

Actuarial Report on

WorkSafeBC Pension Plan

Actuarial Valuation
as at December 31, 2019

Vancouver, British Columbia
December 16, 2020

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December 16, 2020

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Highlights and Actuarial Opinion

We have completed an actuarial valuation of the WorkSafeBC Pension Plan (the "Plan") as at December 31, 2019 and have pleasure in submitting our report thereon. Our report addresses the Plan's experience in the period since March 31, 2017, the date of the last valuation.

Scope of the Valuation

The purpose of the actuarial valuation is to:

1. Report on the financial position of the Basic Account as at December 31, 2019;
2. To determine the contribution requirements for the period from January 1, 2020 until the results of the next valuation are available, for which the effective date must be no later than December 31, 2022; and
3. To provide the actuarial certifications required under the *B.C. Pension Benefits Standards Act* ("PBSA") and the federal *Income Tax Act* ("ITA").

The intended users of this report are WorkSafeBC, the Pension Committee of the Plan, BC Financial Services Authority (BCFSA) and Canada Revenue Agency (CRA). This report is not intended or necessarily suitable for purposes other than those listed above.

The valuation is concerned primarily with the future Basic non-indexed benefits provided under the Plan (including all indexing granted up to the valuation date). The valuation does not directly consider the liabilities for future indexing as such future indexing is to occur only to the extent it can be adequately financed by amounts available in the Inflation Adjustment Account ("IAA"); the future indexing liabilities have been considered indirectly, by setting liabilities exactly equal to the assets in the IAA.

Changes in Benefits and Assumptions since the Last Valuation

The only Plan amendment which is material to this valuation which has been made since the previous valuation is the change to the report date from March 31 to December 31.

The plan rules are summarized in Appendix A, including a summary of the other plan amendments made since the previous valuation.

The funding requirements set out in the BC Pension Benefits Standards Act and Regulations (the “PBSA”) for defined benefit provisions were amended effective December 31, 2019. Further details are provided in this report, but in conjunction with these changes, the discount rate assumption used for the going concern valuation is now a best estimate, and an explicit Provision for Adverse Deviations (“PfAD”) is included in the going concern liabilities and normal cost, where required.

The going concern actuarial assumptions have been revised since the previous valuation. In particular, the discount rate was lowered in view of reduced long-term expectations of investment returns, but the prior margin was removed from the rate. This happens to result in a best estimate discount rate for the 2019 valuation that is the same as the rate with margin used for the 2017 valuation. The key long-term economic assumptions used include (assumptions for the previous valuation are in brackets).

	Funding Valuation
Annual Investment Return	5.65% (2019 is a best estimate; 5.65% with a margin was used in 2017)
Annual Salary Increase	2.75% plus seniority (same as previous valuation)
Annual Indexing	0% for basic costs 2.25% for indexed costs (both same as previous valuation)

The going concern mortality rate assumptions were updated from Club Vita Canada’s 2016 VitaCurves to the Club Vita Canada’s 2019 VitaCurves, both projected generationally with improvement scale CPM-B. This produced a small decrease in the going concern liabilities and current service cost.

Minor adjustments were made to the assumed rates of retirement, disability and withdrawal from the Plan.

The hypothetical wind-up/solvency economic assumptions were revised to reflect market conditions as at the valuation date.

The assumptions are described in detail in Appendix D.

Summary of Results

The results as at December 31, 2019 for the Basic Account are summarized below.

(\$,000's)	Going concern	Hypothetical Wind-up/Solvency
Assets (net of wind-up expenses if applicable)	1,860,741	1,956,348
Liabilities (including PfAD if applicable)	1,456,319	1,869,767
Going Concern Actuarial Excess (Unfunded Liability)	404,422	
Solvency Surplus (Deficiency)		86,581
Funded/Solvency Ratio	127.8%	104.6%
Total current service cost (% of active payroll)	18.11%	
Going Concern Special Payments	Nil	
Solvency Special Payments	Nil	

The current going concern valuation indicates that the actuarial excess of \$349,548,000 that existed at March 31, 2017 has increased to \$404,422,000 at December 31, 2019. The increase in actuarial excess is the net result of a number of items, the major one being the investment earnings on a smoothed asset value basis greater than the rates assumed in the last valuation, partially offset by the inclusion of the PfAD and actual contributions being less than the current service cost. More detailed analysis of the going concern results and changes is given in Appendix E.

The current valuation indicates that the total current service cost for Basic Account (non-indexed benefits) has decreased from 18.51% to 18.11% (integrated¹). The decrease in the Basic Account current service cost is the result of a number of factors, the major cause being the changes in the active membership profile, particularly the reduction in average age and service. These changes are analyzed in detail in Appendix F.

The hypothetical wind-up/solvency valuation indicates that the solvency surplus of \$41,385,000 that existed at March 31, 2017 has increased to a solvency surplus of \$86,581,000 at December 31, 2019. The primary driver for the improvement was the investment earnings on a market value basis being greater than the solvency rates prescribed for the last valuation, partially offset by the decrease in the prescribed solvency rates at December 31, 2019 compared to those in effect at March 31, 2017. The solvency ratio of the Plan is 104.6% (greater than 100%) and, because of this, where lump sums are transferred from the Basic Account by a terminated member or with respect to a deceased member, they are due to be paid in full and no additional contributions will be required.

¹ The term “integrated” refers to the set of two contribution rates that apply to earnings up to and over the YMPE. For employees, 7% integrated means 5.5% of that part of the employee’s salary that does not exceed the YMPE, and 7.0% of the employee’s salary which is in excess of the YMPE. For the employer, 11.1% integrated means 9.61% of salary up to the YMPE, and 11.1% on the portion of salary in excess of the YMPE.

As in previous valuations, we evaluated the going concern actuarial excess and maximum contributions in terms of the limits permitted under the *ITA*. The *ITA* surplus/contribution tests have been calculated on a basis that recognizes full indexing of benefits on a pre-funded basis, as permitted by the *ITA* – detail is provided in Appendix A.

Since there is both a going concern actuarial excess and a solvency surplus, no special funding payments are required.

The current service cost rate for the Basic Account is 18.11% integrated. Assuming that employee contributions continue to be made at the rate of 7% of salaries (integrated), WorkSafeBC’s portion would be 11.11% (integrated). As well, as required under the plan rules, the employees and WorkSafeBC each contribute 1% of salaries to the IAA. Based on the payroll rates as at December 31, 2019, the current service costs are summarized below:

Current Service Cost

	Basic Account		IAA		Total
	Rate	\$ at December 31, 2019	Rate	\$ at December 31, 2019	\$
Employees	7.0% integrated	16,387,000	1.0%	2,714,000	19,101,000
WorkSafeBC	11.11% integrated	27,541,000	1.0%	2,714,000	30,255,000
Total	18.11% integrated	43,928,000	2.0%	5,428,000	49,356,000

The foregoing valuation results recognize only those benefits up to the maximum *ITA* benefit limits. Benefits above these limits are paid under Part 11 of the Plan, via a Supplemental Benefit Account, which is maintained at a zero balance. Since WorkSafeBC may need to recognize a liability for these Part 11 benefits in its financial statements for the Accident Fund, we have recalculated the liabilities and costs, ignoring the *ITA* limits. When this is done, the going concern actuarial excess reduces by \$18,356,000 to \$386,066,000 and the employer current service cost requirement for basic non-indexed benefits increases by 0.12%, from 11.11% integrated to 11.23% integrated of salaries, assuming employees continue to contribute at 7% integrated.

Summary of Results - Impact of Current Going Concern Actuarial Excess

Due to the going concern actuarial excess and solvency surplus, contributions to the Basic Account may be made at a rate lower than the current service cost rate of 18.11% integrated.

After setting aside a buffer equal to 5% of the Basic Account liability, as required under the *PBSA*, the remaining \$331,606,000 of accessible going concern excess (the actuarial excess above the 5% buffer) may be used in part or full to reduce contributions. However, as a reduction in contributions cannot result in a solvency deficiency, the maximum reduction for the next three years is 11.1%, resulting in a minimum contribution of 7.01% integrated. Alternatively, WorkSafeBC could elect to retain the accessible going concern excess in the fund.

WorkSafeBC is currently contributing at a rate of 7.00% integrated to the Basic Account. Combined with the employee contributions of 7.00%, this gives current total contributions to the Basic Account of 14.00% integrated.

Further details are given in Appendix H.

The maximum contribution rate under the *ITA* that can be paid until the next valuation is the current service cost on an indexed basis. Including the IAA contributions, the total indexed current service cost is 24.68% (integrated). Assuming employee contributions remain at 8% (integrated; including IAA contributions), the maximum contribution WorkSafeBC can make is 16.68% (integrated).

More details are provided in Appendix I.

Reliance

We have relied on the asset information as provided in the audited financial statements of the Plan (for fiscal year ends to March 31) and in the audited financial statements of WorkSafeBC as they relate to the Plan for the relevant calendar years. We have also relied on WorkSafeBC and the plan administrator to provide all relevant data, additional asset information and to confirm the pertinent Plan terms.

Further detail with respect to both the results of the valuation and the information and methods used for the valuation is set out in the attached appendices.

Subsequent Events

Subsequent to December 31, 2019, the COVID-19 pandemic has been evolving. The impact of COVID-19 on the valuation cannot be reasonably estimated at this time. Future valuations or extrapolations will reflect any long-term impact of COVID-19, as appropriate. To the best of our knowledge there have been no events subsequent to the valuation date, other than disclosed above, that would have an impact on the results of this valuation, or alter our opinion.

Actuarial Opinion

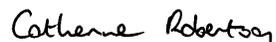
In our opinion,

- a) the membership data on which the valuation is based are sufficient and reliable for purposes of the valuation,
- b) the assumptions are appropriate for the purposes of the valuation, and
- c) the methods employed in the valuation are appropriate for the purposes of the valuation.

This report has been prepared, and our opinions given, in accordance with accepted actuarial practice in Canada. For regulatory purposes, the next valuation should be completed no later than as of December 31, 2022.

We would be pleased to discuss the report with you at your convenience.

Respectfully submitted,



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December 16, 2020

¹ The Canadian Institute of Actuaries is the Primary Regulator.

Appendix A Summary of Plan and Amendments

The previous valuation was based on the provisions of the WorkSafeBC Pension Plan (Plan) as at March 31, 2017. The Plan Rules were amended three times from April 1, 2017, to December 31, 2019, as summarized below.

- Effective January 24, 2018, the Plan Rules were amended to remove the provision for the automatic transfer of the excess investment return from the basic account to the inflation adjustment account (IAA). When the most recent actuarial valuation shows a surplus in the basic account, the board retains the ability under the Plan Rules to transfer surplus from the basic account to the IAA as it determines is appropriate.
- Effective May 17, 2018, the Plan Rules were amended to reflect two new *Employment Standards Act* leave types for which the employer is required to pay the employer portion of contributions, if the employee chooses to pay their portion of contributions. The two new leaves of absence are those respecting the disappearance of a child and the death of child.
- Effective December 13, 2018, the Plan Rules were amended to implement housekeeping amendments and to align terminology with the *Pension Benefits Standards Act* (PBSA) relating to benefits.

The main provisions of the Plan are summarized below. The section references are to the Plan Rules, as at December 31, 2019. WorkSafeBC is referred to in the Plan Rules as the "board".

