



Actuarial Report on the Government Annuities

As at 31 March 2021
Office of the Chief Actuary



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I. Executive Summary

A. Purpose of Report

In accordance with section 15 of the *Government Annuities Improvement Act* (“the Improvement Act”) an actuarial valuation was conducted as at 31 March 2021 for purposes of determining the actuarial liabilities and financial position of the Government Annuities Account (“the Account”). Section 15 of the Improvement Act also states that any surplus or deficit emerging as a result of the actuarial valuation shall be reported and, in the case of a surplus, credited to the Federal Government’s Consolidated Revenue Fund (CRF) and charged to the Account or, in the case of a deficit, charged to the Federal Government’s CRF and credited to the Account.

B. Data, Method and Assumptions

Data on current retirees, beneficiaries, deferred members, premiums and benefit payments were provided by Employment and Social Development Canada (ESDC) and Service Canada. The data are gathered through the electronic reports from the Government Annuities Secured Website. The Government Annuities Branch located in Bathurst administers the annuities as well as the corresponding website. The data are from a reliable source. We have performed summary tests on the data, and have found that they are accurate, reliable and sufficient for the purposes of the valuation. A description of contract types and a summary of the data are shown in Appendix 1 and Appendix 2 of this report. The actuarial liabilities are the present value of expected future benefits, determined in accordance with accepted actuarial practice and statutory valuation assumptions. Subsection 3(4) of the *Government Annuities Regulations* (“the Regulations”) states that the actuarial liability is to be determined using an interest rate of 7% per annum and the mortality rates of the Annuity Table for 1983, as modified by Projection Scale G.

C. Results

The following table summarizes the results of the actuarial valuation as at 31 March 2021.

Table 1 Results Overview

	As at 31 March 2021	
Assets		\$ 76,637,877
Liabilities		<u>\$ 75,755,079</u>
Surplus (Deficit)		\$ 882,798
	Count	Average Annual Pension
Vested Members	19,476	\$ 688
Deferred Members	73	\$ 1,646
Total	<u>19,549</u>	<u>\$ 691</u>

D. Conclusion

The surplus of \$882,798 is credited to the Federal Government's CRF and charged to the Account. The next valuation will be performed as at 31 March 2022.

II. Introduction

The Canadian *Government Annuities Act* of 1908 was one of the earliest significant pieces of social legislation in Canada. Its purpose was to encourage Canadians to prepare financially for their retirement. Government Annuities were purchased either by individuals or by employers as pension plans for their employees.

By the 1960's, other social benefit plans, such as Old Age Security (OAS) and the Canada Pension Plan were introduced and began gaining importance in providing Canadians with basic retirement income. The government's recognition that retired Canadians could now be served by other social security programs as well as the private sector brought about the decision to disband the Annuities sales force. In 1975, an Act of Parliament formally ended the sale of Government Annuities. Employers, however, could register new employees under group contracts until 1979. The Government Annuities are not sponsored by the Government – meaning the Government has no fiduciary liability. Its responsibilities are limited to provide and secure benefits in accordance with each contract's provisions.

The Annuities Branch continues to administer contracts under payment and those due to become payable, on behalf of clients from across Canada and around the world. The Account is not subject to any federal or provincial pension legislation; it is only subject to the *Government Annuities Act*, the Improvement Act and the Regulations. The assets and liabilities are shown in the Public Accounts of Canada. The assets are notional and are not subject to any investment policy or performance goals and objectives.

The Office of the Chief Actuary (OCA), Office of the Superintendent of Financial Institutions Canada (OSFI), has the mandate of performing the annual actuarial valuation of the Account as of 31 March 2021. The purpose of the valuation is to establish the Account's liabilities, notional assets, and financial position, based on the statutory valuation assumptions.

III. Data

A. Data Required

Since the actuarial valuation determines both the assets and the liabilities, full details on the members as well as on the cash flows that occurred within the year are needed.

B. Member Data

Basic data on pensioners, beneficiaries and deferred members are provided by ESDC and Service Canada. The data are retrieved from the Government Annuities Secure Website maintained by the Annuities Branch in Bathurst. The site enables the production of reports which show the member data required to establish the liabilities: certificate number, maturity date, member, spouse and beneficiaries' gender and dates of birth, annual pension amounts, and form of pension.

The required data reports are VY4741 for vested members (pensioners) and GY5642 for deferred members (members with deferred rights).

Notes on VY4741 Vested Data

Additional pension amounts data are required from Service Canada concerning the continuing pensions for joint and survivor contracts with percentages other than 50% or 100%, as well as for reducing annuities. VY4741 data does not show the accurate continuing pension amounts for annuities of type 29, 37, and 70-79.

