date; however, the Act does not require the Plan to be funded on the solvency basis. A hypothetical wind-up valuation measures the same funded status, with minor differences, and is required under accepted actuarial practice. Since all benefits have been valued under this solvency valuation and assuming that the asset liquidation value would be equal to the market value of assets, the hypothetical wind-up funded status would be the same as the solvency funded status shown below.

The solvency funded status of the Plan is determined by reducing the market value of the assets by an allowance for estimated wind-up expenses and comparing the result to the actuarial liability for benefits earned up to the valuation date. Liabilities are determined assuming the Plan is terminated on the valuation date, with immediate settlement of obligations.

Based on the Plan's provisions, membership data, asset information, and solvency assumptions and methods described in the Appendices, in conjunction with the requirements of the Act, the solvency funded status of the Plan is shown in the table below.

Solvency Funded Status	December 31, 2016 ($ million)	December 31, 2017 ($ million)
Solvency assets		
Market value of assets	11,911	13,426
Expense allowance	(25)	(26)
Total assets	11,886	13,400
Solvency liabilities		
Active members	8,049	8,112
Retirees & beneficiaries	7,503	7,970
CPS suspended members	1,211	1,254
Deferred members	1,014	1,007
Hold on deposit members	16	17
Total liabilities	17,793	18,360
Solvency excess (deficiency)	(5,907)	(4,960)
Solvency ratio	66.8%	73.0%

5.2 Incremental Cost

The incremental cost on the solvency basis represents the present value of the expected aggregate change in the solvency liabilities from the valuation date to the next valuation date, adjusted for expected benefit payments in the inter-valuation period. The present value of the incremental cost figures shown in the table below are as of the beginning of each period shown. These figures are required to be disclosed under accepted actuarial practice.

Incremental Cost	($ million)
January 1, 2018 to December 31, 2018	1,081
January 1, 2019 to December 31, 2019	1,034
January 1, 2020 to December 31, 2020	1,046

5.3 Solvency Sensitivity

The effect on the solvency liabilities of using discount rates 1% lower than those used for the solvency valuation would be an increase in the solvency liabilities of $3,143 million. All other assumptions and methods as used in this valuation were maintained.

6. Contribution Rates

6.1 Contribution Rate in Respect of Normal Actuarial Costs

The normal actuarial cost is the cost, on the going concern basis, of benefits accruing under the Plan as a result of service after the valuation date. Based on the Plan provisions, membership data, and going concern assumptions and methods described in the Appendices, the following table provides details on the breakdown of the normal actuarial cost, provision for adverse deviation, and provision for non-investment expenses, along with the resulting total normal actuarial contribution rate.

	December 31, 2016	December 31, 2017
Normal actuarial cost	$441,123,000	$462,601,000
Provision for adverse deviation (PfAD)	$69,204,000	$77,857,000
Provision for non-investment expenses	$13,925,000	$14,075,000
• Next year's pensionable earnings	$2,785,000,000	$2,815,000,000
Normal actuarial cost rate	15.85%	16.43%
PfAD rate	2.48%	2.77%
Provision for non-investment expenses	0.50%	0.50%
Total normal actuarial contribution rate	18.83%	19.70%

6.2 Contribution Rate in Respect of Unfunded Liability

The following table summarizes the amortization schedule that has been established prior to the valuation date along with the present value at December 31, 2017 of the additional contributions for which each schedule is expected to account over its remaining lifetime.

Valuation Date at which Schedule Established	Commencement of schedule	Contribution Rate (% of pensionable earnings)	End Date for Schedule	Present Value at Dec. 31, 2017 ($ million)
December 31, 2011	January 1, 2013	4.34%	December 31, 2026	1,073

Between this valuation date and the last, actuarial/experience gains amounted to $600 million. These gains were reduced by assumption changes, in particular the decrease in the discount rate, resulting in an unfunded liability of $754 million at this valuation date. Maintaining the remaining period of the last established amortization schedule would result in a contribution rate of 3.22% (versus the 4.34% shown above). Alternatively, maintaining the total plan contribution rates established at the last valuation would modestly reduce the amortization period by 0.5 years (changing the end of the schedule from December 31, 2026 to June 30, 2026).

The Board has decided to keep the Plan's split contribution rates (below/above the YMPE) unchanged and, as a result, the following table illustrates the revised amortization schedule as at the valuation date:

Valuation Date at which Schedule Established	Commencement of schedule	Contribution Rate (% of pensionable earnings)	End Date for Schedule	Present Value at Dec. 31, 2017 ($ million)
December 31, 2011	January 1, 2013	3.42%	June 30, 2026	754

6.3 Excess Surplus

The *Income Tax Act (Canada)* prescribes the maximum going concern surplus that may be retained by the Plan while full contributions continue. Since there is no going-concern surplus, contribution rates would not be affected by the prescribed maximum surplus limit.

6.4 Contribution Rate in Respect of Solvency Deficiency

The Act does not require additional contributions to fund the solvency deficiency.

6.5 Total Required Contribution Rate

The total contribution rates that are required to provide for accruing service and appropriate amortization of the unfunded liability in accordance with the schedule above are outlined in the following table. These rates have been established on the basis that total costs are shared equally between the Plan's active members and their employers.

Total Contribution Rates (% of pensionable earnings)	Members	Employers	Total
Level Rate on All Earnings			
Normal actuarial cost rate (including provision for adverse deviation and non-investment expenses)	9.85%	9.85%	19.70%
Unfunded liability payments	1.71%	1.71%	3.42%
Total contribution rate	11.56%	11.56%	23.12%
Split Rate Below/Above YMPE			
On earnings below YMPE	10.47%	10.47%	20.94%
On earnings above YMPE	14.95%	14.95%	29.90%

In accordance with the Act and the Plan's Funding Policy Statement, expected contributions must be sufficient to satisfy the minimum funding requirements over the course of the period up to the next actuarial valuation.

While the total contribution rate of 23.17% in effect at the valuation date is greater than the 23.12% required to fund the normal actuarial cost and unfunded liability payments as described above, the split rates remain unchanged and are adequate for purposes of the Act and the Plan's Funding Policy Statement.

7. Funding Policy Considerations

7.1 Margin and Provision for Adverse Deviation

A margin for adverse deviation has been built into the going concern assumptions as described in Appendix E. The effect of the margin on the resulting liabilities and normal actuarial cost results in a provision for adverse deviation. The margin and resulting provision are aimed at reducing the potential adverse effect of the uncertainty inherent in the going concern assumptions. If the future unfolds in accordance with what are considered to be best estimate assumptions (that is, assumptions without margin), then the provision for adverse deviation will be released into surplus.

The amount of margin to include in the going concern assumptions is guided by the Plan's Funding Policy Statement. This Statement contemplates that the target amount of margin for adverse deviation incorporated into the actuarial assumptions will be a 1.0% reduction in the best estimate discount rate. Such a reduction should result in a target provision for adverse deviation in the Plan's going concern liabilities and normal actuarial cost of 10% to 20%.

For this valuation, the amount of margin incorporated into the discount rate assumption is 1.0% per annum. In other words, the discount rate is 1.0% lower than the best estimate long-term rate of return assumption. This margin has been discussed with the Board and the Board has expressed their comfort with the margin level.

The following table illustrates the effect of the 1.0% discount rate margin expressed in terms of a percentage of the going concern liabilities and normal actuarial cost determined using best estimate assumptions (i.e., the resulting provision for adverse deviation, or PfAD).

	Going-Concern Value ($ million)	Best Estimate Value ($ million)	PfAD ($ million)	PfAD (as a % of Best Estimate Value)
Liabilities	$13,445	$11,860	$1,585	13.4%
Normal actuarial cost	19.20%	16.43%	2.77%	16.9%

Appendix A – Plan Provisions

A.1 Plan Provisions

This summary contains the main provisions of the Plan as at the valuation date. For a complete description, reference should be made to the Plan text.

Provision	Detail
Effective date	May 14, 1993 (Royal Assent received – Plan was implemented by Bill 68 of the Alberta legislature). Most of its provisions, including those dealing with pension and related benefits, came into effect January 1, 1994. The PSPP is a continuation of the pension plan provided under the *Public Service Pension Plan Act*, which was applicable prior to 1994. Schedule 2 to the Act established the Public Service Pension Board and outlines the duties of the Board and the funding disciplines. A separate regulation to the Act (the Public Service Pension Plan, Alberta Regulation 368/93) outlines the specific benefit provisions of the Plan.
Eligibility	Full-time and part-time employees of the government of Alberta, and of the agencies, boards and Provincial corporations identified in Part 2 of regulation 368/93, are eligible to participate in the Plan.
Current service contributions	With effect from January 1, 1992, the current service benefit accruals of the PSPP have been funded in equal parts by contributions from PSPP members and their employers which, in total, are equal to the normal cost of the benefit accruals attributable to the years for which the contributions are made.
Unfunded liability contributions	Any unfunded liability of the Plan arising after 1998 is to be funded over a period not exceeding 15 years from the applicable valuation date, in equal parts by contributions from PSPP members and their employers.
Solvency contributions	The Act does not require funding of any solvency deficit.
Purchase of service	Members are entitled to contribute for the purchase of certain periods of service. The actuarial basis for determining the purchase price approximates the going-concern actuarial liability that will arise in respect of that service.
Credited interest	Prior to 1994, Plan member contribution accounts were credited with interest at the rate of 4% per annum. Effective January 1, 1994, the interest credited to accumulated member contributions is equal to the rate of return credited on 5-year term deposits by Canadian chartered banks as reported in CANSIM series V 122515 (formerly B14045) maintained by Statistics Canada.