Employee Eligibility

Section 2 states the Plan applies to all eligible WorkSafeBC employees.

Section 3 outlines eligible employees as:

- a) a permanent employee of the board in receipt of a salary in payment for service; or
- b) any other employee of the board who has completed two years of continuous employment with salary from the board of at least 35% of the year's maximum pensionable earnings (YMPE) in each of two consecutive calendar years and who elect to have the Plan apply to them.

Member Contributions

Section 5 defines the following contributions that are deducted from a member's salary during a calendar year:

- a) 5.5% of the member's salary payable that does not exceed the YMPE (paid into the Basic Account);
- b) 7.0% of the member's salary payable that exceeds the YMPE (paid into the Basic Account); and
- c) 1.0% of the member's entire salary (paid into the Inflation Adjustment Account (IAA)).

Member contributions cease after 35 years of pensionable service have been accrued.

Employer Contributions

Section 6 outlines how WorkSafeBC is required to contribute such amounts which, based on the recommendation of the actuary, are determined by WorkSafeBC to be necessary to provide for the benefits under the Plan. Actuarial surplus funds may be used to reduce or eliminate contributions that might otherwise be required. All WorkSafeBC contributions must also comply with the requirements of the ITA and the PBSA.

Employer contribution rates include:

- a) 5.5% of that part of the employee's salary that does not exceed the YMPE (paid into the Basic Account);
- b) 7.0% of the employee's salary which is in excess of the YMPE (paid into the Basic Account); and
- c) 1.0% of the employee's salary (paid into the IAA).

Employer contributions also cease in respect of an employee's salary after the employee has accrued 35 years of pensionable service.

Retirement Benefits: Eligibility Conditions for Pension

Section 96 defines earliest retirement age as age 55, normal retirement age as age 65 and latest retirement age as November 30th of the year the member turns age 71.

Section 50 provides that an active member who, on or after September 30, 2015, terminates employment, is on application, entitled to an unreduced pension and bridge benefit calculated under section 54 if the member has reached:

- a) age 55 and the sum of the member's age plus years of contributory service is 90, or
- b) age 60 with at least 2 years of contributory service, or
- c) age 65.

Section 51(a) provides for a reduced pension and bridge benefit calculated under section 55(1) if the terminated member has reached age 55 and completed at least 2 years of contributory service.

Section 51(b) provides for a reduced pension and bridge benefit calculated under section 55(2) if the terminated member has attained age 55 but has not completed 2 years of contributory service.

Calculation of Unreduced Retirement Benefit

Section 54 provides that a member referred to in section 50 is entitled to receive an unreduced pension payable in the form of a single life option guaranteed for 10 years, calculated as follows:

- a) 2% of the member's highest average salary multiplied by the number of years of pensionable service (not exceeding 35 years), less:

0.7% of the lesser of:

1. the member's highest average salary, and
2. 1/12 of the YMPE for the calendar year immediately before the calendar year of the pension effective date,

multiplied by the member's years of pensionable service not exceeding 35 years.

- b) plus a bridge benefit, until member reaches age 65 or dies, equal to:

0.7% of the lesser of:

1. the member's highest average salary, and
2. 1/12 of the YMPE for the calendar year immediately before the calendar year of the pension effective date,

multiplied by the member's years of pensionable service not exceeding 35 years.

Sections 97 and 98 define highest average salary as one-twelfth of the average annual salary earned by a member during the 5 years of pensionable service (not necessarily consecutive) in which the salaries were highest (or, if the member has accrued less than 5 years of pensionable service, the total number of years and partial years of pensionable service).

Calculation of Reduced Retirement Benefit

Section 55 provides that a member referred to in section 51 be entitled to receive a reduced pension payable in the form of a single life option guaranteed for 10 years.

The pension is reduced for each year of age that either:

- a) the member is over age 55 but under 60, and age plus contributory service total less than 90, or
- b) the member is over age 60 but under 65, with fewer than two years of contributory service

If a member terminates employment after age 50 and has at least 10 years of contributory service, the component of the pension calculated as 2% of the member's highest average salary multiplied by the number of years of pensionable service, is reduced by 3% for each year of age the lesser of:

- a) the member's age plus years of contributory service is less than 90, or
- b) the member is under age 60

In all other cases, the pension is reduced by 5%. Pension reductions are pro-rated by month for partial years.

Optional Forms of Pension

Section 56 provides a pension may be granted on the single life option, single life with a guaranteed period of 5, 10 (normal form) or 15 years, joint life and last survivor option, temporary annuity option in combination with one of the aforementioned options, or a combination of these options with the approval of the Plan administrative agent. The amount of any pension granted on a form other than the normal form is calculated on an actuarially equivalent basis.

Where a member has a spouse at retirement, the member is required to elect a 60% joint life and last survivor option, unless the spouse waives this requirement in writing or there is a written agreement or court order made under Part 5 or 6 of the *Family Law Act* that is filed with the Plan administrative agent. This option provides for a reduced amount payable to the member, continuing to the spouse on death of the member at 60% of the initial reduced amount. A spouse is as defined in the PBSA, and includes a common-law or same-sex spouse.

Long-Term Disability (LTD)

Sections 12(5) and 99(2) provide that if a member is receiving a monthly income benefit from a group disability plan, approved for pension purposes, the member and employer do not make contributions. The member is not entitled to a pension under the Plan, but the period for which the member receives such group LTD income benefit is considered pensionable service, with the final pension based on the highest average salary at disablement increased to retirement in accordance with changes in the Consumer Price Index (CPI).

Pre-retirement Death Benefits

Section 69 outlines the following pre-retirement death benefits provisions for active and inactive members who die on or after September 30, 2015, but before being granted a termination or retirement benefit.

- a) if there is no surviving spouse or a valid spousal waiver has been filed, the benefit payable to the beneficiary is equal to the commuted value (calculated per section 46) which the member would have been entitled to in respect of the member's pensionable service had the member terminated employment immediately before the date of death.
- b) if the member has not attained age 55 at the date of death and is not entitled to a pension, and there is a surviving spouse and a valid spousal waiver has not been filed, the spouse may elect to receive either of the following benefits:
 1. the commuted value which the member would have been entitled to in respect of the member's pensionable service had the member terminated employment immediately before the date of death, or
 2. an immediate pension that is actuarially equivalent to the commuted value and payable as if the member had chosen the joint life and last survivor option.

- c) if the member has attained age 55 on the date of death and is entitled to an immediate pension, and there is a surviving spouse and a valid spousal waiver has not been filed, an immediate pension is payable to the spouse which is actuarially equivalent to the commuted value which the member would have been entitled to in respect of the member's pensionable service had the member terminated employment immediately before the date of death, and payable as if the member had chosen the joint life and last survivor option.

Termination Benefits and Portability

Under sections 42 and 46, a member who terminates employment on or after September 30, 2015, is eligible to receive one of the following:

- a) if the member has reached age 55, a deferred unreduced or reduced pension calculated (see above "Eligibility conditions for pension" section), or;
- b) if the member has not reached age 55, a commuted value under section 46, subject to the commuted value being payable on a locked-in basis.

Under certain limited conditions (small pensions, or small commuted values) the PBSA permits the election of a lump-sum payout, regardless of age, and on a non-locked-in basis (section 48).

An inactive member who terminated employment before September 30, 2015, is entitled to receive that retirement benefit or commuted value calculated in accordance with the rules in force at the date of termination of employment (section 42(5)).

Section 100 provides that if an inactive member, whose employment terminated on or after January 1, 1983, is entitled to and applies to receive a deferred pension, their highest average salary is to be increased in each year from the first of the month following the month in which termination of employment occurred to the end of the month immediately preceding the month in which the pension benefit is to be granted, and is based on the percentage increase granted to retirement benefits each January 1 (under section 73) and prorated for the number of complete months.

Section 75(3)(i) provides that the cost of the deferred indexing described above is funded from the IAA.

The Plan has in place transfer agreements with other public sector pension plans in Canada, including the four main BC public sector pension plans. Under these agreements, members may elect to transfer their service from one plan to another. Transfers under the agreement take into account the benefits under the transferring plans and pro-rate service if the importing plan's reserve requirements are higher than those available from the exporting plan. Members may pay for any shortfall, subject to CRA approval, within certain deadlines.

Cost of Living Benefits (Indexing)

Section 73 sets out how cost of living benefits are to be administered. The Plan provides for increases to retired members on January 1 of each year, with the benefits funded from the IAA. The benefit is based on the total amount of pension being received, including previous indexing increases, less any portion of the pension that is a result of voluntary contributions (which are no longer permitted). The maximum increase is equal to the percentage increase in the CPI over the 12 months ending on September 30 of the previous year.

Section 73 sets out additional requirements about the indexing benefit, including:

- a) the same uniform percentage increase will be granted in respect of all pensions eligible for adjustment;
- b) the increase is prorated if the pension has not been in payment for at least 12 months;
- c) the total capitalized value of all indexing benefits granted on January 1 must not exceed the amount in the IAA on the preceding September 30; and
- d) the capitalized value of all indexing benefits granted annually is transferred from the IAA to the Basic Account.

Plan Termination

Section 103 states for purposes of testing the PBSA solvency rules, benefits are to be calculated as follows:

- a) all active members are deemed to be terminated at the date of Plan termination;
- b) benefits are calculated only on the basis of earnings and service frozen at the valuation date;
- c) future indexing is ignored, both before and after retirement; and
- d) the liability for future indexing is limited to assets in the IAA.

In the event the Plan is terminated, priorities are set out for any surplus that might emerge. Wage and CPI indexing are first restored before any residual surplus is considered.

Pension Fund

Section 75 provides that the pension fund is divided into the following three accounts:

- a) the Basic Account consisting of all the assets in the fund other than assets in the IAA and the Supplemental Benefits Account;
- b) the IAA consisting of:
 - 1. the 1% active members' contributions made under section 5(1)(c),
 - 2. the 1% board contributions under section 6,
 - 3. net investment income earned on the account,

4. where the most recent actuarial valuation discloses a surplus in the Basic Account, such amount as the board determines be transferred from such surplus,

less

5. amounts transferred to the Basic Account under sections 73 and 88,
6. contributions made under section 5(1)(c) refunded to members who terminated employment before September 30, 2015, without vesting in accordance with the terms of the Plan in effect on the date the member terminated employment,
7. amounts determined by the Plan administrative agent in respect of the portion of any commuted value, actuarial reserve value or other form of lump sum transferred out of the pension fund that is attributable to the cost of living adjustment,
8. amounts transferred to the Basic Account that are equal to the capitalized value of the increase in a member's retirement benefit resulting from any increase in the member's highest average salary under section 100, and
9. amounts, specified by the board, contributed to the Supplemental Benefits Account.

b) the Supplemental Benefits Account consisting of:

1. contributions to the pension fund provided for in section 86,
2. amounts from contributions under section 6 specified by the Plan administrative agent as necessary to cover any annual shortfall between current assets in the account and the cost of providing benefits under section 87 and the cost of providing cost of living benefits under section 88,
3. amounts otherwise contributed under section 6 which are specified by the Plan administrative agent to be required to pay for the cost of administering the account, including the costs to administer any benefits under Part 11, and
4. other amounts that may be specified by the board,

less

5. amounts paid in respect of benefits under section 87,
6. amounts paid in respect of cost of living benefits under section 88, and
7. amounts determined by the Plan administrative agent as the cost of administering the account, including the costs to administer any benefits under Part 11.