Moreover, manual additions must be done, as the VY4741 report excludes certain members due to internal validation controls at Bathurst. The data related to this limited number of members were extracted from the VY5141 report. There were 31 such members as at 31 March 2021.

Notes on GY5642 Deferred Data

Pursuant to the Improvement Act which granted annual accrual of contributions accounts at 7% from 1 April 1975, the following table shows the multipliers that must be applied to the annual original pension amounts.

Table 2 Multipliers for Deferred Pension Amounts

Premium Series	Original Interest Rate	Multiplier
4	4.0%	1.22
5	3.0%	1.32
6	3.5%	1.29
7	4.0%	1.22
8	5.0%	1.14

These multipliers reflect the increase between the original interest rate applicable on the contracts and 7%. As the deferred members data only show the pension amounts prior to the enhancements, these multipliers are used to update the annual pensions.

It can be seen that the methodology used to derive these multipliers granted higher increases to contracts with lower interest rates, and vice-versa. The objective sought at the time was to distribute the increases as equitably as possible.

A reconciliation of pension amounts and membership status with last year's membership has been performed. A detailed summary of membership data is shown in the Appendix 2 of this report.

C. Asset Data

Income consists of premiums received, funds reclaimed from the CRF for previously untraceable annuitants, notional earned interest and any transfer needed to cover the actuarial deficit. Payments and other charges represent matured annuities, commuted value of death benefits, premium refunds and withdrawals, and transfers to the CRF of actuarial surpluses and unclaimed annuities related to untraceable annuitants.

All reports used to determine the value of assets are provided by ESDC.

A list showing the names and short descriptions of the required reports is given in Appendix 3 of this report.

The data used are considered to be sufficient and reliable for the purposes of the actuarial valuation.

IV. Methods and Assumptions

A. Liability Valuation Method

The actuarial liabilities are associated with two groups of members: vested and deferred. The vested group consists of the participants for whom the pensions are in payment as at 31 March 2021. The deferred group consists of members for whom payment of pensions will start in the future. The liabilities are the actuarial present value of future pension payments, the result of discounting the future expected benefits with interest and post-retirement mortality.

B. Assumptions

The interest and post-retirement mortality assumptions are statutory, as stated in section 15 of the Improvement Act and subsection 3(4) of the Regulations. Namely, the liabilities must be based on a rate of interest of 7% per annum and on the mortality rates of the Annuity Table for 1983, as modified by Projection Scale G, published in Transactions of the Society of Actuaries, Vol. XXXV (1983), at pages 882 and 883.

Accordingly, the 1983 individual annuity mortality table (IAM83) is used for individual contracts and the 1983 group annuity mortality table (GAM83) is used for group contracts. Both tables are sex-distinct, and are projected for 15 years with Projection Scale G. Furthermore, for consistency with the methodology used to develop these mortality tables, the liabilities were calculated based on the annuitants' attained age (age last) at the valuation date.

Extracts from these mortality tables as well as associated life expectancies can be found in Appendix 4 of this report.

C. Asset Valuation Method

Since section 14 of the *Government Annuities Act* states that the monies received or paid under this act form part of the CRF, the assets are notional. Each year, any difference with the liabilities calculated is either credited (in the case of a surplus) or charged (in the case of a deficit) to the CRF, with a corresponding charge or credit to the Account. Following these adjustments, the assets value as at 1 April 2020 is equal to the 31 March 2020 liabilities. The assets value as at 31 March 2021 prior to any charge or credit to the CRF is obtained by adding interest at 7% on the 1 April 2020 value and adjusting for cash inflows and outflows also at 7% annual interest rate.

V. Results

A. Balance Sheet

The following table presents a summary of the balance sheet of the Account for the 2021 and 2020 fiscal years.