Provision	Detail
Combined pensionable service (CPS)	Combined Pensionable Service ("CPS") affects members who transfer to (or from) employment covered by the Plan from (or to) employment covered by either the Management Employees Pension Plan ("MEPP") or the Universities Academic Pension Plan ("UAPP"). When a member of MEPP or UAPP transfers to PSPP, the member's PSPP pensionable service is the only service recognized for purposes of calculating the PSPP accrued pension. However, determination of eligibility to benefits from PSPP, such as vesting, early retirement, and the amount of early retirement reduction, is based on the member's CPS. In this case, the member's CPS is equal to his pensionable service under PSPP plus the pensionable service earned under the former plan. Similarly, when a PSPP member transfers to UAPP or to MEPP, the member's PSPP pensionable service up to the time of transfer is the only service used to calculate the PSPP accrued pension. However, the member's CPS is used to determine benefit eligibility as described above. In this case, the member's CPS is equal to the pensionable service under PSPP plus the pensionable service under the new plan. In either case, the member's accrued PSPP pension is based on the highest five-year average earnings over the member's entire CPS. The aggregate of the periods that are to be taken into account in determination the length of the CPS shall not exceed 35 years. CPS results in benefits that are higher than they otherwise would be in its absence, resulting in additional costs.
Normal retirement date	First day of the month coincident with or following the member's 65^{th} birthday.
Unreduced early retirement	A member who has attained age 55, and whose age and years of pensionable service total 85 or more, is entitled to an unreduced retirement pension commencing immediately.
Reduced early retirement	A member who has attained age 55, but whose age and years of pensionable service do not total 85, may elect to receive a pension commencing immediately that is reduced by an early retirement reduction. The early retirement reduction is 3% multiplied by the number of years the member is short of age 65 or 85 points, whichever is less (without recognition of potential service).
Postponed retirement	A member who is eligible for immediate retirement may defer pension commencement, up to the latest age permitted under the *Income Tax Act (Canada)*. An actuarial increase applies in the case of postponement beyond the later of termination of employment and attaining eligibility for an unreduced pension.
Normal form of pension	The normal form of pension is a 5-year guaranteed life annuity. Members can select an alternative form of pension that is actuarially equivalent to the normal form of pension.
Years of pensionable service	The number of complete years and any fraction of a remaining year of pensionable service, up to a maximum of 35 years, less any combined pensionable service.

Provision	Detail
Highest average salary	The member's average annual pensionable salary in the 60 consecutive months in which such average salary was the highest (including during continuing employment after attainment of 35 years of pensionable service). The pensionable salary of part time employees is grossed up to an annual basis to determine average pensionable salary.
Average YMPE	The average of the Year's Maximum Pensionable Earnings (as defined in the Canada Pension Plan) over the same period over which pensionable earnings are averaged.
Normal retirement benefit	The benefit payable at normal retirement age is an annual pension equal to the sum of: (a) 2.0% of average pensionable salary multiplied by years of pensionable service earned or credited in respects of periods prior to January 1, 1966, plus (b) 1.4% of average pensionable salary up to the average YMPE multiplied by years of pensionable service earned or credited in respect of periods after January 1, 1966, plus (c) 2.0% of average pensionable salary in excess of average YMPE, multiplied by years of pensionable service earned or credited in respect of periods after January 1, 1966.
Maximum pensionable earnings	Effective January 1, 1992, and only in respect of pensionable service after 1991, pensionable earnings for each calendar year are limited to the sum of: (a) 50 times the defined benefit annual maximum pension limit for the year under the *Income Tax Act (Canada)*, plus (b) 30% of the YMPE for the year.
Cost of living increases	Pensions payable to retired members, former members with deferred pensions and survivors will be increased annually to reflect 60% of the increase in the Consumer Price Index for Alberta. The Board may approve additional ad hoc cost-of-living increases.
Vesting	Benefits vest on attainment of 2 years of combined pensionable service or age 65.
Termination benefits	(a) *Non-vested benefit:* A non-vested terminated member is entitled to payment of the member's contributions with interest. (b) *Vested benefit:* The vested termination benefit is a deferred pension, commencing at or after age 55 calculated to reflect the early retirement discount applicable at the actual date of retirement of the member (i.e., 3% per annum) and reflecting only pensionable service performed to the date of termination. Portability is permitted.
Death benefits	*Prior to retirement:* (a) *Non-vested benefit:* The non-vested death benefit is a refund of the member's required contributions with interest. (b) *Vested benefit:* The vested death benefit is payment of the commuted value of the member's termination/retirement benefit. However, a surviving pension partner has the option to elect a monthly pension in lieu of the commuted value. Such a monthly pension is determined as the survivor's pension as if the member had retired on an unreduced pension and elected a Joint-and-Survivor 100% optional form. *After retirement:* The post-retirement death benefit is dependent on the form of pension selected at retirement.

Provision	Detail
Disability benefits	A member, or a former member who remains entitled to a deferred pension, is entitled to receive an immediate unreduced pension, provided that he/she: (a) joined the Plan prior to July 1, 2007, (b) is totally disabled, (c) has completed two years of pensionable service, and (d) is not receiving benefits under an approved disability plan. A person who satisfies the above conditions, but is only partially disabled, is entitled to receive a pension commencing immediately that is reduced as for early retirement. A person who is receiving benefits from an approved disability plan is not entitled to receive, concurrently, a disability pension from the Plan. While in receipt of benefits from an approved disability plan, participation in the Plan continues. Salary, for the purpose of current service contributions or for the purpose of determining any pension to which the member may subsequently become entitled, is the salary that was being earned immediately before disability benefits commenced, increased by any subsequent general increases applicable to the pre-disability class of employment of the member.
50% Rule (excess contributions)	Upon a member's retirement, or upon commuted value transfer upon termination or death, if the member's own contributions with interest are greater than half the value of the benefit otherwise payable, then the member/spouse/beneficiary receives a refund of such excess. This does not apply to benefits/contributions for purchased service.
Portability agreements – other public sector plans	Portability agreements have been established with other public sector pension plans, under which a member who transfers between the PSPP and such other plan has the option to transfer service credits from his former plan to his new plan, with a corresponding transfer of funds between the plans. The amounts of such service transfer and fund transfer are generally based on the estimated respective actuarial funding valuation liability for such member in each of the plans.
Plan termination	The Act does not contemplate termination of the Plan.

Appendix B – Plan Membership

B.1 Source of Data

Alberta Pensions Services Corporation (APSC) provides administration services to the Plan and maintains pension records of Plan members on behalf of the Board. The relevant information to carry out this valuation was provided by APSC. We have reviewed the data to ensure its sufficiency and reliability, and consistency with the data used in the last valuation. Specific tests included:

1. A member by member reconciliation of the membership group from December 31, 2016 to December 31, 2017.
2. Tests for reasonableness of the data elements of the record of each individual entitled to or potentially entitled to a benefit under the Plan, including, but not limited to:
   (a) Comparison of changes in age, salaries and pensionable service
   (b) Comparison of the terminated and retired members with the files used for the prior valuation and the retirements, terminations, and deaths that occurred during the inter-valuation period
   (c) Validation with APSC regarding all inconsistencies in comparison with the data used for the previous actuarial valuation, with adjustments made where necessary
   (d) Comparison of the data provided with information contained in the Plan's financial statements.

The results of the above tests demonstrate that the membership data is substantially complete; however, the 2018 salary rate was missing for 908 active/CPS members. To estimate this missing data, these members' 2018 salary rates were derived using:

- the highest of the member's annualized pensionable earnings from the last five years; or
- the average 2018 annual salary rate for the active group ($71,700), if no historical pensionable earnings were available.

In addition, manual adjustments have been made for contribution balances, pensionable service and pensionable earnings for about 3,700 active members and CPS members due to incomplete 2017 year-end calculations. These estimates do not materially affect the results of the valuation. The membership data is sufficient and reliable for the purposes of this valuation.