Income Tax Act (ITA) Limits

The ITA imposes certain limits on the contributions that may be made to, and the benefits that may be paid from, a registered pension plan. However, in total, the contribution requirements from and the benefit promises to Plan members have not been altered under the Plan.

To this end, a Supplemental Benefits Account was created to cover the financing and payment of benefits in excess of those registrable under the ITA. The excess benefits are paid on a current cash basis, by allocating from the regular employer contributions, the amounts necessary to maintain the Supplemental Benefits Account at a zero balance. Effectively, from a Plan member's perspective, it is expected that these procedures will be invisible - the employee contribution and benefit obligations remain unchanged. In completing this valuation, we have calculated the liabilities and costs on two bases, once recognizing the ITA limits and again ignoring those limits. In the Plan summary herein, and elsewhere in this valuation report, our references to contributions/benefits to/from the Basic Account/IAA are inclusive of the allocations to/from the Supplemental Benefits Account; in general, the allocations to/from the Supplemental Benefits Account have not been referenced.

We have also completed supplementary valuations recognizing income tax limits on pensions. Section 49 of the Plan Rules states benefits payable for service accrued after 1991 are limited to pension benefits in accordance with the maximum lifetime retirement benefits under the Income Tax Regulations. The maximum annual pension currently permitted in 2019 (before application of any early retirement reductions, where applicable) is the lesser of:

- a) \$3,025.56 multiplied by the years of service; and
- b) 2% multiplied by the years of service further multiplied by the average of the best 3 years of remuneration paid to the member

The Plan also imposes a 35-year cap on accruals at the above maximum rate.

Plan Termination

Section 103 states for purposes of the Plan termination assumptions needed in calculating the ongoing PBSA minimum funding requirements:

- a) all active members are deemed to have terminated employment at the date of such Plan termination,
- b) benefits shall be calculated only on service and salaries credited up to the termination date and there shall be no projection of salary increases beyond such date,
- c) in the calculation of the Plan's liabilities in respect of benefits to be provided from the Basic Account, the future indexing of benefits shall be ignored, both before and after retirement, and
- d) the liability for such future indexing shall be limited to the assets in the IAA.

Pension Committee

Section 112 prescribes the creation of the Pension Committee. The Pension Committee Terms of Reference provides for WorkSafeBC to appoint three Pension Committee members, comprising:

- a) one member who represents WorkSafeBC;
- b) one member who represents the employees; and
- c) one member nominated jointly by the two members referred to in (a) and (b).

Other Items

- a) Section 6(4) provides that expenses incurred in the administration shall be paid from the fund.
- b) Section 13 states a maximum of 5 years taken to raise a child may be recognized in establishing eligibility for a pension provided the employee has a record of pensionable service immediately before and after the child-rearing period(s).
- c) Section 57 enables WorkSafeBC to request the board to adopt a Special Retirement Incentive Plan (SRIP), whereby the age and service conditions, or the early retirement percentage reductions, or both, may be adjusted. Where the board agrees, it must also determine the employees eligible for the SRIP, the period it remains open, the conditions applicable to the incentives, the additional costs to WorkSafeBC, and the timing of these payments to fund the SRIP.

Appendix B Membership Information

Data as of December 31, 2019 were prepared by the Pension Corporation for 3,191 active employees, 283 employees currently receiving long-term disability benefits, 461 former employees entitled to deferred pensions, 84 other inactive employees, 1,998 former employees in receipt of pensions and 180 beneficiaries in receipt of pensions as a result of the deaths of Plan members (a total of 2,178 pensioners). The Pension Corporation advised us that the data supplied are generally proper, complete and in accordance with specifications, unless otherwise noted.

- Where possible, we compared totals with corresponding details in the Plan's Annual Report. We also subjected the data to a number of tests of reasonableness and consistency, including the following:
- A member's (and partner's as applicable) age is within a reasonable range;
- A member's gender or date of birth did not change;
- A member joined the Plan or commenced pension at a reasonable age;
- Accrued service increased by a reasonable amount (e.g. no more than 33 months since the last valuation);
- The salary level and the salary increase from the previous valuation was within a reasonable range;
- Pensions in pay increased by a reasonable amount (e.g. in line with the indexation since the last valuation); and
- We examined the additions to and deletions from each of the data files (i.e. the files for active employees, pensioners and terminated members) since the previous valuation to determine whether all Plan members were accounted for in this valuation, to check for duplicate records and to confirm pension amounts.

There were a number of discrepancies recorded during our examination of the data and we sought clarification of these from the Pension Corporation. Where necessary, we modified the data, our assumptions, or both, to compensate for these discrepancies, as summarized below.

Data Adjustments

The active member data included 104 persons who had no salary or service reported for the year ending December 31, 2019, or with a last-contribution-date prior to December 2019. We excluded them from the active member base, and have included them with the inactive data.

The information supplied with respect to 32 of the 461 former employees entitled to deferred pensions was incomplete. We held liabilities for them equal to twice their contributions plus interest. Of the 84 other inactive employees, the bulk of them had less than 2 years of service at termination. For these 84 other inactive and the 9 non-retired individuals with very limited data, we also held a liability equal to twice their contributions plus interest.

Of the total pensioner data, there was one member excluded from the valuation because the member died prior to the valuation date with no outstanding guaranteed pensions due.

The data from the Pension Corporation, and our treatment of this data, are summarised below:

Treatment of Member Data in Valuation

Category of Membership From Pension Corporation	Pension Corporation Membership Count	Treatment in Valuation					
		Active Members	LTD	Deferred Vested	Refund 2 x CWI ¹	Pensioners with zero liability	Pensioners
Active Members	3,191	3,087			104		
Leave of Absence	0						
Long Term Disability	283		283				
Terminated Vested	461			429	32		
Inactive Members	84				84		
Limited Data	9				9		
Pensioners	2,178					1	2,177
Total membership	6,206	3,087	283	429	229	1	2,177

¹ Contributions with interest.

Data Reconciliation

A reconciliation of the data received and membership movements between March 31, 2017 and December 31, 2019 is included below:

Summary of Changes in Membership - March 31, 2017 to December 31, 2019

	Active	LOA	LTD	Deferred Vested	Inactive	Limited Data	Pensioners and Beneficiaries	Total
Data Received March 31, 2017	2,889	2	256	408	91	7	1,887	5,540
Additions:								
- new members	786		18	42		2	8	
Changes:								
- vested terminations	(73)		(1)	76	(2)			
- retirements	(291)		(42)	(34)			367	
- deaths with beneficiary	(3)	(1)	(3)	(4)			11	
- disablement	(98)		98					
- pension split								
- returned to active	37	(1)	(31)	(4)	(1)			
- to inactive				(2)	2			
- to exception	(1)					1		
Deletions:								
- terminations with CV	(38)		(3)	(21)	(6)	(1)		
- terminations – refund	(13)		(2)					
- deaths with CV	(2)		(7)					
- deaths, no benefit due							(95)	
- guarantee expired								
- reciprocal transfer out	(2)							
Data Received December 31, 2019	3,191	0	283	461	84	9	2,178	6,206

Data Summaries

Details regarding the data used in the valuation are set out below.

The data for the 3,087 actives are summarized below:

Active Employee Data - December 31, 2019

Age ¹	Males			Females		
	Number	Average Service (years)	Average Salary ²	Number	Average Service (years)	Average Salary ²
Under 25	10	1.0	\$49,020	26	1.0	\$46,260
25 - 29	59	1.7	59,957	135	1.9	56,636
30 - 34	114	4.1	77,140	188	3.3	71,624
35 - 39	172	5.1	84,275	216	5.1	81,620
40 - 44	158	8.8	89,829	232	8.9	86,526
45 - 49	177	10.3	97,771	275	13.2	90,077
50 - 54	194	14.7	103,681	310	17.6	92,518
55 - 59	188	17.1	110,031	268	17.9	90,107
60 - 64	129	19.2	105,122	140	19.3	85,420
65 & over	38	19.3	115,970	58	16.8	72,833
Total	1,239	11.3	\$94,901	1,848	11.7	\$83,226

Summary Statistics Male and Female Combined	
Total Actives	3,087
Average Age	46.8
Average Service	11.5
Average Salary	\$87,912

¹ Age nearest birthday at valuation date.

² Actual earnings for the 12 months ended December 31, 2019 for those employees employed all year and annualized for others.

A comparison of the December 31, 2019 active membership with the March 31, 2017 active membership is as follows:

Comparison of Active Employee Data - December 31, 2019 vs March 31, 2017

	March 31, 2017	December 31, 2019	Change 2017 to 2019
Males			
- Number	1,108	1,239	+ 11.8%
- Proportion of total	39.4%	40.1%	+ 0.7%
- Average age	48.5	47.4	- 1.1 years
- Average service	12.6	11.3	- 1.3 years
- Average salary ¹	\$91,005	\$94,901	+ 4.3%
Females			
- Number	1,701	1,848	+ 8.6%
- Proportion of total	60.6%	59.9%	- 0.7%
- Average age	47.8	46.4	- 1.4 years
- Average service	13.0	11.7	- 1.3 years
- Average salary ¹	\$77,839	\$83,226	+ 6.9%

The above comparison indicates a 9.9% increase in the covered membership during the inter-valuation period. The proportion of males to females has increased slightly. The average ages have decreased by 1.1 years for males and 1.4 years for females. The average service has decreased by 1.3 years for males and 1.3 years for females.

The percentage increase in the average salary is higher for females (6.9% increase) than males (4.3% increase). However, when we consider only the members who were active in both valuations, the percentage increase in the average salary is even higher, at 12.8% (same percentage for both females and males). These increases compare with an expected average salary increase, prior to allowance for seniority increases, of about 7.7% (2.75 years compounded at 2.75% per year) based on the previous valuation assumptions, producing a liability loss during the inter-valuation period (as shown in the gain and loss analysis in Appendix E).

¹ Average salary in the 12 months ending on the valuation date.

The data for the 283 employees receiving long-term disability benefits are summarized below.

Members on Long-Term Disability - December 31, 2019

	Number	Average age	Average service	Average salary
Males	51	51.3	15.9	\$83,043
Females	232	51.9	17.2	73,641
Total	283	51.8	17.0	\$75,335

Summary of Active Employees and Members on Long-Term Disability – December 31, 2019

	Number	Average age	Average service	Average salary	Expected Average Remaining Service Lifetime
Actives & LTD	3,370	47.2	12.0	\$86,856	9.3

The data for the 429 deferred vested members are summarized below.

Deferred Vested Member Data - December 31, 2019

	Number	Average age	Average initial annual pension ¹	Average annual offset at age 65	Employee regular contributions with interest
Males	149	49.1	\$10,048	\$1,881	\$4,822,215
Females	280	48.6	7,804	1,766	7,092,511
Total	429	48.8	\$8,583	\$1,806	\$11,914,726

The data for the 229 other inactive members is summarized below.

Other Inactive Member Data - December 31, 2019

	Number	Employee regular contributions with interest
Total	229	\$2,696,843

We held a liability for the 229 members with incomplete equal to twice the employee regular contributions with interest balance.

¹ These pensions are calculated based on salaries at date of termination and assumed to commence at the first age which the employee is entitled to an unreduced pension, i.e. at various age between 60 and 65.