Table 3 Balance Sheet

Fiscal Year	2020 – 2021	2019 – 2020
Assets as at 1 April	\$ 85,407,162	\$ 96,301,548
<u>INCOME</u>		
Interest to 31 March	\$ 5,438,538	\$ 6,141,971
Premiums for Deferred Annuities	72	72
Unclaimed annuities recovered from CRF	<u>7,226</u>	<u>32,306</u>
TOTAL	5,445,836	6,174,349
<u>PAYMENTS AND OTHER CHARGES</u>		
Payments to Vested Members:		
Vested Regular Annuity Payments	\$ 14,057,002 ¹	\$ 15,715,870 ²
Vested Commuted Values	<u>80,058</u>	<u>33,096</u>
Total Payments to Vested Members:	14,137,060	15,748,966
Monies Refunded	2,271	7,895
Values Transferred to CRF (Vested & Deferred)	<u>75,789</u>	<u>84,023</u>
TOTAL	14,215,120	15,840,884
INCOME LESS PAYMENTS AND OTHER CHARGES	\$ (8,769,284)	\$ (9,666,535)
Assets as at 31 March	\$ 76,637,877	\$ 86,635,013
Surplus charged to the Account and credited to the CRF	\$ (882,798)	\$ (1,227,852)
Net Assets as at 31 March	\$ 75,755,079	\$ 85,407,162
Actuarial Liabilities as at 31 March	\$ 75,755,079	\$ 85,407,162

¹ Includes annuity and retroactive payments totalling \$10,619 for members recovered from the CRF in 2020-2021.

² Includes annuity and retroactive payments totalling \$40,088 for members recovered from the CRF in 2019-2020. Additionally, \$10,136 of the \$40,088 is an overpayment that was made to a participant who was not recovered or transferred to the account receivable as at 31 March 2020.

B. Calculation of Interest

The following table outlines the calculation of the notional 7% annual interest credited to the Account for the 2021 and 2020 fiscal years.

Table 4 Calculation of Interest

Fiscal Year	2020 – 2021	2019 – 2020
<u>VESTED MEMBERS</u>		
Interest on :		
Prescribed Assets as at 1 April of prior year	\$ 5,875,819	\$ 6,594,020
Maturities	26,031	64,969
CRF Recoveries	408	1,302
Less interest on :		
Annuity Payments	(537,225)	(598,832)
Commuted Values	(2,938)	(639)
Transfers to CRF	0	0
TOTAL VESTED	5,362,095	6,060,820
<u>DEFERRED MEMBERS</u>		
Interest on :		
Prescribed Assets as at 1 April of prior year	102,682	147,089
Premiums	1	1
CRF Recoveries	4	18
Less interest on :		
Maturities	(26,031)	(64,969)
Refunds	(201)	(660)
Transfers to CRF	(12)	(328)
TOTAL DEFERRED	76,443	81,151
TOTAL INTEREST	\$ 5,438,538	\$ 6,141,971

C. Development of Actuarial Liabilities

The following table outlines the Account’s actuarial liabilities by members’ category as at 31 March of 2021 and 2020.

Table 5 Development of Actuarial Liabilities

Fiscal Year	Contract Type	2020 – 2021	2019 – 2020
<u>VESTED MEMBERS</u>			
Males, Ordinary Life	10 – 16	\$ 36,289,397	\$ 41,336,309
Females, Ordinary Life	10 – 16	20,173,534	21,911,561
Males, Guaranteed	21 – 29	8,875,497	9,948,624
Females, Guaranteed	21 – 29	4,662,576	5,126,150
Last Survivor	30 – 37	3,789,856	4,662,986
Reducing at OAS	70 – 79	605,067	729,029
Annuities Certain	50, 80	177,639	208,146
Temporary Annuities	60	4,889	4,160
Suspended Payments		20,310	13,309
VESTED TOTAL		74,598,766	83,940,273
<u>DEFERRED MEMBERS</u>			
Ordinary Life	10	44,514	41,602
Males, Guaranteed	21 - 24	642,737	887,815
Females, Guaranteed	21 - 24	412,659	484,366
Refunds in Process		1,520	1,814
Suspense Accounts	Account 721	54,884	51,293
DEFERRED TOTAL		1,156,313	1,466,889
TOTAL ACTUARIAL LIABILITIES		\$ 75,755,079	\$ 85,407,162

VI. Experience

A. Analysis of Experience

As there are no new contracts purchased under the *Government Annuities Act*, the main source of experience gains or losses is the mortality. It includes changes in expected future payments due to the death or survival of annuitants and the difference between actual and expected benefit payments during the year.

The table below presents a reconciliation of the surplus between 31 March 2020 and 31 March 2021.

Table 6 Gains (Losses)

Surplus as at 31 March 2020	-
Premiums paid with interest	\$ 73
Vested members mortality	860,210
Deferred members - retirements, mortality, refunds	43,507
Transfers from CRF and other data changes	(20,992)
Surplus as at 31 March 2021	\$ 882,798

B. Alternative Assumptions for Purposes of the Account's Financial Statements

Mortality

Following an external audit of the Account as at 31 March 2014, ESDC management asked the OCA to conduct a mortality experience study and to include the amount of the actuarial liabilities under experience-adjusted mortality rates in future Actuarial Reports on the Government Annuities.