B.2 Summary of Membership Data

There were the following members as of the current and last valuation dates:

Active Members

Membership Summary	December 31, 2016	December 31, 2017
Number of members	41,490	42,252
Male	13,512	13,785
Female	27,978	28,467
Average age	44.1	44.2
Male	43.7	43.8
Female	44.3	44.3
Average Plan service (years)	9.7	9.6
Male	9.6	9.5
Female	9.7	9.6
Average annualized earnings	$71,194	$71,746
Male	$78,574	$78,898
Female	$67,629	$68,283

Retirees & Beneficiaries

Membership Summary	December 31, 2016	December 31, 2017
Number of members	25,422	26,187
Male	11,031	9,729
Female	14,391	16,458
Average age	72.5	72.6
Male	73.6	72.8
Female	71.6	72.5
Average current pension (including any coordination)	$15,788	$16,319
Male	$17,898	$19,231
Female	$14,170	$14,597

CPS Suspended Members

Membership Summary	December 31, 2016	December 31, 2017
Number of members	4,148	4,473
Male	1,820	1,951
Female	2,328	2,522
Average age	47.6	47.6
Male	47.9	47.9
Female	47.4	47.3
Average Plan service (years)	8.8	8.6
Male	8.9	8.6
Female	8.7	8.6
Average CPS service (years)	7.3	7.3
Male	7.7	7.7
Female	7.0	7.0
Average annualized earnings	$114,177	$110,811
Male	$117,758	$114,436
Female	$111,377	$108,009

Deferred Members

Membership Summary	December 31, 2016	December 31, 2017
Number of members	9,612	9,817
Male	3,086	3,122
Female	6,526	6,695
Average age	47.7	47.7
Male	48.4	48.3
Female	47.4	47.5
Average deferred pension[1]	$6,246	$6,183
Male	$7,296	$7,121
Female	$5,750	$5,746

[1] *Includes cost of living adjustments to the January 1 following the valuation date.*

Hold-On-Deposit Members

Membership Summary	December 31, 2016	December 31, 2017
Number of members	4,756	4,936
Male	1,553	1,631
Female	3,203	3,305
Average age	48.7	47.8
Male	48.7	48.7
Female	47.2	47.4
Average contributions with interest	$3,342	$3,450
Male	$3,411	$3,567
Female	$3,308	$3,393

B.3 Changes in Membership Data

The following table shows the changes in the Plan membership since the last valuation date:

Reconciliation of Membership Data	Active Members	CPS Suspended Members	Deferred/ Hold-on-Deposit	Retirees and Beneficiaries	Total
As at December 31, 2016	41,490	4,148	14,368	25,422	85,428
New entrants	4,692	8	270	0	4,970
Return to active status	291	(38)	(253)	0	0
New CPS	(542)	642	(100)	0	0
Terminations - deferred	(1,807)	(108)	1,915	0	0
Paid out/transfers	(978)	(38)	(1,125)	0	(2,141)
Retirements	(865)	(137)	(292)	1,294	0
Deaths or expiry of guarantee	(29)	(4)	(30)	(581)	(644)
Data adjustments	0	0	0	52	52
As at December 31, 2017	42,252	4,473	14,753	26,187	87,665

B.4 Active Members - Detail

Distribution of Pensionable Service and Contributions - All Active

Age	Under 5	5 – 9	10 – 14	15 – 19	20 – 24	25 – 29	30 – 35	Total
Under 25	740	10						750
	$50,497	$50,566						$50,497
	$6,724	$26,980						$7,001
25 – 29	3,661	523	6					4,190
	$59,949	$65,666	$52,200					$60,652
	$12,895	$39,178	$44,830					$16,259
30 – 34	3,715	1,857	367	2				5,941
	$66,022	$73,461	$75,168	*				*
	$16,425	$48,442	$71,412	*				*
35 – 39	2,628	1,916	1,158	154	2			5,858
	$69,276	$75,833	$80,603	$78,483	*			*
	$17,570	$52,780	$80,330	$95,353	*			*
40 – 44	1,883	1,400	1,295	618	56			5,252
	$69,335	$75,600	$80,601	$83,361	$79,666			$75,544
	$18,206	$54,700	$83,787	$106,875	$114,750			$55,746
45 – 49	1,471	1,213	1,183	804	338	121		5,130
	$69,768	$73,993	$79,359	$81,538	$79,917	$72,757		$75,563
	$17,875	$54,640	$85,557	$108,563	$118,092	$124,781		$65,766
50 – 54	1,053	1,002	1,058	758	462	630	182	5,145
	$72,094	$72,943	$75,739	$79,167	$78,097	$77,220	$74,479	$75,302
	$19,860	$55,368	$81,697	$105,329	$116,637	$135,294	$143,858	$79,549
55 – 59	790	776	867	759	480	748	798	5,218
	$68,635	$69,432	$72,741	$74,557	$76,206	$76,275	$73,769	$72,874
	$18,721	$53,237	$78,073	$99,815	$116,322	$135,956	$143,721	$90,662
60 - 64	341	467	616	550	408	437	781	3,600
	$68,802	$70,888	$72,033	$73,322	$72,462	$73,083	$74,319	$72,447
	$20,914	$55,222	$78,972	$99,766	$109,690	$132,676	$144,089	$97,824
65 +	80	156	210	180	95	130	317	1,168
	$67,367	$70,803	$69,909	$70,626	$75,752	$69,763	$76,019	$72,082
	$21,810	$56,350	$77,076	$97,581	$114,841	$129,475	$142,369	$100,307
Total	16,362	9,320	6,760	3,825	1,841	2,066	2,078	42,252
	$65,783	$73,313	$77,182	*	*	$75,272	$74,381	$71,746
	$16,168	$52,154	$81,091	*	*	$133,998	$143,665	$58,998

** Not shown for confidentiality reasons.*

Each cell shows: Number of members
Average annual pensionable earnings
Average contributions with interest

George&Bell CONSULTING

Distribution of Pensionable Service and Contributions - Male Active

Age	Under 5	5 – 9	10 – 14	15 – 19	20 – 24	25 – 29	30 – 35	Total
Under 25	243	1						244
	$53,974	*						*
	$7,406	*						*
25 – 29	1,209	188						1,397
	$62,637	$69,925						$63,618
	$14,063	$41,833						$17,841
30 – 34	1,258	592	153	1				2,004
	$69,157	$76,839	$78,830	*				*
	$17,404	$53,094	$78,271	*				*
35 – 39	880	605	435	51	1			1,972
	$74,412	$80,477	$84,489	$86,738	*			*
	$19,234	$59,213	$88,670	$112,872	*			*
40 – 44	617	473	474	215	27			1,806
	$77,806	$81,302	$86,137	$89,245	$85,650			$82,387
	$21,847	$61,630	$94,597	$119,326	$124,900			$64,671
45 – 49	482	388	403	280	124	37		1,714
	$80,259	$82,102	$87,555	$89,051	$88,403	$78,913		$84,388
	$21,386	$64,105	$99,735	$124,796	$133,346	$138,156		$77,351
50 – 54	340	300	331	224	156	209	49	1,609
	$85,176	$83,650	$85,894	$91,702	$86,048	$83,143	$84,760	$85,756
	$24,657	$66,977	$97,364	$127,294	$133,748	$151,320	$168,195	$93,322
55 – 59	229	221	232	208	143	262	226	1,521
	$79,221	$80,645	$83,815	$88,028	$88,042	$84,706	$84,016	$83,819
	$23,464	$66,883	$94,177	$123,018	$139,198	$156,499	$172,337	$110,376
60 - 64	118	150	182	144	118	130	284	1,126
	$80,810	$81,597	$83,925	$89,255	$82,432	$82,406	$83,536	$83,540
	$27,015	$68,876	$96,433	$129,177	$128,982	$155,283	$170,611	$118,916
65 +	32	53	68	45	25	39	130	392
	$73,530	$82,137	$81,168	$78,478	$92,551	$87,431	$84,862	$82,941
	$24,035	$70,119	$92,996	$111,889	$145,276	$166,929	$164,028	$120,689
Total	5,408	2,971	2,278	1,168	594	677	689	13,785
	$71,562	*	$84,985	*	*	$83,622	$84,031	$78,898
	$18,334	*	$93,736	*	*	$154,265	$169,763	$68,170

** Not shown for confidentiality reasons.*

Each cell shows: Number of members
Average annual pensionable earnings
Average contributions with interest

George & Bell CONSULTING

Distribution of Pensionable Service and Contributions - Female Active

Age	Under 5	5 – 9	10 – 14	15 – 19	20 – 24	25 – 29	30 – 35	Total
Under 25	497	9						506
	$48,796	$48,010						$48,782
	$6,395	$25,402						$6,740
25 – 29	2,452	335	6					2,793
	$58,624	$63,276	$52,200					$59,168
	$12,319	$37,687	$44,830					$15,468
30 – 34	2,457	1,265	214	1				3,937
	$64,417	$71,879	$72,550	*				*
	$15,922	$46,266	$66,509	*				*
35 – 39	1,748	1,311	723	103	1			3,886
	$66,690	$73,690	$78,265	$74,396	*			*
	$16,727	$49,811	$75,312	$86,678	*			*
40 – 44	1,266	927	821	403	29			3,446
	$65,206	$72,690	$77,406	$80,222	$74,095			$71,957
	$16,427	$51,164	$77,546	$100,232	$105,300			$51,063
45 – 49	989	825	780	524	214	84		3,416
	$64,656	$70,180	$75,125	$77,523	$75,000	$70,046		$71,135
	$16,176	$50,189	$78,231	$99,890	$109,254	$118,890		$59,963
50 – 54	713	702	727	534	306	421	133	3,536
	$65,855	$68,367	$71,116	$73,909	$74,044	$74,280	$70,691	$70,545
	$17,530	$50,406	$74,563	$96,115	$107,914	$127,338	$134,892	$73,260
55 – 59	561	555	635	551	337	486	572	3,697
	$64,314	$64,968	$68,694	$69,473	$71,184	$71,730	$69,720	$68,371
	$16,782	$47,803	$72,180	$91,056	$106,615	$124,882	$132,414	$82,548
60 - 64	223	317	434	406	290	307	497	2,474
	$62,448	$65,820	$67,046	$67,671	$68,406	$69,136	$69,052	$67,399
	$17,766	$48,761	$71,649	$89,334	$101,840	$123,103	$128,934	$88,251
65 +	48	103	142	135	70	91	187	776
	$63,258	$64,971	$64,517	$68,009	$69,753	$62,191	$69,871	$66,597
	$20,326	$49,265	$69,452	$92,812	$103,971	$113,424	$127,311	$90,011
Total	10,954	6,349	4,482	2,657	1,247	1,389	1,389	28,467
	$62,930	$70,256	$73,216	*	*	$71,203	$69,594	$68,283
	$15,098	$48,506	$74,663	*	*	$124,120	$130,719	$54,553