The information with respect to those in receipt of pension benefits as at December 31, 2019 is as follows:

Pensions in Payment to Former Employees - December 31, 2019

Age Group ¹	Number of Pensioners ²	Annual Pensions (\$,000's) ³				
		Single Life	Joint Life & Survivor	Single Life with Guarantee	Joint with Guarantee	Temporary Life
Males						
Under 59	41	-	593	218	466	487
60 - 64	120	159	2,174	774	761	1,347
65 - 69	218	589	4,160	920	1,378	-
70 - 74	192	1,346	2,932	683	1,003	-
75 - 79	125	1,594	1,892	168	69	-
80 - 84	68	696	972	-	-	-
85 - 89	31	278	394	-	-	-
90 & over	27	437	182	-	-	-
Total Males	822	5,099	13,298	2,762	3,677	1,833
Females						
Under 59	95	-	773	817	582	1,127
60 - 64	240	644	1,867	2,462	1,349	2,732
65 - 69	365	2,406	2,407	2,974	1,413	-
70 - 74	260	2,575	1,486	1,140	450	-
75 - 79	122	1,620	414	236	-	-
80 - 84	51	470	133	-	-	-
85 - 89	33	478	12	-	-	-
90 & over	10	167	-	-	-	-
Total Females	1,176	8,359	7,092	7,629	3,794	3,858
Basic Total	1,998	13,459	20,390	10,391	7,471	5,691
Supplemental Pensions in addition to the above		36	521	140	209	0

The average age of the pensioners was 70.3 as of December 31, 2019.

¹ Age nearest birthday at December 31, 2019.

² These figures include only those who were formerly contributors to the Plan.

³ Excluding indexing granted as at January 1, 2020.

Pensions in Payment to Beneficiaries - December 31, 2019

Age Group ¹	Number of Beneficiaries ²	Annual Pensions (\$,000's) ³	
		Single Life	Single Life with Guarantee
Males			
Under 65	13	200	21
65 - 69	8	81	5
70 - 74	13	215	-
75 - 79	5	46	14
80 & over	4	28	-
Total Males	43	570	40
Females			
Under 65	16	292	28
65 - 69	10	188	85
70 - 74	28	667	89
75 - 79	13	375	-
80 - 84	18	332	-
85 - 89	19	349	-
90 & over	30	576	-
Total Females	134	2,780	202
Remaining guarantees	2	-	38
Basic Total	179	3,350	280
Supplemental Pensions in addition to the above	-	19	-

The average age of the 177 beneficiaries in receipt of lifetime pensions was 76.7 as of December 31, 2019.

¹ Age nearest birthday at December 31, 2019.

² These figures include spouses (or estates) currently receiving benefits where the former contributor is deceased.

³ Excluding indexing granted as at January 1, 2020.

Appendix C Operation of the Fund

The Fund's financial statements are prepared by the Pension Corporation and based on the market or fair values of assets. The day-to-day investment of the Fund is carried out by the British Columbia Investment Management Corporation (BCI). We have relied upon the financial statements of the fund (as used in the audited financial statements of WSBC) for purposes of our valuation.

The change in the Basic Account during the last five calendar years to December 31 is shown below.

Year by Year Change in Basic Account Fund Balance from 2015 to 2019

	Basic Account (\$,000's)				
	2015	2016	2017	2018	2019
Opening Fund balance	1,434,488	1,549,891	1,606,407	1,733,728	1,754,968
Plus: Contributions - employees	13,919	13,740	13,965	14,804	16,005
Contributions - employer	21,129	13,899	13,973	14,872	16,011
Contributions receivable - employer	(70)	(8)	(56)	0	(21)
Net transfers from other plans	1,881	538	974	648	1,467
Transfer from IAA	8,589	5,164	6,989	9,342	13,825
Investment income	118,151	75,335	150,469	46,123	221,567
Less: Pensions paid	(43,500)	(47,140)	(51,806)	(55,832)	(60,480)
Termination & death benefits	(1,505)	(1,238)	(3,535)	(3,784)	(2,298)
Administration expenses (expected)	(1,015)	(1,024)	(1,039)	(1,096)	(1,189)
Investment expenses	(2,176)	(2,750)	(2,613)	(3,837)	(2,307)
Closing Fund balance	1,549,891	1,606,407	1,733,728	1,754,968	1,957,548

Year by Year Change in Inflation Adjustment Account (IAA) from 2015 to 2019

	<i>Inflation Adjustment Account (\$,000's)</i>				
	2015	2016	2017	2018	2019
Opening Fund balance	258,882	291,724	318,993	366,263	367,075
Plus: Contributions - employees	2,337	2,299	2,337	2,472	2,664
Contributions - employer	2,329	2,307	2,337	2,473	2,665
Contributions receivable - employer	(5)	(2)	0	0	0
Net transfers from other plans	384	(170)	(83)	(143)	(156)
Transfer from IAA	(8,589)	(5,164)	(6,989)	(9,342)	(13,825)
Investment income	38,037	29,451	53,439	8,739	44,339
Less: Pensions paid	0	0	0	0	0
Termination & death benefits	(993)	(918)	(3,234)	(2,602)	(1,380)
Administration expenses (expected)	0	0	0	0	0
Investment expenses	(658)	(534)	(537)	(785)	(461)
Closing Fund balance	291,724	318,993	366,263	367,075	400,921

The distribution of assets on December 31, 2019 is summarized below. The figures are taken from the pension note of WorkSafeBC's audited financial statements.

	December 31, 2019	
	Amount \$,000's	% of total
Cash/receivables and payables	(6,945)	-0.3%
Money market funds	41,823	1.8%
Bond funds	668,524	28.4%
Mortgage funds	76,606	3.2%
Private debt fund	58,984	2.5%
Canadian equity funds	81,291	3.4%
Global equity funds	489,116	20.7%
Emerging markets equity funds	119,711	5.1%
Private equity funds	201,738	8.6%
Infrastructure and renewable resources funds	274,571	11.6%
Domestic real estate funds	231,356	9.8%
Global real estate funds	117,660	5.0%
Total Currency hedging contracts	4,034	0.2%
Fund Balance	2,358,469	100.0%
Comprising: Basic Account	1,957,548	
Inflation Adjustment Account	400,921	
Supplemental Benefit Account	-	

Asset Allocation Policy

Effective April 10, 2019, the plan's Statement of Investment Policies and Procedures (SIPP) sets out the following minimum, maximum and target allocations:

	Minimum Allocation (%)	Maximum Allocation (%)	Target Mix (%)
Short Term	0	10	2
Mortgages	0	10	5
Bonds	5	30	23
Corporate Bonds	0	10	5
Private Debt	0	10	4
Fixed Income Sub-total	15	50	39
Canadian Equities	0	15	3
Global Equities	10	35	17
Emerging Markets	3 ¹	15	4
Private Equity	3	15	8
Equity Sub-total	20	60	32
Real Estate	10	25	16
Infrastructure and Renewable Resources	5	16	13
Real Assets Sub-total	20	40	29
Other	0	5	0

Fund Returns

The fund market values and the total fund returns during the last 5 years are set out below. Our yield calculations are determined assuming that cash flows occur at mid-year. The assumption of mid-year cash flows will distort the results if the weighted cash flows are too far from mid-year. The yields are based on the total net assets of the fund including both invested and non-invested assets (i.e. receivables and payable are included in the asset base to determine yields). The nature of our calculations is such that the results will likely differ somewhat from those produced by performance measurement services who apply more refined techniques. The yields are also shown on the smoothed asset value basis (described in Appendix D).

¹ The SIPP was subsequently updated effective September 22, 2020 to reduce the minimum Emerging Markets allocation to 0%.

Historical Market Value Yields

December 31	Market Values (\$,000's)			Total Fund Yields on Market Value
	Basic Account	Inflation Adjustment Account	Total Fund	
2015	1,549,891	291,724	1,841,615	
2016	1,606,407	318,993	1,925,400	5.5%
2017	1,733,728	366,263	2,099,991	10.5% ¹
2018	1,754,968	367,075	2,122,043	2.4%
2019	1,957,548	400,921	2,358,469	12.5%

Historical Smoothed Value Yields

December 31	Smoothed Values (\$,000's)			Total Fund Yields on Smoothed Value
	Basic Account	Inflation Adjustment Account	Total Fund	
2015	1,412,413	265,847	1,678,260	
2016	1,518,221	301,482	1,819,703	9.6%
2017	1,626,824	343,679	1,970,503	9.8% ²
2018	1,734,889	362,875	2,097,764	8.0%
2019	1,860,741	381,094	2,241,835	8.2%

¹ The 10.5% market return is split 3.2% for the first 3 months of the year up to March 31, 2017 (the last valuation date) and 7.1% for the 9 months of 2017 from April 1, 2017.

² The 9.8% smoothed return is split 2.5% for the first 3 months of the year up to March 31, 2017 (the last valuation date) and 7.1% for the 9 months of 2017 from April 1, 2017.

Appendix D Actuarial Basis & Assumptions

Monies contributed to the Plan are deposited in a trust fund, from which benefits and expenses are paid. There is not, of course, any guarantee that the assets of the fund will be sufficient at any particular time to meet the liabilities for plan benefits that have accrued up to then. The adequacy of the fund is examined at the time of each actuarial valuation, when the value of the assets on hand is compared with the value placed upon the plan's liabilities according to certain actuarial assumptions. Emerging experience, differing from the assumptions, will result in gains or losses which will be revealed in future valuations.

Going Concern Valuation

The going concern valuation assumes that the plan will continue to operate indefinitely, and is used to estimate the funded position of the Plan, and to determine the contributions currently required to be made to the Plan's fund, both to fund the cost of any benefits being earned by members for current service and, in the event there is a funding deficiency, to liquidate the amount of the funding deficiency. Any deficit on the going concern basis must be funded over a period not exceeding 10 years.

The assumptions that underlie the calculation of the liabilities for the going concern valuation are unchanged from those used for the previous valuation with the exception of the following:

- the going concern economic assumptions have been updated in view of current long-term expectations of interest rates, inflation and investment returns, to remove the previous margin from the discount rate, and to add in the PfAD as required effective December 31, 2019 by the *PBSA*;
- the going concern mortality table has been updated from the Club Vita Canada's 2016 VitaCurves to the Club Vita Canada's 2019 VitaCurves;
- the withdrawal, disability and retirement scale assumptions were updated; and
- the allowance for administration expenses was updated.

The significant actuarial assumptions used for the going concern valuation are summarized below.

Investment Return	5.65% per annum (same as used in the previous valuation)
General Salary Increases	2.75% per annum (same as used in the previous valuation)
Seniority Salary Increases	Annual percentages varying by age and sex
Pension Indexing	<p>Future indexing of pensions and deferred pensions ignored, as will be covered by Inflation Adjustment Account</p> <p>Future indexing (by inflation) of wage base for disability accruals assumed to be a charge to the Basic Account and to be 2.25% per annum (same as used in the previous valuation)</p> <p>Indexing to date is capitalized and forms part of pension liability</p>
Asset Values	Assets carried at smoothed values
Actuarial Costing Method	Recommended contributions are based on an accrued benefit approach

More detail with respect the actuarial basis and assumptions is set out below.