Discount Rate

To promote greater comparability with other public service pension plans that are part of the Public Account of Canada, the liabilities shown in the Account's financial statements is measured using a different discount rate than the prescribed interest rate of 7%. The alternative rate is established based on a yield curve approach. This yield curve is determined by reference to market yields at the end of the reporting period on Government of Canada Bonds and treasury bills.

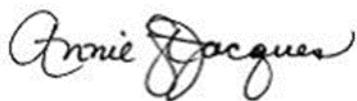
The OCA has determined that the liabilities as at 31 March 2021 under experience-adjusted mortality rates and the alternative discount rate is \$97.8 million, which is \$22.0 million higher than under the prescribed assumptions. More details are presented in Appendix 5.

VII. Actuarial Opinion

In our opinion, considering that this report was prepared pursuant to the *Government Annuities Act* and the *Government Annuities Improvement Act*:

- the data on which this report is based are sufficient and reliable for the purposes of this report;
- the assumptions used comply with legislative requirements;
- the methods employed are appropriate for the purposes of this report; and
- as at 31 March 2021, there is a surplus of \$882,798 which is credited to the Federal Government's Consolidated Revenue Fund and charged to the Government Annuities Account.

This report has been prepared, and our opinion given, in accordance with accepted actuarial practice in Canada. As of the date of the signing of this report, we have not learned of any events that would have a material impact on the results presented in this report as at 31 March 2021.



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Ottawa, Canada
30 August 2021

Appendix 1 – Contract Types

The following describes the annuities provisions as specified by the contracts:

Ordinary Life: At maturity, this annuity is payable for as long as the annuitant lives, but at death the annuity ceases immediately and there are no death benefits.

Guaranteed: The annuity under this contract is payable for life but it is guaranteed for a minimum period of 5, 10, 15 or 20 years.

Contingent Survivor: This annuity is based on two lives. The annuity is payable to the principal annuitant for as long as he or she lives. At death, the annuity is payable to the survivor until his or her death.

Joint and Last Survivor: This contract differs from the Contingent Survivor contract in that the annuity instalments are payable to both parties. After the death of one partner, the annuity is made payable to the survivor as long as he or she lives.

Reducing Option: The Reducing Option is an arrangement whereby the level of the annuity purchased is paid at an increased amount from age 50 (or later) to age 65. At age 65, the annuity decreases by the amount of Old Age Security in effect at the date of maturity. The annuity is payable for life, with death benefits available for the duration of the guaranteed period, if there is one.

The following describes the contract types:

Single Life - No Guarantee (10 – 16)

10. Ordinary
11. Guarantee expired: on valuation change of 21 – 24
12. From last or contingent survivor: 30, 35, 36, 37
13. From last survivor guarantee expired: on first death of 31
14. From reducing ordinary: on reduction of 70
15. From reducing guaranteed: on reduction of 79, on valuation change of 29 or from 71-74 where reduction and end of guarantee coincide
16. From reducing survivor: 36, 37

Single Life with Guarantee (21 – 29)

21. Guaranteed 5 years
22. Guaranteed 10 years
23. Guaranteed 15 years
24. Guaranteed 20 years
29. From 71-74 after reduction still within guarantee

Joint Lives No Guarantee (30 – 37)

- 30. Ordinary Last Survivor (100%)
- 31. Last Survivor guarantee expired (100%)
- 35. Contingent Survivor (100%)
- 36. Contingent Survivor reducing by one half at death of Principal Annuitant (50%)
- 37. Contingent Survivor reducing by any other amount at death of Principal Annuitant

Annuities Certain (50 & 80)

- 50. Certain level amount (Includes from 80 after reduction)
- 80. Certain, reducing

Temporary Annuities (60)

- 60. Temporary

Reducing Annuities (70- 79)

- 70. Ordinary, reducing
- 71. Guaranteed 5 years, reducing
- 72. Guaranteed 10 years, reducing
- 73. Guaranteed 15 years, reducing
- 74. Guaranteed 20 years, reducing
- 79. From 71-74, guarantee expired before reduction

Appendix 2 – Membership Data

A. Vested members

Table 7 Membership Data - Contract Types 10-16: Vested Ordinary Life

AGE		MALES	FEMALES	TOTAL
50-59	Average Pension	505	850	720
	Number	3	5	8
	Average Age	58.7	58.0	58.3
60-69	Average Pension	979	877	919
	Number	69	98	167
	Average Age	65.8	66.4	66.1
70-79	Average Pension	811	708	764
	Number	963	804	1,767
	Average Age	76.3	75.6	76.0
80-89	Average Pension	642	551	615
	Number	6,155	2,591	8,746
	Average Age	85.2	85.1	85.1
90-100	Average Pension	708	554	649
	Number	4,041	2,496	6,537
	Average Age	93.0	93.7	93.3
100 +	Average Pension	700	474	559
	Number	70	116	186
	Average Age	101.9	102.7	102.4
Total Average Pension		682	577	645
Total Number		11,301	6,110	17,411
Total Average Age		87.2	87.4	87.2