** Not shown for confidentiality reasons.*

Each cell shows: Number of members
Average annual pensionable earnings
Average contributions with interest

George&Bell CONSULTING

B.5 Retirees & Beneficiaries - Detail

Distribution of Annual Pension

Age	Years Since Retirement					
	Under 5	5 – 14	15 – 24	25 – 34	35 +	Total
Under 60	1,261	135	40	12		1,448
	$24,592	$15,133	$9,622	$5,772		$23,141
60 – 64		1	61	968	260	1,290
		*	$9,220	$10,288	$9,087	*
65 – 69	2,199	1,728	68	19	4	4,018
	$23,692	$22,309	$10,676	$7,390	$3,251	$22,780
70 – 74	2,193	3,458	181	42	8	5,882
	$20,093	$18,719	$9,315	$7,073	$4,358	$18,839
75 – 79	463	3,164	1,606	71	15	5,319
	$20,875	$17,716	$11,665	$8,074	$6,255	$16,003
80 – 84	32	1,169	2,355	212	29	3,797
	$18,114	$15,405	$11,184	$10,546	$6,796	$12,473
85 – 89	2	106	1,605	1,089	33	2,835
	*	$13,451	$10,413	$10,645	$6,833	*
90 +		5	527	1,041	25	1,598
		$14,001	$10,354	$9,991	$8,217	$10,095
Total	6,150	9,766	6,443	3,454	374	26,187
	*	*	$22,350	$22,350	$22,350	$16,319

** Not shown for confidentiality reasons.*

Each cell shows: Number of members
Average annual pension

George & Bell CONSULTING

Appendix C – Assets

C.1 Plan Asset Information

Plan assets are held in trust and managed by Alberta Investment Management Corporation. The fund is audited annually by the Auditor General of Alberta. The asset data required for the valuation in respect of the Plan's trust fund was taken from the Plan's audited financial statements at December 31, 2017.

The asset value has been tested and reconciled with the value at the last valuation. The benefits paid from the fund have also been examined and tested against the membership data.

C.2 Statement of Plan Assets and Asset Mix

A breakdown of the market value of the fund as at the valuation date, with the last valuation shown for comparison, is shown in the following table:

	December 31, 2016		December 31, 2017	
Asset Class	Amount ($ millions)	Asset Mix (%)	Amount ($ millions)	Asset Mix (%)
Cash and Short-Term	92	0.8%	78	0.6%
Other Fixed Income	2,403	20.2%	2,843	21.2%
Equities	6,828	57.5%	7,753	57.8%
Alternatives	2,476	20.8%	2,661	19.8%
Strategic Opportunities	88	0.7%	84	0.6%
Subtotal	11,888	100.0%	13,419	100.0%
Adjustments				
Accounts Receivable	39		40	
Accounts Payable	(16)		(33)	
Subtotal	23		7	
Total	11,911		13,426	

C.3 Changes to the Plan Assets

The following table shows the changes to the market/assigned value of the assets during the inter-valuation period:

Beginning of Period	January 1, 2017 ($ million)
Opening Asset Value	11,911
Contributions	
Employer	362
Employee	361
Past service	8
Transfers from other plans	4
Subtotal	735
Benefit Payments	
Pension payments	(405)
Disability payments	(2)
Termination benefits	(113)
Death benefits	(35)
Transfers to other plans	(6)
Subtotal	(561)
Expenses	
Non-investment expenses	(13)
Investment expenses	(65)
Subtotal	(78)
Investment Earnings	1,419
Closing Asset Value	13,426
End of Period	**December 31, 2017**

C.4 Long Term Asset Mix

The Board has adopted an investment policy that includes the following long-term asset mix:

Asset Class	Target %
Money market	0.5%
Long bonds	7.0%
Universe bonds	7.0%
Private mortgages	5.0%
Private debt and loans	1.5%
Canadian equities	13.0%
Global equities (traditional)	22.0%
Global equities (low volatility)	11.0%
Emerging market equities	5.0%
Private equities	4.0%
Canadian real estate	13.0%
Foreign real estate	2.0%
Infrastructure	9.0%
Total	100.0%

C.5 Fund Rates of Return

The rate of return history of the market value of assets, net of investment management fees, is shown below.

Year	Market Value
2012	11.5%
2013	14.4%
2014	12.1%
2015	9.8%
2016	7.0%
2017	11.3%

C.6 Development of Actuarial Value of Assets

The actuarial value of assets is determined by adjusting for fluctuations in market value to moderate the effects of market volatility on the Plan's funded status. The projected asset values are calculated by starting with the market value of assets for the specific year and projecting forward with the assumed rate of return and actual cash flows for each year until the valuation date. The corridor approach is used so that if the calculated value is more than 10% above the market value, then 110% of the market value will be used as the actuarial value. Similarly, if the calculated value is less than 10% below the market value, then 90% of the market value will be used as the actuarial value.

	2013 $ millions	2014 $ millions	2015 $ millions	2016 $ millions	2017 $ millions
Market value at December 31, 2013	8,559				
Net cash flow	182				
Assumed return (7.00%)	606				
Projected/Market value at December 31, 2014	9,347	9,787			
Net cash flow	185	185			
Assumed return (6.60%)	623	652			
Projected/Market value at December 31, 2015	10,155	10,624	10,937		
Net cash flow	204	204	204		
Assumed return (6.60%)	677	708	729		
Projected/Market value at December 31, 2016	11,036	11,536	11,870	11,911	
Net cash flow	160	160	160	160	
Assumed return (6.50%)	723	755	777	779	
Projected/Market value at December 31, 2017	11,919	12,451	12,807	12,850	13,426
	Five-Year Average of Projected / Market Values (rounded)				12,691
	Corridor Maximum (110% of Market Value of Plan Assets)				14,769
	Corridor Minimum (90% of Market Value of Plan Assets)				12,083
	Actuarial Value of Assets				**12,691**

C.7 Impact of Asset Fluctuation Adjustment

The historical market and actuarial values of assets, along with the resulting asset fluctuation adjustment and the year-by-year change in the adjustment, are shown below:

Year	Market Value ($ millions)	Actuarial Value ($ millions)	Asset Fluctuation Adjustment ($ millions)	Change in Asset Fluctuation Adjustment ($ millions)
2008	4,771	5,248	(477)	n/a
2009	5,488	6,037	(549)	(72)
2010	6,167	6,577	(410)	139
2011	6,481	6,739	(258)	152
2012	7,300	7,030	270	528
2013	8,559	7,988	571	301
2014	9,787	9,002	785	214
2015	10,937	10,087	850	65
2016	11,911	11,346	565	(285)
2017	13,426	12,691	735	170

Appendix D – Actuarial Methods

D.1 Actuarial Cost Method – Going Concern Valuation

The projected unit credit actuarial cost method has been used for this valuation, as was the case in the previous valuation. Under this method, the going concern liabilities at the valuation date are the actuarial present value of benefits in respect of service prior to the valuation date, but based on pensionable earnings projected to retirement. The normal actuarial cost is the present value, at the middle of the ensuing year, of benefits that accrue to active members in the ensuing year, again based on projected pensionable earnings.

Benefits in respect of excess contributions are determined as of the date the member's benefits are determined by comparing accumulated total service contributions with total service benefits and then the difference, if any, is allocated between past and future service periods on a pro-rata basis.

The pattern of future contributions necessary to pre-fund future benefit accruals for any one particular individual will increase gradually as a percentage of his or her pensionable earnings as the individual approaches retirement. For a stable population (i.e., one where the demographics of the group remain relatively constant from year to year), the normal actuarial cost will remain relatively level as a percentage of pensionable earnings.

An actuarial excess is the excess of the going concern assets over the going concern liabilities; an unfunded liability is the excess of the going concern liabilities over the going concern assets.

D.2 Actuarial Cost Method – Solvency Valuation

The *Act* requires disclosure of the Plan's financial position at the valuation date under the solvency valuation provision of the Alberta *Employment Pension Plans Act*. The *Act* does not require funding of any solvency deficit.

As in the last valuation, the solvency liabilities have been calculated as the actuarial present value of the benefits to which a member would be entitled if participation in the Plan was terminated on the valuation date. It is further noted that the solvency liabilities do not take into consideration any benefit reductions that may be required in the event of actual Plan termination on the valuation date.

D.3 Asset Valuation Method – Going Concern and Solvency Valuations

The going-concern asset valuation method determines the value that will be assigned to the assets on the valuation date. The actuarial value of assets has been determined by applying a smoothing methodology to the Plan's market value of assets at the valuation date. The same method was used in the previous valuation.