Provision for Adverse Deviations (PfAD)

Since the non-fixed income asset allocation is greater than 30%, the PBSA requires that the PfAD is calculated as the greater of 5% or 5 times the long-term bond rate. As at December 31, 2019, the long-term bond rate (CANSIM Series V122544 as published by the Bank of Canada) was 1.67% pa, so the PfAD is 8.35%.

Hypothetical Wind-up/Solvency Valuation

A hypothetical wind-up/solvency valuation is intended to reflect the status of the Plan as if it had been wound up on the valuation date and the Plan members had been provided with the benefits specified by the Plan and the *PBSA*. The purpose of this valuation is to show the degree of benefit security provided for all of the Plan members’ accrued benefits by the current assets of the pension fund. The valuation does not take into consideration the probability of wind-up, which we believe to be very low for this Plan, given the quasi-public sector nature of WSBC.

The hypothetical wind-up/solvency valuation reflects current transfer value assumptions and market annuity interest rates; these differ from those required at the time of the previous valuation.

Investment Return and General Salary Increase Rates

Our actuarial costing method involves projecting future benefit disbursements and investment income. In such projections, the most significant assumptions are those that are made for the future rates of return to be earned by the fund and the future general salary increases (which are across-the-board increases applying to employees regardless of service, rank or position).

We have assumed that the investment return of the fund, net of investment-related expenses, would be at a rate of 5.65% per annum compounded annually over the future long term. Since the *PBSA* now requires an explicit PfAD to be added to the going concern liabilities, this investment return is now determined on a best estimate basis. In the previous valuation, the investment return assumption was reduced to provide an implicit margin in the liabilities, resulting in an assumption of 5.65% with margin and 6.10% on a best estimate basis.

The discount rate was determined using Eckler’s 2020 funding discount rate model. Our model determined expected long term capital market returns, standard deviations and correlations for each major asset class (universe bonds, Canadian equities, global equities, etc.) by using historic returns, current yields and forecasts. We then stochastically generated projected asset class returns for 5,000 paths over 30 years to create expected returns for each asset class. The expected going concern return (before diversification and rebalancing) is the return at the median of each asset class weighted by the Plan’s target asset mix.

Further adjustment is made to reflect the diversification and rebalancing effect (the discipline of rebalancing at intervals to the plan’s target asset mix provides a mechanism for “selling high and buying low” that is expected to enhance the fund’s return over the long term).

For the purposes of establishing the discount rate used in this report, we have assumed that there will be no added-value returns from employing an active management strategy in excess of the associated additional investment management fees.

Based on these key economic expectations over the long term, adjusting for expenses, the going concern discount rate assumption has been developed as follows:

Going Concern Discount Rate

	Discount rate
Expected return, before diversification and rebalancing effect and before allowance for active management	5.55%
Diversification and rebalancing effect	0.30%
Additional return expected from active management	0.45%
Subtotal	6.30%
Provision for investment related expenses (passive management)	(0.15%)
Provision for investment related expenses (active management)	(0.45%)
Rounding	(0.05%)
Discount return assumption	5.65%

The total investment expense allowance of 0.60% was provided by BCI and allows for both active and passive management fees. BCI also provided a split of 0.15% for passive management and 0.45% for active management.

a) Real return and salary relationships - derive salary assumption

The 5.65% investment return assumption used in the 2017 valuation was viewed as consisting of a real return component of 3.4% per annum plus a long-term underlying inflation assumption of 2.25% per annum. We continued with the same real return component of 3.4% for this valuation and obtain the same long-term underlying inflation assumption of 2.25% per annum.

The general salary increase assumption used in the 2017 valuation was 2.75% per annum. This was viewed as consisting of the underlying inflation assumption of 2.25% per annum, plus a real salary increase component of 0.5% per annum. We continued with the same real salary increase component of 0.5% and obtain the same general salary increase assumption of 2.75%.

b) Summary of interrelationships

The 2019 and 2017 annual investment return and general salary increase assumptions, and their underlying economic interrelationships, are summarized below.

	2017 and 2019 Valuations
1. Investment return	5.65%
2. Real return rate	3.40%
3. Implied underlying inflation = 1 - 2	2.25%
4. Real salary increase	0.50%
5. General salary increase = 3 + 4	2.75%

c) Salary Data and Salary Growth Assumption

The salary data provided to us for this valuation were the actual earnings during 2019. Based on our understanding of the pattern of salary increases during this period, we used these salary amounts without further adjustment as being equal to the salary rates on the valuation date (this may understate very slightly the actual salary rates at the valuation date). Thereafter, the assumed rates of salary increase are applied continuously during each future year.

Because the assumed rate of salary increase is a long-term assumption, we did not adjust it to reflect any specific future salary increases that are agreed to in the near future. To the extent that the assumed salary increase differs from the actual increases during the coming valuation period, gains or losses will emerge at the next valuation.

d) YMPE increase

We also assumed that the YMPE under the Canada Pension Plan would increase at the general salary increase rate of 2.75% per year from its 2019 level of \$57,400. In the previous valuation we assumed that the YMPE would increase at the rate of 2.75% per year from its 2017 level of \$55,300.

Pension Indexing - Valuation of Basic Account

Indexing supplements on and after January 1, 1984 are on an annual basis and are limited to those amounts that can be appropriately financed by the balances available in the Inflation Adjustment Account. Thus we do not need to allow for future indexing in our calculations, as the costs of this indexing are currently fixed at 1% of salaries to be paid by each of the employees and WorkSafeBC. With respect to indexed supplements granted through January 1, 2019, the present values have been included in the actuarial liabilities for pensions in the course of payment and thus form part of the determination of the recommended contribution.

With regard to the vested pensions of members who have terminated employment, the amounts of deferred pensions quoted to us include indexing during the deferred period to date. We understand that such transfers from the Inflation Adjustment Account do not occur until retirement (theoretically, such transfers should be made on an annual basis as the indexing occurs, so as to reduce the inter-generational transfer of the costs of such indexing). We have therefore adjusted the deferred pension amounts to remove this indexing so that the Basic Account liability is aligned with the allocation of assets between the Basic and IAA accounts.

The indexing of salaries before retirement in the case of employees on long-term disability is, on the other hand, a charge to the Basic Account rather than to the Inflation Adjustment Account. Accordingly, in valuing the deferred pensions for those members currently on long-term disability, we have made an allowance for this by applying an escalation assumption (at the full underlying inflation assumption) of 2.25% per annum during the deferral period to retirement.

Asset Values

The fund's audited financial statements record assets on a market value basis. As in previous valuations, we applied a smoothing technique for purposes of the previous actuarial valuation by adjusting the market values over a five year period. We believe a smoothing approach is appropriate as it would cushion the actuarial valuation results against the dramatic swings in market value that can occur.

To determine the smoothed value of assets, we first determine the actual return on the basis of market values during the year after allowing for the net contributions minus benefits and non-investment expenses. We then determine an assumed return for the year at a rate equal to the rounded assumed underlying real interest rate plus the year-over-year change in the consumer price index. The difference between the two returns is then spread over a five year period, recognizing one-fifth of it in each of the current and four succeeding years. This approach effectively spreads the difference between (a) the total investment return (including both realized and unrealized capital changes) and (b) a hypothetical return based on a long-term real interest rate, over a five year period.

The application of this approach to the total fund yields the following results:

Determination of Smoothed Value of Assets

	2017	2018	2019
1. Market value on January 1	1,925,400	2,099,991	2,122,043
2. Net contributions (contributions less benefits and non-investment expenses)	(26,167)	(28,188)	(26,712)
3. Expected interest	103,265	114,724	120,195
4. = 1 + 2 + 3	2,002,498	2,186,527	2,215,526
5. Market value on December 31	2,099,991	2,122,043	2,358,469
6. Excess (shortage) of market over assumed returns = 5 - 4	97,493	(64,484)	142,943
7. Withheld from current year (T) excess = item 6 of year T x 4/5	77,994	(51,587)	114,354
8. Withheld from excess in year T-1 = item 6 of year T-1 x 3/5	5,918	58,496	(38,690)
9. Withheld from excess in year T-2 = item 6 of year T-2 x 2/5	26,849	3,946	38,997
10. Withheld from excess in year T-3 = item 6 of year T-3 x 1/5	18,727	13,424	1,973
11. Total amount withheld (added) = 7 + 8 + 9 + 10	129,488	24,279	116,634
12. Smoothed asset value on December 31 = 5 - 11	1,970,503	2,097,764	2,241,835

Total Fund Smoothing

December 31	2016	2017	2018	2019
1. Dec-over-Dec increase in CPI	1.5%	1.9%	2.0%	2.2%
2. Base return = (1) + 3.5%	5.0%	5.4%	5.5%	5.7%
Year-end asset values (\$,000's)				
3. Market value	1,925,400	2,099,991	2,122,043	2,358,469
4. Smoothed value	1,819,703	1,970,503	2,097,764	2,241,835
5. Ratio of (4) ÷ (3)	94.5%	93.8%	98.9%	95.1%
Annual returns				
6. Market value	5.5%	10.5%	2.4%	12.5%
7. Smoothed value	9.6%	9.8%	8.0%	8.2%

Using the relationship between the market and adjusted values shown in line 5 above, and applying this relationship to the Basic Account and Inflation Adjustment Account balances, we get:

Basic Account (\$,000's)	December 31, 2019
8. Market value	1,957,548
9. Smoothed value	1,860,741
10. Ratio of (9) ÷ (8)	95.1%
Inflation Adjustment Account (\$,000's)	
11. Market value	400,921
12. Smoothed value	381,094
13. Ratio of (12) ÷ (11)	95.1%

The figures above indicate that the smoothed asset value is 4.9% lower than the market value as at December 31, 2019. This is a slight decrease in smoothing cushion relative to the last valuation, when the smoothed asset value was 6.2% lower than the market value. The small decrease occurred because the cumulative market value returns in the 3 years prior to the last valuation were slightly higher than the cumulative market value returns during the inter-valuation period. The financial position of the plan has improved significantly due to the performance of the assets on both a market value basis and a smoothed value basis.

Mortality

A key demographic assumption is the longevity of the plan members. For this valuation, Club Vita Canada’s 2019 VitaCurves were used (CV19 VitaCurves), with generational projection using the CPM-B improvement scale.

VitaCurves are baseline mortality rates that vary by member based on their individual longevity characteristics and have been developed using a generalized linear modelling framework. (More details on the methodology can be found in the Canadian Institute of Actuaries member’s paper: Key Factors for Explaining Differences in Canadian Pensioner Baseline Mortality.) The CV19 VitaCurves have been calibrated based on Club Vita Canada’s longevity dataset for the years 2015-2017. Club Vita Canada’s longevity dataset is composed of a subset of Canadian registered pension plans across Canada, and includes plans covering a range of industries in both the private and public sector. Club Vita Canada’s CV19 VitaCurves have been developed based on longevity experience consisting of 2.1 million exposure years and 54 thousand deaths over 2015-2017, and vary by the following longevity factors:

- Gender;
- Pensioner type - pensioner or surviving spouse;
- Disability status at retirement for pensioners - disabled or non-disabled pensioner;
- Postal code-based lifestyle/longevity group - five groups for each of males and females;

- Affluence as measured by pension amount or earnings - there are three pension bands for males and females, while there are four earnings bands for males and three for females; and
- Occupation type - currently or formerly employed in a blue or white collar occupation; and
- Pension form at retirement for pensioners - single life or joint life.