Table 8 Membership Data - Contract Types 21-29: Vested Guaranteed

AGE		MALES	FEMALES	TOTAL
50-69	Average Pension	2,093	1,913	2,020
	Number	168	114	282
	Average Age	66.5	66.0	66.3
	Average guarantee	9.4	8.7	9.1
70-79	Average Pension	1,361	1,131	1,290
	Number	445	198	643
	Average Age	74.7	74.0	74.5
	Average guarantee	4.7	4.8	4.7
80-89	Average Pension	888	883	886
	Number	31	12	43
	Average Age	81.7	80.8	81.5
	Average guarantee	1.7	2.9	2.1
Total Average Pension		1,529	1,397	1,485
Total Number		644	324	968
Average Age		72.9	71.5	72.4
Average guarantee		5.8	6.1	5.9

Table 9 Membership Data - Contract Types 30-37: Vested Joint & Survivor

	MALES	FEMALES	TOTAL
Total Average Pension	564	322	559
Total Number	1,008	22	1,030
Average Age	85.9	84.2	85.9
Average Spouse Age	82.7	83.3	82.7
Average Continuing Percentage	74%	70%	74%

Table 10 Membership Data - Contract Types 50 & 80: Vested Certain

Average Pension	1,177
Number	43
Average Certain Period	4.40

Table 11 Membership Data - Contract Type 60: Vested Temporary

	TOTAL
Average Pension	829
Number	2
Average Age	61.5
Average Period	3.5

Table 12 Membership Data - Contract Types 70-79: Vested Reducing

	MALES	FEMALES	TOTAL
Average Pension	3,873	4,497	4,185
Number	11	11	22
Average Reduced Pension	2,007	1,882	1,944
Average Age	62.5	62.3	62.4

B. Deferred Members

Table 13 Membership Data - Contract Types 10: Deferred Ordinary Life

	TOTAL
Average Pension	3,202
Number	2
Average Age	66.0

Table 14 Membership Data - Contract Types 21-24: Deferred Guaranteed

	MALES	FEMALES	TOTAL
Average Pension	1,768	1,362	1,602
Number	42	29	71
Average Age	62.1	61.1	61.7
Average Guarantee	15.0	15.0	15.0

C. Membership Reconciliation

Table 15 Membership Reconciliation

VESTED							
Contract Types	10-16	21-29	30-37	50&80	60	70-79	Total
Count as at 31 March 2020	19,530	1,116	1,217	53	4	29	21,949
Maturities	0	25	0	0	1	0	26
Transfers from/to Other Contract Types	330	(155)	(174)	6	0	(7)	0
Deaths or Expired Annuities ¹	(2,443)	(16)	(12)	(16)	(3)	0	(2,490)
Net CRF Transfers ²	(6)	(2)	(1)	0	0	0	(9)
Count as at 31 March 2021	17,411	968	1,030	43	2	22	19,476
DEFERRED							
Count as at 31 March 2020							101
Maturities							(26)
Deaths and Refunds							(1)
Net CRF Transfers							(1)
Count as at 31 March 2021							73

¹ The 2,490 Deaths or Expired Annuities are composed of 1,705 group certificates and 785 individual contracts.

² The 9 net CRF transfers are 4 group contracts and 5 individual contracts.

Appendix 3 – Sources of Data

Reports Required

The following are the reports used in order to perform the Government Annuities Account valuation. The main reports are provided by ESDC and Service Canada.

Membership Data

VY4741P1: Basic Vested Data

VY5141: Vested Annuitants to be added manually (Records to be completed using report VY4742P1)

GY5642: Basic Deferred Data

Service Canada also provides us with accurate pension amounts for plans 16, 37, 70-79, and 29, and additional data for plans 50 and 80. This data consists of pension amounts, reduced pension amounts where applicable, date of reduction and date of final payment. Even though the total actuarial liability is taken directly from VY5141 for plans 50 and 80, it must be individually calculated for purposes of gains and losses analysis.

Asset Data

VM3942: Vested benefit payments and maturities by period

GY5646, GM4741, and GM4742: Data related to refunds

Premiums paid are provided by the Annuity Accounting Division of ESDC.