The actuarial value of assets is based on the market value of Plan assets (adjusted for accrued contributions and payments), plus an Asset Fluctuation Adjustment. This adjustment is based on a five-year smoothing of market rates of return over the expected long-term rate of return, specifically:

- investment income is assumed to accrue each year at a rate equal to the expected long-term rate of return assumed in the most recent valuation as at the beginning of that year;
- actual market values of the Plan's assets from each of the four previous year-ends are then projected to the current valuation date, using actual annual net cash flows and imputed investment income at these assumed rates for each year;
- these four projected results at the current valuation date, together with the actual market value at the current valuation date, are then averaged;
- this averaged value is then constrained to be no less than 90%, and no greater than 110%, of the current market value;
- the Asset Fluctuation Adjustment is calculated as the excess (positive or negative) of this constrained averaged value over the market value.

The actuarial asset value is then determined as the market asset value at the valuation date, plus the Asset Fluctuation Adjustment. Calculation of the Asset Fluctuation Adjustment for the current valuation is detailed in Appendix C of this report.

For purposes of the solvency valuation, assets have been valued at market value.

D.4 Margins for Adverse Deviation

A margin for adverse deviation has been built into the going concern discount rate assumption. This margin is aimed at reducing the potential adverse effect of the uncertainty inherent in the going concern assumptions. If the future unfolds in accordance with what are considered to be best estimate assumptions (that is, assumptions with no such margins), then the margins built into the going concern assumptions will be released into surplus.

D.5 Incremental Cost Method for Solvency Valuation

The incremental cost represents the present value, at the beginning of each period shown (time t), of the expected aggregate change in the solvency liabilities between time t and time t+1, adjusted upwards for expected benefit payments between time t and time t+1.

The calculation methodology can be described as follows:

1. the present value at time t of expected benefit payments between time t and time t+1, discounted to time t; plus

2. the projected solvency liabilities at time t+1, discounted to time t, allowing for, if applicable to the pension plan being valued:
    - expected decrements and related changes in membership status between time t and time t+1,
    - accrual of service to time t+1,
    - expected changes in benefits to time t+1, and
    - a projection of pensionable earnings to time t+1; less
3. the solvency liabilities at time t.

The actuarial assumptions used to calculate the incremental cost can be described as follows:

- The assumptions for expected benefit payments in item 1. above and decrement probabilities, service accruals, and projected changes in benefits and pensionable earnings in the item 2. above are consistent with the assumptions used in the Plan's going concern valuation.
- The assumptions used to calculate the projected solvency liabilities at time t+1 would generally be consistent with the assumptions for the solvency liabilities at time t, assuming that discount rates remain at the levels applicable at time t, that the select period is reset at time t for discount 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 t remain in effect at time t+1.

Active and inactive plan members as of time t and assumed new entrants over the period between time t and time t+1 are considered in calculating the incremental cost.

Appendix E – Actuarial Assumptions

E.1 Actuarial Assumptions - Going Concern Valuation

The going concern valuation is based on the assumption that the Plan will continue to operate indefinitely into the future. At each valuation, past experience is compared to the assumptions made at the last valuation to determine if, together with known changes to plan provisions, investment policy, and expectations of future trends, the assumptions should be changed.

In this valuation, we reviewed the history of experience gains and losses and have provided a rationale for any assumption changes from the prior valuation which are described below. Emerging experience differing from these assumptions will result in experience gains and losses that will be revealed in future valuations.

The actuarial assumptions used in this and the last valuations are summarized in the following table. All rates and percentages are annualized unless otherwise noted.

Going Concern Assumptions	December 31, 2016	December 31, 2017
Economic		
Long-term rate of return	6.5%	6.1%
Margin for adverse deviation	1.0%, inherent in discount rate	1.0%, inherent in discount rate
Discount rate	5.5%	5.1%
Inflation rate	2.1%	2.0%
Interest rate used for lump sums upon termination	2.2% for 10 years; 3.5% thereafter	2.6% for 10 years; 3.4% thereafter
Inflation rate used for lump sums upon termination	1.1% for 10 years; 2.2% thereafter	1.2% for 10 years; 1.8% thereafter
Increases in pensionable earnings		
• General earnings increase rates	1.0% for 2 years starting April 1, 2017; 3.3% thereafter	0.0% for 2 years starting April 1, 2018; 3.2% thereafter
• Merit and promotion increase rates	Age based rates on 2015 study	Same
Initial salary increase rate for CPS members	15%	Same
YMPE and Maximum Pension Limit	3.35%	3.2%
Cost-of-living adjustments	1.26%	1.2%
Interest on member contributions	4.1%	4.0%
Expenses	0.5% of pensionable earnings	Same

Going Concern Assumptions	December 31, 2016	December 31, 2017
Demographic		
Mortality	Males: CPM Private Table projected with Scale CPM-B Females: 95% of CPM Private Table projected with Scale CPM-B	Males: CPM Private Table projected with Scale MI-2017 Females: 95% of CPM Private Table projected with Scale MI-2017
Termination	5-year select, gender distinct, age-based table based on 2015 experience study	Same
Transfer to MEPP/UAPP under CPS provision	370 active members transfer to MEPP/UAPP per year	Same
Retirement	Active: age and service-based, gender distinct table based on 2015 experience study Deferred: age 55	Same
Proportion of vested terminated members electing a lump sum	80% if service less than 5 years, 50% if service between 5 and 15, 60% if service between 15 and 20, 70% if service between 20 and 25, 75% if service greater than 25	Same
Proportion of members with spouses	100% married	Same
Spousal age differential	Male spouse 3 years older	Same
Future Plan membership for funding the unfunded liability	Plan active membership will remain stable and the aggregate pensionable earnings base will increase at the rate of increase for general earnings	Same

Further detail concerning these assumptions is summarized below.

Economic assumptions

Inflation Rate

As the level of inflation influences the rate of increase in several economic factors that affect the Plan, it is necessary for a going-concern valuation to make an assumption regarding the future inflation rate. The inflation rate is assumed to be 2.0% per annum. This assumption is considered to be best estimate considering current economic and financial market conditions. The previous valuation assumed inflation to be 2.1% per annum.

Long-term rate of return

The primary economic assumption used in the going concern valuation is the rate of return that the fund is expected to earn over the long term. In this valuation, we have used a long-term rate of return of 6.1% per year. At the last valuation, the assumed long-term rate of return was 6.5% per year.

Long-term rate of return	%
Expected inflation	2.0
Expected real return	3.8
Value added for rebalancing/diversification	0.4
Value added for active management	0.1
Expected investment expenses	(0.2)
Expected non-investment expenses	0.0
Rate of return	6.1

In deriving the long-term rate of return, we have assumed that the assets would be invested according to the Plan's Statement of Investment Policies and Procedures revised at June 21, 2017.

The expected returns for the fund were estimated using our expected returns for applicable asset classes taking into account the target asset mix as outlined under the Plan's investment policy. Return assumptions for all asset classes are based on long-term expectations of at least 25 years.

The frequency of rebalancing the fund's weight in each asset class to its target in the investment policy, the weights themselves, and the time horizon, will all have an effect on the long-term return. The long-term return is also influenced by the diversification of the fund. The expected effect of rebalancing and diversification on the fund's return was estimated on the basis of a log-normal distribution.

A provision has been considered in the discount rate to take into account the added value associated with active management for traditional asset classes. This provision is less than the estimated fees corresponding to active management for those asset classes.

The rate of return has been adjusted to take into account expected investment management expenses on traditional asset classes. No investment management expenses have been considered for non-traditional asset classes as the expected real returns for those classes are assumed to be net of investment management fees.

Discount rate

The discount rate equals the long-term rate of return assumption less a margin for adverse deviation of 1.0%, or 5.1% per annum.

The discount rate used in the previous valuation was 5.5% per annum and reflected a margin of 1.0% per annum.

Interest rate and inflation rate used for lump sums upon termination

As it is assumed that a portion of vested terminated members will elect a lump sum settlement in lieu of a deferred pension, an assumption regarding the rate that will be used to determine the value of the lump sum amount is necessary. The interest rate has been assumed to be 2.6% for 10 years and 3.4% thereafter and the inflation rate has been assumed to be 1.2% for 10 years and 1.8% thereafter, both of which are representative of the prescribed assumptions used to determine such lump sum settlements at the valuation date and seen to be best estimates.

The previous valuation assumed the interest rate to be 2.2% for 10 years and 3.5% thereafter and the inflation rate to be 1.1% for 10 years and 2.2% thereafter.

Increases to average wages

As the rate of increase in average wages in the economy influences the rates of increase in the YMPE, member salaries, and other economic factors that affect the Plan, it is necessary for a going concern valuation to make an assumption regarding the future increases in average wages. Average wages are assumed to increase at 3.2% per annum. This assumption is considered best estimate and is comprised of an annual increase of 2.0% on account of inflation, plus a best-estimate assumed increase of 1.2% on account of productivity.

The previous valuation assumed average wages to increase 3.3% per annum; however, this assumption was built upon an inflation assumption of 2.1% per annum.

Increases in pensionable earnings

As the benefits paid to a member from the Plan are dependent on the member's future pensionable earnings, it is necessary for a going concern valuation to make an assumption regarding the future increases in such earnings. A member's pensionable earnings are assumed to increase in line with the rate of general earnings increases, plus age-related merit and promotion increases as follows.