Given that the availability of longevity factors varies by plan, and also by members within a plan, the CV19 VitaCurves are calibrated based on different combinations of the factors outlined above, resulting in over 500 baseline mortality tables. The best VitaCurve is assigned to each individual member based on the longevity factors available for that member.

An aggregate ill health VitaCurve is assigned for all current active disabled members, for pensioners who retired on account of disability, and after incidence of disability for those assumed to become disabled in the future.

For deferred vested pensions, mortality was ignored during the deferral period before retirement. The same assumption was used in the previous valuation.

In the previous valuation, the assumed rates of mortality were based on Club Vita Canada’s CV16 VitaCurves, also projected using CPM-B improvement scale, with the exception that the CPM-B improvement scale was not used for disabled lives.

Withdrawal

We examined the rates of withdrawal for reasons other than death, retirement or disability over the period April 1, 2017 to December 31, 2019 and compared this with the experience observed and the rates used for previous valuations. We made modest changes to the withdrawal rates used for the previous valuation, by adopting the following multiples of those rates:

Multiples Applied to 2017 Withdrawal Rates

	In the first 3 years of service			After 3 years of service
	1 st year	2 nd year	3 rd year	
Males	100%	100%	100%	110%
Females	100%	100%	100%	105%

Sample withdrawal rates are shown in the following tables. The withdrawal rates applicable in the first 3 years of service include terminations from disability.

Withdrawal Rates Applicable in the First 3 Years of Service (including terminations from disability)

Age at entry	2017 valuation			2019 valuation		
	1 st year	2 nd year	3 rd year	1 st year	2 nd year	3 rd year
Males						
20	.177	.141	.136	.177	.141	.136
30	.091	.086	.089	.091	.086	.089
40	.084	.075	.062	.084	.075	.062
50	.067	.051	.055	.067	.051	.055
Females						
20	.112	.122	.147	.112	.122	.147
30	.106	.122	.127	.106	.122	.127
40	.074	.074	.053	.074	.074	.053
50	.059	.060	.049	.059	.060	.049

Withdrawal Rates Applicable After 3 Years of Service

Attained age	2017 valuation		2019 valuation	
	Males	Females	Males	Females
23	.134	.124	.148	.130
33	.047	.072	.052	.076
43	.023	.030	.025	.032
53	.014	.014	.015	.014

The withdrawal rates we have used do not extend past age 54. They are the same as those used for the March 31, 2020 valuation under the BC Public Service Pension Plan, as we believe that the withdrawal experience of this Plan is likely to be similar to the experience of the BC Public Service Pension Plan, and that it is reasonable for this Plan to use the same assumption.

Disability

The Plan provides for the continued accrual of pension benefits for employees receiving long-term disability benefits. We examined the experience of employees going on long-term disability and in some cases increased the rates used in the previous valuation. We have continued to value the disability cost for active employees as a deferred pension (indexed before retirement) with continued accrual of service, and we have continued to assume that the deferred pensions would commence at age 65.

Sample disability rates are shown in the following table. No direct allowance is made for the possibility of an individual recovering from disability prior to retirement - the rates used have been reduced from the observed disability incidence to implicitly allow for such recoveries. The rates adopted are the same as those used for the March 31, 2020 actuarial valuation for the BC Public Service Pension Plan, as we believe that the disability experience of this Plan is likely to be similar to the experience of the BC Public Service Pension Plan, and that it is reasonable for this Plan to use the same assumption.

Sample Disability Rates

Age	2017 Valuation		2019 Valuation	
	Males	Females	Males	Females
25	.0003	.0001	.0003	.0001
35	.0004	.0011	.0004	.0013
45	.0023	.0037	.0027	.0041
55	.0075	.0100	.0089	.0112

The rates used for the 2019 valuation are 230% for males and 190% for females of the respective rates used for the valuation of the Pension Plan for the Public Service of Canada as at March 31, 2011. The previous valuation used 195% for males and 170% for females of the respective rates used for the valuation of the Pension Plan for the Public Service of Canada as at March 31, 2011.

Retirement

We examined the 2017-2019 retirement experience and compared this with the experience observed in our previous analyses of the retirement rates and with the rates used in the previous valuation. In general, the actual experience shows fewer retirements than were expected on the basis of the rates used in the previous valuation. We gave partial recognition to the observed experience by making modest adjustments at some ages to the rates previously used.

The rates used in this and the previous valuations, are as follows:

Rates of Retirement

Age	Service	2017 valuation		2019 valuation	
		Males	Females	Males	Females
For unreduced retirement pensions					
55 - 59	rule of 90	.40	.70	.35	.65
60	10	.26	.32	.24	.32
61	10	.18	.23	.16	.20
62	10	.16	.20	.16	.17
63	10	.21	.18	.21	.18
64	10	.23	.23	.20	.21
65	0	1.00	1.00	1.00	1.00
55 - 59	at least 10 years, but not rule-of-80	.06	.06	.05	.06
55 - 59	rule-of-80	.10	.10	.10	.10

Even though pensions (unreduced and reduced) are available with less than 10 years of service, we have continued to apply the retirement rates before age 65 only to those with 10 or more years of service, on the assumption that those with fewer than 10 years would not retire until the age 65. Adding an assumption allowing for retirement with less than 10 years based on observed experience would not have a material impact on the results.

Seniority Salary Scales

Seniority salary increases are in addition to the general salary increases and are intended to reflect increasing seniority, recognition of merit and promotion. We examined the seniority salary scales based both on the earnings history of the active members during the intervaluation period and on the graduated average salaries of the active members as of December 31, 2019, and compared these with the experience observed and rates used in the previous valuation. Based on these investigations we decided to continue with the previous salary scales.

The annual seniority increases are assumed to reduce with age. Sample seniority increase assumptions at key ages are shown below. The assumptions represent the assumed seniority increase in the next year.

Sample Seniority Salary Rate Increases

Age	2017 and 2019 valuations	
	Males	Females
25	.037	.029
35	.016	.015
45	.007	.009
55	.003	.004
65	.000	.000

Proportions of Contributors Married at Death

Since the pre-retirement death benefit is 100% of the commuted value of the earned pension, the benefit does not differ by single vs. married status, and thus this assumption is not relevant.

Expenses

Administration expenses are paid out of the pension fund. These amounts (excluding investment-related expenses) totalled 0.49%, 0.48% and 0.45% of salaries for the 2017/18, 2018/19 and 2019/20 fiscal years to March 31 respectively. Projected expenses provided by the Pension Corporation for the next few years indicate that estimated administration expenses will increase. Accordingly, we increased the expense provision to 0.55% of payroll, from the allowance of 0.45% of payroll used in the previous valuation. This provision is added to the current service cost.

The investment management fees are excluded from our analysis above. They are reflected in the long-term investment return assumption.

Recognition of Child-Rearing Periods for Pension Eligibility

We assumed this would only affect female members, and that, on average, it would increase the member's contributory service (which is used for determining pension eligibility) by 2 years; there would, of course, be no increase to the member's pensionable service (which is used for determining pension amounts). The impact of this would be to reduce the eligibility requirement for unreduced pensions between ages 55 and 59, from a rule-of-90 to a rule-of-88. We assumed that there would be no impact on the eligibility assumptions made for other benefits. The same assumption was made in the previous valuation.

Voluntary Contributions

As in the 2017 valuation, this is not a material figure, and we have ignored it in the valuation balance sheet.

Maximum Pension Rule

The tax-registered provisions of the pension plan limit the amount of pension as required by the *ITA*, in respect of service after 1991. The maximum annual pension currently permitted is the lesser of:

- i. \$3,025.56 in 2019 multiplied by the years of service (adjusted as described below); and
- ii. 2% multiplied by the years of service further multiplied by the average of the best 3 years of remuneration paid to the member.

While the Plan applies the *ITA* limits only in respect of service after 1991, we have, for ease of calculation, assumed that this limit applies on all service; this assumption does not affect the current service costs, but the accrued liabilities will be slightly understated. The Plan also imposes a 35 year cap on accruals at the above maximum rate, which we have applied.

For an individual in this Plan to be currently affected by the \$3,025.56 maximum, the final average salary must be very high; while current salaries are not such as to cause many problems, the salaries projected in the future through application of the assumed salary increase rates outlined above are such that more individuals would be limited. However, under the income tax rules, the flat \$3,025.56 limit is automatically indexed each year after 2019 in accordance with increases in the average wage (at the previous valuation the corresponding dollar limit was \$2,914.44). Accordingly, we have applied a 2.75% per annum increase to the \$3,025.56 limit after 2019 (the same rate was applied in the previous valuation).

While the provisions of the Plan limit the normal formula benefits to the *ITA* maxima, the excess benefits are paid under the Part 11 provisions via the Supplemental Benefit Account. Even though no assets are to be accumulated in this account, WorkSafeBC may still need to recognize a liability for these excess benefits in its

financial statements for the Accident Fund. Accordingly, we have also calculated the liabilities and costs ignoring the *ITA* limits.

It should also be noted that, in the tax-limited results, we valued the deferred vested pensions in full as provided to us, i.e. we were unable to carve out any “excess” portions. This will slightly overstate the accrued liabilities, but the impact should be minimal when combined with the slight understatement mentioned above resulting from applying the *ITA* limits on all service.

Treatment of Inflation Adjustment Account

Our valuation of the liabilities deals primarily with the basic non-indexed benefits covered under the Basic Account; the Inflation Adjustment Account is “ignored” on the basis that it is akin to a defined contribution or money-purchase account, used to provide indexing. Where there are sufficient monies in the IAA, full CPI indexing is provided; alternatively, if the monies in the IAA cannot provide full CPI indexing, then the amount of indexing is limited to the monies available. In either case, the mechanics are such that the capitalized value of the indexing granted is transferred from the IAA to Basic, each time indexing is granted.

For disclosure purposes in WorkSafeBC’s financial statements for the Accident Fund, the Inflation Adjustment Account component is treated as if it is a defined contribution plan, with liabilities set equal to the assets, i.e. the Inflation assets are added to both the Basic assets and liabilities. The net effect of this is neutral on the actuarial excess (unfunded liability) calculated for the Basic Account. Consistent with the 2017 valuation, we included the Inflation Adjustment Account assets with offsetting liabilities exactly equal to these assets.

Testing of Income Tax Maximum Surplus and Contribution Limits

The foregoing assumptions deal with the regular liabilities under the Basic Account. For purposes of testing the Plan surplus and current service contribution requirements against the maximum permissible *ITA* limits, we also carried out a subsidiary valuation assuming the pensions are fully indexed to inflation. In this scenario, we made the following changes to the regular valuation:

- We combined the assets in the Basic and Inflation Adjustment Accounts;
- We applied an indexing assumption equal to the full assumed underlying inflation rate, i.e. 2.25% per annum, effective January 1, 2020 and annually thereafter both to pensions after retirement and during the pre-retirement period in the case of deferred vested pensions and disability salary accruals, with the exception that we adjusted the January 1, 2020 indexing to pensions in payment as of the valuation date from the assumption of 2.25% to the actual cost of living increase granted of 1.9%; and
- In determining the employer portion of the current service costs, we combined the employee contributions to the IAA with those to the Basic Account, i.e. we assumed a total employee contribution rate of 7% + 1% = 8% (reduced by 1.5% of salaries below the YMPE).