Benefit payments are provided by the Annuity Accounting Division of ESDC.

The monthly VM3942 reports are extracted to reconcile the Annuity Accounting Division's benefit payments. Ultimately, the Annuity Accounting Division's figures are used for balance sheet purposes. The monthly GM4741 and GM4742 reports must be extracted for group and individual contracts.

Other Data

ESDC also provides balances for suspense accounts (GY5644 and GR3442), refunds in progress (GY5941) and suspended payments (VY5443).

Appendix 4 – Mortality Tables

Projection of Mortality

The mortality assumption is statutory, as stated in section 15 of the Improvement Act and subsection 3(4) of the Regulations. Mortality rates are to follow the Annuity Table for 1983, as modified by Projection Scale G published in Transactions of the Society of Actuaries, Vol. XXXV (1983), at pages 882 and 883. SOR/97-495, s. 2.

Accordingly, the IAM83 table is used for individual contracts and the GAM83 table is used for group contracts. Both tables are used on sex-distinct basis and are projected for 15 years with Projection Scale G. Furthermore, for consistency with the methodology used to develop these mortality tables, the liabilities were calculated based on the annuitants’ attained age (age last) at the valuation date.

The following table shows the mortality rates as well as Projection scale G for selected attained ages.

Table 16 Mortality Rates

AGE	GAM83 ORIGINAL		IAM83 ORIGINAL		PROJECTION SCALE G		GAM83 PROJECTED		IAM83 PROJECTED	
	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES
10	0.000293	0.000096	0.000382	0.000141	0.007500	0.012000	0.000262	0.000080	0.000341	0.000118
15	0.000325	0.000140	0.000435	0.000188	0.002200	0.007000	0.000314	0.000126	0.000421	0.000169
20	0.000377	0.000189	0.000505	0.000260	0.001400	0.005000	0.000369	0.000175	0.000494	0.000241
25	0.000464	0.000253	0.000622	0.000349	0.001000	0.006500	0.000457	0.000229	0.000613	0.000316
30	0.000607	0.000342	0.000759	0.000441	0.004900	0.010500	0.000564	0.000292	0.000705	0.000376
35	0.000860	0.000476	0.000917	0.000545	0.015000	0.018500	0.000686	0.000360	0.000731	0.000412
40	0.001238	0.000665	0.001341	0.000742	0.020000	0.022500	0.000914	0.000473	0.000990	0.000527
45	0.002183	0.001010	0.002399	0.001122	0.018500	0.021000	0.001650	0.000735	0.001813	0.000816
50	0.003909	0.001647	0.004057	0.001830	0.017500	0.020000	0.003000	0.001216	0.003113	0.001352
55	0.006131	0.002541	0.005994	0.002891	0.016000	0.018500	0.004813	0.001920	0.004706	0.002185
60	0.009158	0.004241	0.008338	0.004467	0.015000	0.017500	0.007300	0.003254	0.006647	0.003428
65	0.015592	0.007064	0.012851	0.007336	0.015000	0.017500	0.012429	0.005420	0.010244	0.005629
70	0.027530	0.012385	0.021371	0.011697	0.013500	0.017500	0.022452	0.009504	0.017429	0.008976
75	0.044597	0.023992	0.035046	0.020127	0.012500	0.016000	0.036929	0.018836	0.029020	0.015802
80	0.074070	0.042945	0.057026	0.036395	0.012500	0.015000	0.061334	0.034234	0.047220	0.029013
85	0.114836	0.069918	0.090987	0.065518	0.012500	0.015000	0.095090	0.055736	0.075342	0.052228
90	0.166307	0.111750	0.134887	0.113605	0.011000	0.013500	0.140882	0.091139	0.114265	0.092652
95	0.234086	0.182419	0.191214	0.174228	0.010000	0.012500	0.201328	0.151052	0.164455	0.144269
100	0.319185	0.295187	0.270906	0.239215	0.004000	0.005000	0.300561	0.273806	0.255099	0.221888
105	0.469531	0.487816	0.405278	0.353414	0.000000	0.000000	0.469531	0.487816	0.405278	0.353414
110	1.000000	1.000000	0.634814	0.584462	0.000000	0.000000	1.000000	1.000000	0.634814	0.584462

Life Expectancies

The following table shows life expectancies under the above-stated mortality assumption for selected attained ages.