General Earnings Increases

The best estimate general earnings increase rate for pensionable earnings in the long-term is equal to the rate of average wage increase of 3.2% per annum. To reflect current expectations of near-term increases, pensionable earnings have been assumed to remain static for 2 years, until March 31, 2020. The previous valuation assumed general earnings increases of 1.0% for two years starting April 1, 2017 and 3.3% per annum thereafter.

Merit and Promotion Increases

The assumed age-related merit and promotion increases used for this valuation are as outlined in the following table of rates. These rates are based on an experience study conducted in 2015 and are considered best estimate. The merit and promotion increases assumed for the previous valuation were based on the same experience study conducted.

2015 Experience Study

Age	Rate of Increase	Age	Rate of Increase
<23	7.75%	40	0.50%
23	7.25%	42	0.50%
24	6.75%	42	0.25%
25	5.75%	43	0.25%
26	5.00%	44	0.25%
27	4.25%	45	0.25%
28	3.75%	46	0.25%
29	3.25%	47	0.25%
30	3.00%	48	0.25%
31	2.50%	49	0.35%
32	2.25%	50	0.35%
33	2.00%	51	0.35%
34	1.75%	52	0.35%
35	1.50%	53	0.35%
36	1.25%	54	0.35%
37	1.25%	55	0.35%
38	1.00%	56	0.35%
39	0.75%	>56	0.00%

Initial salary increases for CPS members

As the accumulated number of CPS transfers is growing, the CPS effect on the Plan is no longer immaterial. As such, assumptions for new CPS members were developed as at the 2016 valuation to appropriately reflect the impact of the CPS provision on the Plan. For members who transfer from the Plan to either MEPP or UAPP, the members' salary rate is assumed to increase by 15% at the time of transfer. This assumption was developed based on an analysis of the historical earnings information for CPS transfers.

YMPE increases

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 YMPE is assumed to increase, up until the time the member retires, dies or terminates from active employment, at the assumed increase in average wages or 3.2% per annum. The previous valuation assumed the maximum pension limit would increase at 3.35% per annum which was consistent with the increase in average wages assumed in that valuation.

Increases in maximum pension limit

Pensions are limited to the maximum limits under the *Income Tax Act (Canada)*. Consistent with the provisions of the *Act,* it is assumed that the maximum pension limit will increase at the assumed increase in average wages or 3.2% per annum. The previous valuation assumed the maximum pension limit would increase at 3.35% per annum which was consistent with the increase in average wages assumed in that valuation.

Cost of living adjustments ("COLA")

As the Plan's benefits are increased after termination/retirement at 60% of inflation, it is necessary to make an assumption regarding the rate of COLA that will be applied in the future. It has been assumed that COLA will be applied at 60% of the assumed inflation rate of 2.0%, or 1.2% per annum.

The previous valuation assumed future COLA increases of 1.26% which was based on 60% of the assumed inflation rate of 2.1% per annum.

Interest on Member Contributions

As the Plan's benefits are dependent to some degree on the member contribution account balances (due to the "50% Rule" test), it is necessary to make an assumption regarding interest that will be credited to member contribution account balances in the future. It has been assumed that member contribution account balances will be credited with interest at the assumed inflation rate plus 2.0%, or at 4.0% per annum. This assumption is based on the long-term expected spread of five-year term deposit rates over inflation and is considered best estimate.

The previous valuation also assumed interest would be credited on member contributions at a rate that exceeded assumed inflation by 2.0% per annum.

Demographic assumptions

Members may cease active status as a result of death, retirement, termination of membership, or disability and may cease to be entitled to monthly pension payments as a result of death.

Mortality

For this valuation, the gender-distinct mortality rates have been assumed to be in accordance with:

- for males, 100% of the Canadian Pensioner Mortality (CPM) 2014 – Private Sector Males mortality table with future improvements in mortality in accordance with Scale MI-2017; and
- for females, 95% of the Canadian Pensioner Mortality (CPM) 2014 – Private Sector Females mortality table with future improvements in mortality in accordance with the Scale MI-2017.

As the Canadian Institute of Actuaries has recently published a new mortality improvement scale MI-2017 as part of an effort to better reflect Canadians' increased longevity, we have updated the morality improvement scale used in the valuation from CPM-B to MI-2017 accordingly. The base mortality table and adjustment assumptions are unchanged from the last valuation and they were based on the analysis and conclusions of the Plan's 2014 Mortality Experience Study and are considered best estimate.

Retirement

A member's benefit entitlement under the Plan is dependent on when the member decides to commence, or is deemed to commence, to receive a pension from the Plan (referred to as "retirement" from the Plan). Accordingly, an assumption with respect to when a member is expected to retire from the Plan has been made.

The retirement rates used for active/CPS members in the valuation are shown in the following tables. These rates are based on the results of a study performed in 2015 on the Plan's retirement experience and are considered best estimate. The same retirement rates were used in the previous valuation.

For both this and the previous valuation, deferred vested members are assumed to retire at age 55, which is the age that maximizes the pension value for such members.

George&Bell CONSULTING

Male Retirement Rates – Active / CPS Members – 2015 Experience Study

	Age															
Service	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
2	2.5%	3.0%	3.0%	3.05%	4.5%	6.5%	5.0%	6.5%	7.0%	14.5%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
3	2.5%	3.0%	3.0%	3.5%	4.5%	6.5%	5.0%	6.5%	7.0%	15.0%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
4	2.5%	3.0%	3.0%	3.5%	5.0%	6.5%	5.0%	6.5%	7.0%	15.0%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
5	2.5%	3.0%	3.0%	3.5%	5.0%	6.5%	5.0%	6.5%	7.0%	15.0%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
6	2.5%	3.0%	3.0%	4.0%	5.0%	6.5%	5.0%	7.0%	7.0%	15.5%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
7	2.5%	3.0%	3.0%	4.0%	5.0%	7.0%	5.0%	7.0%	7.0%	15.5%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
8	2.5%	3.0%	3.0%	4.0%	5.0%	7.0%	5.0%	7.0%	7.0%	16.0%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
9	2.5%	3.0%	3.0%	4.0%	5.0%	7.0%	5.0%	8.0%	7.0%	16.0%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
10	2.5%	3.0%	3.0%	4.0%	5.0%	7.0%	5.0%	8.0%	7.0%	16.5%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
11	3.5%	3.5%	3.0%	4.0%	5.5%	7.0%	5.0%	8.0%	7.0%	16.5%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
12	3.5%	3.5%	3.0%	4.0%	5.5%	7.5%	5.0%	8.0%	7.0%	17.0%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
13	3.5%	3.5%	3.0%	4.0%	5.5%	7.5%	5.0%	8.0%	7.0%	17.0%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
14	3.5%	3.5%	3.0%	4.5%	5.5%	7.5%	7.0%	8.0%	7.0%	17.0%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
15	3.5%	3.5%	3.0%	4.5%	5.5%	7.5%	7.0%	8.0%	7.0%	17.5%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
16	3.5%	3.5%	3.0%	4.5%	5.5%	7.5%	7.0%	8.0%	7.0%	17.5%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
17	3.5%	3.5%	3.0%	4.5%	6.0%	7.5%	7.0%	8.0%	7.0%	18.0%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
18	3.5%	3.5%	3.0%	4.5%	6.0%	7.5%	7.0%	8.0%	7.0%	18.0%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
19	3.5%	3.5%	3.0%	4.5%	6.0%	7.5%	7.0%	8.0%	7.0%	18.5%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
20	4.5%	3.5%	3.0%	4.5%	6.0%	7.5%	7.5%	8.0%	7.0%	18.5%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
21	4.5%	3.5%	3.0%	4.5%	6.0%	7.5%	7.5%	8.0%	15.0%	20.0%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
22	4.5%	3.5%	3.0%	4.5%	6.0%	12.0%	7.5%	8.0%	10.0%	27.5%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
23	4.5%	3.5%	3.0%	5.0%	6.0%	12.0%	7.5%	20.0%	15.0%	28.0%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
24	4.5%	3.5%	3.0%	5.0%	6.5%	12.0%	15.0%	20.0%	15.0%	28.5%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
25	4.5%	5.0%	5.0%	5.0%	10.0%	20.0%	7.0%	20.0%	10.0%	28.5%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
26	4.5%	5.0%	5.0%	10.0%	10.0%	8.0%	8.0%	10.0%	10.0%	29.0%	35.0%	25.0%	25.0%	50.0%	50.0%	100.0%
27	4.5%	5.0%	15.0%	10.0%	7.5%	8.0%	9.5%	10.0%	10.0%	29.5%	45.0%	25.0%	25.0%	50.0%	50.0%	100.0%
28	4.5%	15.0%	15.0%	7.5%	7.5%	8.0%	8.5%	10.0%	10.0%	29.5%	45.0%	25.0%	25.0%	50.0%	50.0%	100.0%
29	5.0%	15.0%	10.0%	7.5%	7.5%	8.0%	9.0%	10.0%	10.0%	30.0%	45.0%	25.0%	25.0%	50.0%	50.0%	100.0%
30	15.0%	10.0%	10.0%	7.5%	7.5%	11.0%	12.0%	10.0%	10.0%	30.0%	45.0%	25.0%	25.0%	50.0%	50.0%	100.0%
31	15.0%	10.0%	10.0%	7.5%	7.5%	11.0%	12.0%	10.0%	10.0%	30.5%	45.0%	25.0%	25.0%	50.0%	50.0%	100.0%
32	15.0%	10.0%	10.0%	7.5%	15.0%	11.0%	12.0%	10.0%	10.0%	31.0%	45.0%	25.0%	25.0%	50.0%	50.0%	100.0%
33	15.0%	10.0%	15.0%	7.5%	15.0%	13.5%	13.0%	15.0%	20.0%	31.0%	45.0%	25.0%	25.0%	50.0%	50.0%	100.0%
34	15.0%	10.0%	15.0%	15.0%	15.0%	16.0%	15.5%	15.0%	20.0%	31.5%	45.0%	25.0%	25.0%	50.0%	50.0%	100.0%
35	30.0%	25.0%	15.0%	20.0%	15.0%	20.0%	22.5%	20.0%	20.0%	32.0%	45.0%	25.0%	25.0%	50.0%	50.0%	100.0%
36	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Rates are set at 100% for ages 70 and over and for service over 35 years.
Green shading indicates the earliest age/service combination at which unreduced retirement is available.