Actuarial Cost Method

We have continued with the approach used in the previous valuation, namely, the Accrued Benefit Actuarial Cost Method. Under this approach, the actuarial present value of benefits earned for service before the valuation date, including projected future salary increases, is compared with the assets on hand to determine the unfunded actuarial liability or actuarial excess, as the case may be.

With regard to current service costs, the actuarial present values for benefits to be earned for service after the valuation date are calculated only for the one year following the valuation date to determine the rate of contribution required to finance currently accruing benefits. This cost will rise as an individual ages and gets closer to retirement. For the group as a whole this step-rate increase in cost is mitigated by the addition of younger new entrants to the plan but, to the extent the group ages, costs can be expected to rise.

The intent of this method is to accumulate assets systematically to provide security for the benefits provided in respect of service that has already been rendered, without further recourse to any other assets; of course, such security is not guaranteed.

PBSA Framework for the Funding Valuation of a Defined Benefit Provision

The *PBSA* sets out a framework for the going concern valuation of a Defined Benefit Provision which contains several key elements:

“Provision for Adverse Deviation Percentage” (“PfAD%”) is a specific percentage, defined by in the legislation as the greater of 5% or 5 times the long-term bond rate¹. This percentage is applied to the going concern liability to provide a buffer, or Provision for Adverse Deviation (“PfAD”), against adverse experience. The PfAD% is also applied to the current service cost, unless the plan has Accessible Going Concern Excess (see below).

“Accessible Going Concern Excess” means the amount by which going concern asset value exceeds 105% of the Going Concern Liabilities $\times (1 + \text{PfAD}\%)$

“Accessible Solvency Excess” means the amount by which the solvency assets value exceeds 105% of the solvency liabilities.

¹ The PfAD% may be lower if the plan has less than 30% invested in non-fixed income.

For this Plan, the funding requirements from the PBSA are:

- Monthly amount equal to 1/120 of the amount, if any, by which the going concern assets is less than the amount determined by the following formula: $\text{Going Concern Liabilities} \times (1 + \text{PfAD}\%)$, plus
- Monthly amount equal to 1/60 of the amount, by which 85% of the solvency liabilities exceeds the sum of the solvency assets and solvency asset adjustment, plus
- Current service cost, plus
- If there is no Accessible Going Concern Excess additional monthly contributions equal to: $\text{PfAD}\% \times \text{current service cost}$.

If the plan has an Accessible Going Concern Excess, then it is possible under the *PBSA* to consider improvements to accrued benefits, distribution as provided by the plan text, or Accessible Going Concern Excess may be left in the plan as a further contingency reserve.

Hypothetical Wind-up / Solvency Valuation

Under the *PBSA*, certain certifications are required with respect to the hypothetical wind-up/solvency position of the Plan. These are needed for a variety of reasons, including: (a) to ensure minimum funding requirements are met, and (b) to determine whether transfers of commuted values in respect of terminating or deceased members can be made in full, immediately, as these may be restricted by the “solvency” position of the Plan.

For this purpose, liabilities must be determined on a “plan termination basis”. The Standards of Practice – Practice Specific Standards for Pension Plans issued by the Canadian Institute of Actuaries require the actuary to postulate a scenario upon which a hypothetical wind-up valuation is based. For this purpose, when calculating the wind-up/solvency liabilities, we have assumed the plan has terminated due to the insolvency of the Plan sponsor (although we believe this scenario is very unlikely). Note that the liabilities would be the same even if a different termination scenario was used.

As with the prior valuation, we used the unit credit method. Under this method, the actuarial liabilities consist of the present value of pensions in payment and vested deferred benefits for terminated employees.

The Plan text indicates that for purposes of testing the *PBSA* solvency rules, benefits are to be calculated as follows:

- all active members are deemed to be terminated and 100% vested;
- benefits are calculated only on the basis of earnings and service frozen at the valuation date;
- future indexing should be ignored, both before and after retirement; and
- the Inflation Adjustment Account continues to be recognized on a defined-contribution basis with liabilities set equal to the assets, as for the going-concern valuation.

Accordingly, we have applied the following changes to the actuarial assumptions in determining the hypothetical wind-up/solvency status of the Plan as at December 31, 2019:

- all non-terminated members assumed to be terminated and 100% vested in their accrued pensions as at December 31, 2019;
- for those inactive and deferred vested members with incomplete data, we assumed their hypothetical wind-up/solvency liability to be equal to twice the employee regular contributions with interest balance;
- for all other active, disabled and deferred vested members, liabilities are determined as deferred vested pensions payable at age 55 if the member is now below age 55, or as an immediate pension if the member is now over age 55, subject to the regular 3% or 5% per year early retirement reductions below age 60, as applicable, based on actual average earnings over the last 5 years (or such shorter period of plan membership) and the 2019 YMPE of \$57,400;
- interest: 2.4% per annum for 10 years, 2.5% per annum thereafter for actives, deferred vested and LTD members below age 55 (2.3%/3.9% was used at the previous valuation); for pensioners and other non-retired members aged 55 and over, we used a flat rate of 2.95% (based on a duration for these liabilities of 11.0 years) throughout as a proxy to immediate annuity purchase rates (a flat rate of 3.2% was used in 2017, based on a duration for these liabilities of 11.0 years);
- mortality: for all members, the 2014 Canadian Pensioners Mortality Table (CPM2014) combined with projection scale CPM Improvement Scale B (CPM-B) on a sex distinct basis (the same assumption was used in the previous valuation); for non-retired members and former members, mortality is ignored before assumed pension commencement date; and
- wind-up expenses: \$1,200,000 assumed; subtracted from the assets. The allowance has been developed as our expectation of best estimate allowance for expenses which would be expected for termination of the plan based on the Plan provisions and our experience with other similar plans, and an assumption that the plan wind-up will occur within 12 months following the valuation date. The same wind-up expense allowance of \$1,200,000 was included at the previous valuation.
- as required, we used the market value of assets for the hypothetical wind-up/solvency valuation (the market value of assets was also used at the previous valuation).

Emerging Experience

It should be noted that emerging experience differing from the assumptions described above will result in gains or losses that will be revealed in future valuations.

Appendix E Going Concern Valuation Balance Sheet

The results of the valuation as of December 31, 2019 with respect to benefits accrued for service to the valuation date are set out below. The March 31, 2017 results are shown for comparison. The cost of benefits for future service subsequent to the valuation date is dealt with in Appendix F.

The Basic Account liabilities include the capitalized value of indexing supplements granted through January 1, 2019, but exclude future indexing to be granted after the valuation date. The inflation granted as of January 1, 2020 is excluded to be consistent with the assets, which exclude the transfer from the Inflation Adjustment Account to cover the cost of that indexing. The Inflation Adjustment Account liabilities are set equal to the Inflation Adjustment Account assets.

Going Concern Valuation Balance Sheet

(\$,000's)	March 31, 2017	December 31, 2019
Assets (smoothed value)		
1. Basic Account	1,538,077	1,860,741
2. Inflation Adjustment Account	319,890	381,094
3. Total Assets	1,857,967	2,241,835
Liabilities		
4. Actuarial present values of Basic Account (non-indexed):		
a) active employees	545,829	573,415
b) disabled employees	56,949	67,371
c) inactive employees (deferred pensions and refunds)	33,739	34,682
d) pensions in payment	552,012	668,620
5. Basic Account sub-total	1,188,529	1,344,088
6. PfAD = 8.35% x (5)	n/a	112,231
7. Inflation Adjustment Account	319,890	381,094
8. Total Liabilities	1,508,419	1,837,413
Actuarial excess (Unfunded Liability)		
9. Actuarial excess (unfunded liability) = 3 - 8	349,548	404,422
10. Going Concern Funded Ratio = 1 / (5 + 6)	129.4%	127.8%
11. Accessible going concern excess = 9 - (5 + 6) x 0.05	290,122	331,606

If the market value of assets were to be substituted for the smoothed value, the actuarial excess would increase to \$501,229,000.

Excess (Income Tax) Benefit Liabilities

The above liabilities and actuarial excess recognize the maximum Income Tax limits on benefits from the registered portion of the pension plan. If these limits are ignored (the excess benefits are currently provided through the Supplemental Benefit Account, which does not accumulate any assets), the liabilities (including PfAD) would increase by \$18,356,000 to \$1,474,675,000 and the actuarial excess would reduce to \$386,066,000.

Reconciliation with Previous Valuation

The previous valuation at March 31, 2017 indicated an actuarial actuarial excess of \$349,548,000, compared to the actuarial excess of \$404,422,000 for this valuation. The change in actuarial position can be traced in an approximate fashion (with all values adjusted for interest to December 31, 2019) as follows:

Change in Actuarial Position

		Approximate Effect on Actuarial excess (\$,000's)
1. Actuarial excess at March 31, 2017		349,548
2. Interest @ 5.65% on item 1 for 2.75 years		57,034
3. Investment income (on smoothed values) greater than 5.65%		133,807
4. Actual salary and YMPE higher than previously assumed		(5,585)
5. Actual WorkSafeBC contributions lower than current service cost rate		(34,819)
6. Assumption changes		
withdrawal rates	3,225	6,749
disability rates	1,461	
retirement rates	535	
VitaCurve update	6,946	
Inclusion of improvement scale on disabled lives	(5,418)	
7. Loss from inclusion of PfAD		(112,231)
8. Other factors including changes in plan membership and other differences between actuarial assumptions and actual experience during the inter-valuation period		9,919
9. Actuarial excess at December 31, 2019		404,422

The main sources of gain/loss were as follows:

- The smoothed rate of return over the inter-valuation period was about 8.5% per annum, compared to the 5.65% per annum going concern investment return assumption, generating a gain of \$133.8 million (item 3).
- As discussed in Appendix B, actual cumulative salary increases over the inter-valuation period were higher than the valuation assumption. Combined with the lower than expected YMPE increases, this generated a loss of \$5.6 million (item 4).
- WorkSafeBC and the employees both contributed to the Basic Account at a rate of 7% integrated each during the inter-valuation period. The total contributions to the Basic Account were less than the current service cost indicated by the previous valuation, decreasing actuarial excess by about \$34.8 million (item 5).
- The assumption changes combined to increase the actuarial excess by about \$6.7 million (item 7). The update to the Club Vita Canada's 2019 VitaCurves for the mortality assumptions increased the actuarial excess, along with changes to the retirement, withdrawal and disability rate as a result of the recent history of gains on the previous assumptions, partially offset by a reduction in the excess due to the inclusion of the mortality improvement scale for disabled lives.
- The addition of the required PfAD reduced the actuarial excess by \$112.2 million, although it should be noted that the going concern discount rate of 5.65% assumed at the March 31, 2017 valuation included a margin for adverse deviation of 0.45%, whereas the going concern discount rate of 5.65% assumed at this valuation represents a best estimate assumption.
- The remainder, an increase in actuarial excess of about \$9.9 million, is due to changes in plan membership, other differences between actuarial assumptions and actual experience during the inter-valuation period and other miscellaneous experience gains and losses. The amounts mainly relate to the actual experience compared to expected for the demographic decrements, and the individual amounts are not material to the gain/loss as a whole.

Thus, the major factors leading to the net increase in the actuarial excess may be summarized as investment income earned at a rate higher than the rate assumed in the previous valuation, partially offset by the actual contributions lower than current service cost and the inclusion of PfAD.