Table 17 Life Expectancies

AGE	GROUP		INDIVIDUAL	
	MALES	FEMALES	MALES	FEMALES
15	65.4	71.8	67.1	72.2
20	60.5	66.8	62.2	67.3
25	55.6	61.9	57.4	62.4
30	50.7	57.0	52.5	57.5
35	45.9	52.1	47.7	52.6
40	41.0	47.2	42.9	47.7
45	36.2	42.3	38.1	42.8
50	31.6	37.5	33.5	38.0
55	27.1	32.7	29.1	33.3
60	22.8	28.1	24.8	28.7
65	18.7	23.6	20.7	24.3
70	15.0	19.3	16.9	20.0
75	11.8	15.3	13.5	16.0
80	9.1	11.9	10.5	12.4
85	7.0	9.1	8.1	9.3
90	5.3	6.6	6.2	6.9
95	4.0	4.6	4.6	5.1
100	2.8	2.9	3.2	3.6
105	1.9	1.9	2.2	2.5
110	1.0	1.0	1.5	1.6

Appendix 5 – Alternative Mortality and Discount Rate Assumptions

Mortality Rates

The experience-adjusted mortality rates are based on the Canada Pension Plan retirement beneficiaries' mortality assumptions, as developed for the 30th Actuarial Report on the Canada Pension Plan as at 31 December 2018. These rates are further adjusted using a 3% load for males and a 4% load for females.

Discount Rates

The annual alternative discount rates used to calculate the liabilities are 1.49% as at 31 March 2021 and 0.93% as at 31 March 2020. They are determined using a yield curve approach. Under this approach, the discount rate corresponds to an equivalent flat discount rate based on a yield curve and the projected cash flows. The yield curve is based on market yields at the end of the reporting period on Government of Canada bonds and treasury bills. The Bank of Canada develops and publishes monthly a yield curve for Government of Canada zero-coupon bonds¹.

Table 18 shows the actuarial liabilities under the experience-adjusted mortality rates and the alternative discount rates while Table 19 provides sample experience-adjusted mortality rates at different ages and for different years.

¹ The methodology to develop this yield curve is set out on the Bank of Canada's website (<http://www.bankofcanada.ca/2004/12/working-paper-2004-48/>).

Table 18 Development of Actuarial Liabilities (with Experience-Adjusted Mortality¹ and Alternative Discount Rate²)

Fiscal Year	Contract Type	2020 – 2021	2019 – 2020
<u>VESTED MEMBERS</u>			
Males, Ordinary Life	10 – 16	\$ 43,387,877	\$ 50,924,126
Females, Ordinary Life	10 – 16	24,651,466	27,593,817
Males, Guaranteed	21 – 29	13,793,404	16,302,027
Females, Guaranteed	21 – 29	7,444,396	8,767,338
Last Survivor	30 – 37	4,863,514	6,259,168
Reducing at OAS	70 – 79	1,011,018	1,286,407
Annuities Certain	50, 80	209,291	252,646
Temporary Annuities	60	4,702	3,297
Suspended Payments		20,310	13,309
VESTED TOTAL		95,385,979	111,402,135
<u>DEFERRED MEMBERS</u>			
Ordinary Life	10	90,010	96,267
Males, Guaranteed	21 - 24	1,380,743	2,071,164
Females, Guaranteed	21 - 24	885,488	1,138,568
Refunds in Process		1,520	1,814
Suspense Accounts	Account 721	54,884	51,293
DEFERRED TOTAL		2,412,645	3,359,106
TOTAL ACTUARIAL LIABILITIES		\$ 97,798,624	\$ 114,761,241

¹ Using mortality assumptions used for the CPP beneficiaries (with appropriate loading) consistent with the 30th CPP Actuarial Report for both fiscal years 2019-2020 and 2020-2021.

² Using a yield curve approach determined by reference to market yields at the end of the reporting period on Government of Canada Bonds and Treasury Bills (the equivalent flat discount rate is 0.93% as at 31 March 2020 and 1.49% as at 31 March 2021).

Table 19 Sample Mortality Rates (Experience-Adjusted Mortality)