Female Retirement Rates – Active / CPS Members – 2015 Experience Study

	Age															
Service	**55**	**56**	**57**	**58**	**59**	**60**	**61**	**62**	**63**	**64**	**65**	**66**	**67**	**68**	**69**	**70**
0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	10.0%	20.0%	30.0%	50.0%	50.0%	100.0%
1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	10.0%	20.0%	30.0%	50.0%	50.0%	100.0%
2	2.0%	2.0%	3.0%	3.5%	5.5%	7.5%	5.0%	6.5%	6.5%	10.0%	10.0%	20.0%	30.0%	50.0%	50.0%	100.0%
3	2.0%	2.0%	3.0%	3.5%	5.5%	7.5%	5.0%	6.5%	6.5%	15.0%	10.0%	20.0%	30.0%	50.0%	50.0%	100.0%
4	2.0%	2.0%	3.0%	3.5%	5.5%	7.5%	5.0%	6.5%	6.5%	15.0%	10.0%	20.0%	30.0%	50.0%	50.0%	100.0%
5	2.0%	2.0%	3.0%	3.5%	5.5%	7.5%	5.0%	6.5%	6.5%	15.0%	10.0%	20.0%	30.0%	50.0%	50.0%	100.0%
6	2.0%	2.0%	3.0%	3.5%	5.5%	7.5%	5.0%	6.5%	6.5%	15.0%	20.0%	20.0%	30.0%	50.0%	50.0%	100.0%
7	2.0%	2.0%	3.0%	3.5%	5.5%	7.5%	5.0%	6.5%	6.5%	15.0%	20.0%	20.0%	30.0%	50.0%	50.0%	100.0%
8	2.0%	2.0%	3.5%	3.5%	6.0%	7.5%	5.0%	6.5%	6.5%	15.0%	30.0%	20.0%	30.0%	50.0%	50.0%	100.0%
9	3.5%	3.0%	3.5%	3.5%	6.0%	7.5%	5.0%	6.5%	6.5%	15.0%	30.0%	20.0%	30.0%	50.0%	50.0%	100.0%
10	3.5%	3.0%	3.5%	3.5%	6.0%	7.5%	5.0%	6.5%	6.5%	25.0%	30.0%	20.0%	30.0%	50.0%	50.0%	100.0%
11	3.5%	3.0%	3.5%	3.5%	6.0%	7.5%	5.0%	6.5%	6.5%	25.0%	30.0%	20.0%	30.0%	50.0%	50.0%	100.0%
12	3.5%	3.0%	3.5%	3.5%	6.0%	7.5%	5.0%	6.5%	6.5%	25.0%	30.0%	20.0%	30.0%	50.0%	50.0%	100.0%
13	3.5%	3.0%	3.5%	3.5%	6.0%	7.5%	5.0%	6.5%	6.5%	25.0%	30.0%	20.0%	30.0%	50.0%	50.0%	100.0%
14	3.5%	3.0%	3.5%	3.5%	6.5%	7.5%	5.0%	6.5%	6.5%	25.0%	30.0%	20.0%	30.0%	50.0%	50.0%	100.0%
15	3.5%	3.0%	3.5%	3.5%	6.5%	7.5%	5.0%	6.5%	6.5%	25.0%	35.0%	20.0%	30.0%	50.0%	50.0%	100.0%
16	3.5%	3.0%	3.5%	3.5%	6.5%	7.5%	5.0%	6.5%	6.5%	25.0%	35.0%	20.0%	30.0%	50.0%	50.0%	100.0%
17	3.5%	3.0%	4.0%	3.5%	6.5%	7.5%	5.0%	6.5%	6.5%	25.0%	35.0%	20.0%	30.0%	50.0%	50.0%	100.0%
18	3.5%	3.0%	4.0%	3.5%	6.5%	7.5%	6.5%	6.5%	9.5%	25.0%	35.0%	20.0%	30.0%	50.0%	50.0%	100.0%
19	3.5%	3.0%	4.0%	3.5%	7.0%	7.5%	6.5%	6.5%	9.5%	25.0%	35.0%	20.0%	30.0%	50.0%	50.0%	100.0%
20	4.0%	3.0%	4.0%	3.5%	7.0%	7.5%	6.5%	6.5%	9.5%	25.0%	50.0%	20.0%	30.0%	50.0%	50.0%	100.0%
21	4.0%	3.0%	4.0%	3.5%	7.0%	7.5%	6.5%	6.5%	15.0%	25.0%	50.0%	20.0%	30.0%	50.0%	50.0%	100.0%
22	4.0%	3.0%	4.0%	3.5%	7.0%	7.5%	6.5%	12.5%	15.0%	27.5%	50.0%	20.0%	30.0%	50.0%	50.0%	100.0%
23	4.0%	3.0%	4.0%	3.5%	7.0%	11.0%	17.5%	17.5%	12.5%	27.5%	50.0%	20.0%	30.0%	50.0%	50.0%	100.0%
24	5.0%	3.0%	4.0%	5.0%	7.0%	20.0%	17.5%	12.5%	10.0%	27.5%	50.0%	20.0%	30.0%	50.0%	50.0%	100.0%
25	5.0%	3.0%	4.0%	7.5%	12.5%	20.0%	12.5%	12.5%	10.0%	27.5%	50.0%	20.0%	30.0%	50.0%	50.0%	100.0%
26	5.0%	3.0%	4.0%	12.5%	12.5%	11.0%	12.5%	12.5%	10.0%	27.5%	50.0%	20.0%	30.0%	50.0%	50.0%	100.0%
27	5.0%	3.0%	12.5%	12.5%	10.0%	10.5%	12.5%	12.5%	10.0%	27.5%	50.0%	20.0%	30.0%	50.0%	50.0%	100.0%
28	5.0%	12.5%	12.5%	10.0%	10.0%	13.5%	10.0%	10.0%	7.5%	27.5%	50.0%	20.0%	30.0%	50.0%	50.0%	100.0%
29	10.0%	12.5%	10.0%	10.0%	10.0%	13.5%	10.0%	10.0%	7.5%	27.5%	50.0%	20.0%	30.0%	50.0%	50.0%	100.0%
30	15.0%	10.0%	10.0%	10.0%	10.0%	14.5%	10.0%	10.0%	7.5%	27.5%	50.0%	20.0%	30.0%	50.0%	50.0%	100.0%
31	14.0%	10.0%	10.0%	10.0%	12.5%	16.0%	10.0%	10.0%	7.5%	27.5%	50.0%	20.0%	30.0%	50.0%	50.0%	100.0%
32	13.0%	10.0%	10.0%	10.0%	12.5%	14.5%	10.0%	10.0%	10.0%	27.5%	50.0%	20.0%	30.0%	50.0%	50.0%	100.0%
33	12.5%	10.0%	10.0%	10.0%	12.5%	13.5%	10.0%	15.0%	15.0%	27.5%	50.0%	20.0%	30.0%	50.0%	50.0%	100.0%
34	9.5%	10.0%	10.0%	10.0%	10.0%	11.0%	10.0%	15.0%	12.5%	27.5%	50.0%	20.0%	30.0%	50.0%	50.0%	100.0%
35	18.5%	15.0%	10.0%	19.5%	19.5%	20.5%	10.0%	20.0%	12.5%	27.5%	50.0%	20.0%	30.0%	50.0%	50.0%	100.0%
36	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Rates are set at 100% for ages 70 and over and for service over 35 years.
Green shading indicates the earliest age/service combination at which unreduced retirement is available.

Termination

The termination rates used in the valuation are shown in the following tables. These rates are based on the results of a study performed in 2015 on the Plan's termination experience and are considered best estimate. These termination rates were also used in the previous valuation.