AGE	MALES				FEMALES			
	2021-22	2031-32	2041-42	2051-52	2021-22	2031-32	2041-42	2051-52
50	0.002773	0.002469	0.002277	0.002101	0.001922	0.001755	0.001619	0.001494
55	0.004191	0.003676	0.003389	0.003127	0.002841	0.002557	0.002358	0.002176
60	0.005349	0.004595	0.004238	0.003906	0.002815	0.002487	0.002293	0.002116
65	0.010739	0.009246	0.008521	0.007856	0.006596	0.005835	0.005380	0.004968
70	0.016115	0.013969	0.012871	0.011879	0.011404	0.010185	0.009401	0.008672
75	0.026560	0.023035	0.021234	0.019594	0.018580	0.016641	0.015354	0.014171
80	0.044643	0.038679	0.035653	0.032914	0.032166	0.028656	0.026431	0.024403
85	0.080794	0.070063	0.064576	0.059600	0.058360	0.051491	0.047466	0.043800
90	0.144823	0.128033	0.120131	0.112872	0.107337	0.095657	0.089740	0.084293
95	0.238170	0.220787	0.211847	0.202970	0.195700	0.181349	0.173824	0.166556
100	0.354901	0.340934	0.331863	0.322434	0.304887	0.291964	0.283696	0.275646
105	0.480654	0.471915	0.465377	0.459404	0.424660	0.415746	0.409847	0.404250
110	0.601219	0.601664	0.602089	0.602209	0.546898	0.547171	0.548032	0.547876
115	0.684757	0.684786	0.684871	0.684873	0.635899	0.636130	0.636312	0.636294
120	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

The table below presents a reconciliation of the actuarial liability between 31 March 2020 and 31 March 2021.

Table 20 Reconciliation of Actuarial Liability (with Experience-Adjusted Mortality¹ and Alternative Discount Rates²)

Fiscal Year	2020 – 2021	2019 – 2020
<u>LIABILITY AS AT 1 APRIL</u>	114,761,241	\$ 122,942,521
Accrued interest	\$ 994,923	\$ 1,966,276
Premiums	72	72
Reclaimed annuities	7,226	32,306
Annuity payments	(14,137,060) ³	(15,748,966) ⁴
Premium refunds and other	(2,271)	(7,895)
Unclaimed annuities	(75,789)	(84,023)
Change in mortality assumption	-	61,801
Change in discount rates ⁵	(3,746,679)	5,944,491
Experience	(3,039)	(345,342)
<u>LIABILITY AS AT 1 APRIL</u>	\$ 97,798,624	\$ 114,761,241

¹ Using mortality assumptions used for the CPP beneficiaries (with appropriate loading) consistent with the 30th CPP Actuarial Report for both fiscal years 2019-2020 and 2020-2021.

² Using a yield curve approach determined by reference to market yields at the end of the reporting period on Government of Canada Bonds and Treasury Bills (the equivalent flat discount rate is 0.93% as at 31 March 2020 and 1.49% as at 31 March 2021).

³ Includes annuity and retroactive payments totalling \$10,619 for members recovered from the CRF in 2020-2021, and vested commuted value payments of \$80,058.

⁴ Includes annuity retroactive payments totalling \$40,088 (including an overpayment of \$10,136) for members recovered from the CRF in 2019-2020, and vested commuted value payments of \$33,096.

⁵ The discount rate used to calculate liabilities changed from 1.72% in 2018-2019 to 0.93% in 2019-2020 and 1.49% in 2020-2021 based on the yield curve approach.

The following table outlines the calculation of interest for the 2021 and 2020 fiscal years.

Table 21 Calculation of Interest (with Experience-Adjusted Mortality¹ and Alternative Interest Rates²)

Fiscal Year	2020 – 2021	2019 – 2020
<u>VESTED MEMBERS</u>		
Interest on :		
Experience adjusted liabilities as at 1 April of prior year	\$ 1,036,040	\$ 2,041,707
Maturities	3,420	15,708
CRF Recoveries	55	323
Less interest on :		
Annuity Payments	(71,789)	(148,096)
Commuted Values	(395)	(159)
Transfers to CRF	0	0
	967,330	1,909,483
<u>DEFERRED MEMBERS</u>		
Interest on :		
Experience adjusted liabilities as at 1 April of prior year	31,240	72,904
Premiums	0	0
CRF Recoveries	1	5
Less interest on :		
Maturities	(3,420)	(15,708)
Refunds	(226)	(326)
Transfers to CRF	(2)	(82)
	27,593	56,793
TOTAL VESTED	967,330	1,909,483
TOTAL DEFERRED	27,593	56,793
TOTAL INTEREST	\$ 994,923	\$ 1,966,276

¹ Using mortality assumptions used for the CPP beneficiaries (with appropriate loading) consistent with the 30th CPP Actuarial Report for both fiscal years 2019-2020 and 2020-2021.

² Using a yield curve approach determined by reference to market yields at the end of the reporting period on Government of Canada Bonds and Treasury Bills (the equivalent flat interest rate is 0.93% for fiscal year 2019-2020 and 1.49% for fiscal year 2020-2021). The calculation of interest for the fiscal year is based on the rates at the beginning of the period while the end of period liabilities are based on the rates at the end of the period.