Male Termination Rates – 2015 Experience Study

Age	Less than 1 year	At least 1 but not 2	At least 2 but not 3	At least 3 but not 4	At least 4 but not 5	At least 5 years
<21	27%	26%	20%	12%	10%	9%
21	27%	26%	20%	12%	10%	9%
22	27%	25%	20%	12%	10%	9%
23	27%	20%	17%	12%	10%	9%
24	27%	20%	17%	12%	10%	9%
25	25%	20%	17%	12%	9%	8%
26	24%	20%	17%	12%	9%	8%
27	23%	20%	17%	12%	9%	8%
28	22%	18%	17%	12%	9%	8%
29	21%	18%	13%	12%	9%	8%
30	18%	16%	13%	11%	9%	7%
31	18%	16%	13%	11%	9%	7%
32	18%	16%	13%	11%	9%	7%
33	18%	16%	13%	11%	9%	7%
34	18%	16%	13%	11%	9%	7%
35	16%	13%	10%	11%	9%	5%
36	16%	13%	10%	9%	9%	5%
37	16%	13%	10%	9%	9%	5%
38	16%	13%	10%	9%	9%	5%
39	16%	13%	10%	9%	9%	5%
40	16%	12%	8%	9%	7%	4%
41	16%	12%	8%	9%	7%	4%
42	16%	12%	8%	9%	7%	4%
43	16%	12%	8%	9%	7%	4%
44	16%	12%	8%	7%	7%	4%
45	11%	12%	7%	7%	6%	3%
46	11%	12%	7%	7%	6%	3%
47	11%	12%	7%	7%	6%	3%
48	11%	12%	7%	7%	6%	3%
49	11%	12%	7%	7%	6%	3%
50	11%	11%	7%	6%	5%	3%
51	11%	11%	7%	6%	5%	3%
52	11%	11%	7%	6%	5%	3%
53	11%	11%	7%	6%	5%	3%
54	11%	11%	7%	6%	5%	3%

Female Termination Rates – 2015 Experience Study

Age	Less than 1 year	At least 1 but not 2	At least 2 but not 3	At least 3 but not 4	At least 4 but not 5	At least 5 years
<21	25%	23%	17%	14%	11%	10%
21	25%	23%	17%	14%	11%	10%
22	25%	22%	17%	14%	11%	10%
23	25%	21%	16%	14%	11%	10%
24	25%	20%	15%	13%	11%	10%
25	24%	20%	15%	13%	11%	9%
26	23%	20%	15%	13%	11%	9%
27	22%	20%	15%	13%	11%	9%
28	21%	19%	15%	13%	11%	9%
29	20%	18%	15%	13%	11%	9%
30	20%	17%	14%	11%	11%	8%
31	20%	16%	14%	11%	11%	8%
32	20%	15%	14%	11%	11%	8%
33	20%	15%	14%	11%	11%	8%
34	18%	15%	14%	11%	11%	8%
35	18%	15%	13%	11%	9%	7%
36	18%	15%	13%	11%	9%	7%
37	18%	15%	13%	11%	9%	7%
38	18%	15%	13%	11%	9%	6%
39	18%	15%	13%	11%	9%	6%
40	18%	14%	10%	10%	8%	5%
41	18%	14%	10%	10%	8%	5%
42	18%	14%	10%	10%	8%	5%
43	18%	14%	10%	10%	8%	4%
44	18%	14%	10%	10%	8%	4%
45	18%	14%	10%	10%	8%	4%
46	18%	14%	10%	10%	8%	4%
47	18%	14%	10%	10%	8%	4%
48	18%	14%	10%	7%	8%	4%
49	18%	14%	10%	7%	8%	4%
50	18%	12%	8%	7%	8%	4%
51	18%	12%	8%	7%	8%	4%
52	18%	12%	8%	7%	8%	4%
53	18%	12%	8%	7%	8%	4%
54	18%	12%	8%	7%	8%	4%

Transfer to MEPP/UAPP under CPS provision

We have assumed that 370 active members will transfer to MEPP/UAPP under the CPS provision each year. This assumption was developed based on an analysis of CPS member data for transfers that occurred from 2008 to 2016. This assumption was unchanged from the previous valuation.

Disability

We have made no allowance for the occurrence of disability before retirement. To the extent that members do become disabled before retirement, there may be an experience gain or loss.

Proportion of vested terminated members electing a lump sum payment versus a deferred annuity

Given the additional cost to the Plan at the present time of a member electing a lump sum transfer, an assumption regarding the proportion of members electing a lump sum transfer in lieu of the deferred pension has been made. The proportion of future terminations electing a lump sum settlement is assumed to be in accordance with the following rates and is based on an experience study performed in 2015. This table was used in the previous valuation.

Years of Service at Termination	Proportion Assumed to Elect a Lump Sum Settlement
Less than 5	80%
Between 5 and 15	50%
Between 15 and 20	60%
Between 20 and 25	70%
More than 25	75%

Proportion of members with spouses and spousal age difference

Under the Plan terms, the value of pre-retirement death benefits depends on the existence and age of a surviving spouse. It has again been assumed that 100% of members are married to a spouse of the opposite gender, with the male spouse being 3 years older than the female spouse.

Future Plan membership for funding the unfunded liability

The Plan's unfunded liabilities are amortized in accordance with established amortization schedules as a level percentage of contributory payroll. For purposes of determining the applicable contribution rates, it has again been assumed that future new entrants will keep the active Plan membership stable following the valuation date, and that the total pensionable earnings of these active members will increase at the assumed rate of general wage increases for Plan members.

If the Plan salary base were to grow more rapidly than assumed, existing unfunded liabilities might be eliminated sooner than assumed. Conversely, if the Plan salary base were to grow less rapidly than assumed, contribution increases may be required in order to eliminate existing unfunded liabilities within the required timeframe.

Expenses

Expenses relating to investment management fees and certain administration and consulting fees incurred in relation to the Plan are paid from the Plan's assets. Consequently, it is appropriate that an assumption regarding such expenses be made.

Investment expenses expected to be paid from the fund in the future are taken into account in the long-term rate of return assumption. Administration and custodial expenses charged to the fund have been in the range of 0.4% to 0.5% of pensionable earnings over the past few years. A best estimate allowance for non-investment expenses of 0.5% of pensionable earnings has been included in the normal actuarial contribution rate. This expense assumption is unchanged from the previous valuation.

E.2 Actuarial Assumptions - Solvency Valuation

The following table provides the assumptions used in the solvency valuation. Further, the termination scenario used in the solvency and hypothetical wind-up valuations includes the following assumptions:

- Plan wind-up would not result from all participating employers' insolvencies.
- All assets could be realized at their reported market values.

The EPPA requires that a plan's solvency valuation liabilities be determined with the presumption that:

- the plan is terminated and wound up on the valuation date, and
- the plan's liabilities are settled immediately.

The following summarizes the prescribed assumptions, methods and benefits that make up the solvency basis for the Plan at the valuation date. Judgement must be exercised in setting certain assumptions, especially as related to determining:

- the proportion of the Plan's benefits expected to be settled by way of annuity purchase and by way of lump sum transfer; and
- the hypothetical annuity purchase rates at the valuation date.

Consequently, if the Plan was terminated and settled on the valuation date, these solvency liabilities may be different than the Plan's actual termination liabilities. Such differences may be attributed to:

- differences between the actual and assumed proportion of benefits being settled by annuity purchase and lump sum transfer; and
- an actual annuity purchase rate that is different than the rates assumed to be representative of the annuity market on the valuation date.

Solvency Assumptions	December 31, 2016	December 31, 2017
Discount Rates		
Lump sum transfers	1.5% for 10 years and 2.2% thereafter	1.9% for 10 years and 2.3% thereafter
Annuity Purchases	1.2%	1.1%
Mortality	2014 Canadian Pensioner Mortality Combined Table with fully generational projection using Scale CPM-B	Same
Retirement	• Members who are entitled to retire from the Plan and commence an immediate pension on the valuation date are assumed to do so; • All other members are assumed to retire at age 55	Same
Termination	All members assumed to terminate and subsequently retire from the Plan in accordance with the retirement age assumption summarized above.	Same
Wind-up expenses	$25,000,000	$26,000,000

Settlement Upon Plan Wind-up

It is assumed that all active and terminated members over age 55 will choose an immediate annuity, reduced accordingly for early retirement, and the remaining active and inactive members will choose a lump sum equal to the commuted value of a pension commencing at age 55 (with appropriate early retirement reductions). Those members that are currently in receipt of an immediate pension are assumed to have an immediate annuity purchased on their behalf.

Discount Rates and Mortality

The assumptions used to value the members' benefits settled by a lump sum transfer are in accordance with the Plan provisions at the valuation date, the applicable legislation as well as the Canadian Institute of Actuaries' standards of practice for pension commuted values.

The assumptions used to value the benefits of members and beneficiaries settled by the purchase of annuities with an insurance company are in accordance with the Canadian Institute of Actuaries in their *Guidance on Assumptions for Hypothetical Wind-up and Solvency Valuations with effective dates between December 31, 2017 and December 30, 2018*.

No Margin for Adverse Deviation

As specified by the Standards of Practice of the Canadian Institute of Actuaries, the solvency assumptions do not include a margin for adverse deviations.

Expenses

Allowance has been made for administrative, actuarial and legal costs which would be incurred if the Plan were to be wound up. It is assumed that the wind-up date, the calculation date and the settlement date are coincident. Expenses related to the resolution of any surplus and deficit issues have not been taken into account. The amount of expenses is only an approximation and may differ significantly from real expenses incurred on Plan wind-up.