Sensitivity Analysis

Below we show the going concern actuarial liability and the current service cost as at December 31, 2019 based on a one percentage point drop in the going concern discount rate assumption. All other assumptions were kept unchanged.

The liability increase per member group is as follows:

Impact on liabilities of 1% drop in discount rates	Going Concern 5.65% (\$,000's)	Going Concern 4.65% (\$,000's)	Increase (\$,000's)
Active members	573,415	677,054	103,639
Disabled members	67,371	81,804	14,433
Deferred members	34,682	39,948	5,266
Pensioners and beneficiaries	668,620	731,479	62,859
Totals	1,344,088	1,530,285	186,197

The increase in the current service cost as percentage of salaries (integrated) is as follows (see Appendix F for more details on the current service cost):

Appendix F Costs for Future Service

The contribution rate required to fund the Basic Account benefits attributable to service on and after January 1, 2020 is 18.11% of salaries (less 3.0% of salaries up to the YMPE). This rate is calculated using the accrued benefit method.

The total current service cost rate calculated in the previous valuation was 18.51% of salaries (integrated). The change from the 18.51% rate to the 18.11% rate indicated by this valuation can be traced as follows:

Change in Total Basic Account Current Service Rate

	Approximate Effect on Current Service Cost
1. March 31, 2017 integrated total Basic Account current service cost rate	18.51%
2. Changes in membership profile from 2017 to 2019	(0.49)
3. Assumption changes:	
• withdrawal rates	(0.07)
• disability rates	0.04
• retirement rates	(0.03)
• VitaCurve update	(0.03)
• Inclusion of improvement scale on disabled lives	0.08
4. Administration Expense allowance	0.10
5. December 31, 2019 integrated total Basic Account current service cost rate	18.11%

As the going concern funded ratio exceeds 105%, the PBSA does not require the PfAD to be added to the current service cost. The PfAD on the current service cost would otherwise be 1.51% of salaries. The present value of this PfAD over 3 years is approximately \$11.8 million.

Assuming that employee contributions continue to be made at the rate of 7% of salaries (integrated), WorkSafeBC's portion would be 11.11% (integrated).

The 18.11% integrated rate deals only with the combined employer and employee current service contribution rates for the Basic Account. Both WorkSafeBC and the employees are, in addition, required to pay 1% of salaries each to the IAA, for a total of 2%.

On the basis of the valuation data and assumptions, and assuming that the covered active membership remains constant, the projected payroll rate as at December 31, 2019 is \$271,384,000. The annual current service costs calculated as at December 31, 2019, and based on that payroll, are as follows:

Current Service Cost

	Basic Account		IAA		Total
	Rate	\$ at December 31, 2019	Rate	\$ at December 31, 2019	\$
Employees	7.0% integrated	16,387,000	1.0%	2,714,000	19,101,000
WorkSafeBC	11.11% integrated	27,541,000	1.0%	2,714,000	30,255,000
Total	18.11% integrated	43,928,000	2.0%	5,428,000	49,356,000

The foregoing amounts recognize the maximum Income Tax limits on benefits. If these limits are ignored, the 18.11% integrated total Basic Account current service cost would increase by 0.12%, to 18.23% integrated.

Impact on current service cost rate of 1% drop in discount rates	Going Concern 5.65%	Going Concern 4.65%	Increase
Current service cost rate	18.11%	21.68%	3.57%

Appendix G Hypothetical Wind-up / Solvency Balance Sheet

The results of the wind-up/solvency valuation as of December 31, 2019 on the basis of the solvency assumptions described in Appendix D are set out below. Comparative results for March 31, 2017 are also included.

Hypothetical Wind-up / Solvency Balance Sheet as at December 31, 2019

(\$,000's)	March 31, 2017	December 31, 2019
Basic Account Assets		
1. Basic Account Assets at Market Value	1,639,426	1,957,548
2. Wind-up expenses	(1,200)	(1,200)
3. Hypothetical Wind-up/Solvency Assets¹	1,638,226	1,956,348
Basic Account Liabilities		
4. Actuarial present values of:		
a) active employees	763,621	844,907
b) disabled employees	85,772	98,467
c) inactive employees (deferred pensions and refunds)	47,786	53,638
d) pensions in payment	699,662	872,755
5. Hypothetical Wind-up/Solvency Liabilities	1,596,841	1,869,767
Surplus (Deficiency)		
6. Hypothetical Wind-up/Solvency surplus/(deficit) = 3 - 5	41,385	86,581
7. Solvency ratio = 3 / 5	102.6%	104.6%

On the basis of the solvency methods and assumptions described in Appendix D, in our opinion, the value of the plan assets would be greater than the actuarial liabilities if the plan were to be wound up on the valuation date. The surplus would have been \$86,581,000.

¹ The IAA assets and liabilities, which are equal to the assets, have not been included in the solvency balance sheet, because the indexing is not a guaranteed benefit. Including the IAA would not affect the solvency deficiency, but would increase the solvency ratio.

The breakdown of active and disabled members' solvency liabilities between those assumed to take a commuted value on plan termination and those assumed to elect an annuity purchase is as follows:

Actuarial Liabilities (\$,000's)	Actives	Disabled
Assumed to take an annuity	424,485	63,638
Assumed to take a commuted value	420,422	34,829
Total liabilities	844,907	98,467

Solvency Ratio and Transfer Deficiencies

The solvency ratio for the plan is 104.6%, which is greater than 100%. Under the *PBSA*, if a plan has a solvency deficiency (a "solvency ratio" less than 100%), there are limits on the amounts that may be transferred out of the Plan. Since the solvency ratio is greater than 100%, amounts transferred from the Plan may be paid in full.

Sensitivity Analysis

Below we show the impact on the solvency liabilities as at December 31, 2019 of a one percentage point drop in the discount rate assumption.

- interest for those assumed to take a commuted value - reduced from 2.4% per annum for 10 years and 2.5% per annum thereafter to 1.4% and 1.5% respectively;
- interest for those assumed to take an annuity - reduced from 2.95% per annum to 1.95% per annum.

All other assumptions were kept unchanged.

Impact on liabilities of 1% drop in discount rates	Solvency 2.4% for 10 years / 2.5% thereafter and 2.95% (\$,000's)	Solvency 1.4% for 10 years / 1.5% thereafter and 1.95% (\$,000's)	Increase (\$,000's)
Active members	844,907	998,918	154,011
Disabled members	98,467	114,349	15,882
Deferred members	53,638	62,787	9,149
Pensions in payment	872,755	973,551	100,796
Total	1,869,767	2,149,605	279,838

Incremental Cost

In accordance with the Canadian Institute of Actuaries' Standard of Practice, we have estimated the incremental cost of the solvency liability as at December 31, 2019. This is the expected aggregate change in solvency liability between December 31, 2019 and the next valuation as of December 31, 2022.

The incremental cost as at December 31, 2019 of amounts funded from the Basic Account is \$181,931,000. This amount makes no allowance for any pension increases that may be granted over the period. The incremental cost does not impact the funding requirements of the Plan under the *PBSA*, and is for information purposes only.

The expected current service cost contributions towards the Basic Account are \$43,928,000 per annum, assuming contributions are increased to the current service cost rates. This is less than the incremental solvency cost over the 3 year period commencing on the valuation date. In other words, if the solvency experience is as expected we would expect a deterioration in the solvency position as of the next valuation date, assuming no other changes in solvency assumptions and that contributions are made at the current service cost rate.

Appendix H Required Contributions

Current Service Cost

Our calculations indicate that the benefits currently accruing will require total contributions to the Basic Account equal to 18.11% of salaries (integrated); based on the current plan rules, this would be allocated as 7% from employees and 11.11% from WorkSafeBC.

Using the projected pensionable payroll as at December 31, 2019 of \$271,384,000, we have estimated that the 18.11% integrated rate will produce an annual contribution to the Basic Account of \$43,928,000 for the calendar year 2020. This figure will vary, of course, depending upon the actual pensionable payrolls.

The following table sets out the estimated contributions, assuming that contributions are made at the current service cost:

Estimated Current Service Cost

		Basic	IAA
Current Service Cost %			
	Employees	7.0 integrated	1.0
	WorkSafeBC	11.11 integrated	1.0
Current Service Cost \$			
	Employees	\$16,387,000	\$2,714,000
	WorkSafeBC	\$27,541,000	\$2,714,000
	Total	\$43,928,000	\$5,428,000

Minimum Contributions

As the Plan is in a surplus position at December 31, 2019 under both the going concern and the solvency valuations, WorkSafeBC may elect to contribute at lower rate, by applying some of the going concern actuarial excess towards its required contribution.

In such a case, the *PBSA* requires that a buffer is set aside equal to 5% of the Basic Account liability, or \$72,816,000. The remaining \$331,606,000 of accessible going concern excess may be used in part or full to reduce contributions. The maximum contribution reduction permitted by the *PBSA* is the amortization of the remaining actuarial excess over a 5 year period. This amounts to a maximum contribution reduction which exceeds the current service cost and, hence, under this measure WorkSafeBC could elect to take a contribution holiday for 5 years from December 31, 2019 and could also elect to provide the members with a contribution holiday for the same period. However, any contribution reduction cannot create a solvency deficiency. Based on the solvency surplus of \$86,581,000, the maximum contribution reduction for the next three years is therefore limited to 11.1%.

Alternatively, WorkSafeBC could elect to retain the accessible going concern excess assets in the fund or use it in part to reduce contributions by up to 11.1%. Under the PBSA, the total contributions to the Basic Account can be any amount between 7.01% and the and Basic Account current service cost of 18.11% of payroll, prior to allowance for the maximum as per the next section.

Written notice of any contribution reduction must be provided to the Superintendent and to the plan members.

Maximum Contributions

At WorkSafeBC's option, WorkSafeBC may choose to fund at a higher level than the current service cost stated above. Based on the Plan's surplus position, the maximum current contribution rate is the current service cost on an indexed basis. Including the IAA contributions, the total indexed current service cost is 24.68% (integrated). Assuming employee contributions remain at 8% (integrated; including IAA contributions), the maximum contribution WorkSafeBC can make is 16.68% (integrated).

More details are provided in Appendix I.

Appendix I Maximum Surplus and Contributions - ITA

Section 147.2(2) of the *ITA* limits employer contributions that may be made to a plan if surplus¹ exceeds a certain amount – the Plan becomes revocable if contributions are made when such surplus exists. This surplus threshold is equal to the lesser of (a) and (b), where

- (a) = the (defined-benefit, i.e. Basic Account) actuarial surplus, and
- (b) = 25% x the (defined-benefit, i.e. Basic Account) actuarial liability

Subsection (c) of Section 147.2(2) of the *ITA* also provides that the benefits taken into account for the purposes of a contribution recommendation “may include anticipated cost-of-living and similar adjustments where the terms of a pension plan do not require that those adjustments be made but it is reasonable to expect that they will be made”.

Indexing at full CPI has been provided since January 1, 1984 under the present plan terms, and for many years before that under earlier plan provisions. As discussed earlier, indexing is currently financed on a mixture of a pay-as-you-go basis (from a matching 1% employee/WorkSafeBC contribution for active members), an excess interest basis (interest in excess of the valuation assumption is transferred each year from Basic to IAA in respect of pensioner liabilities), and a “terminally-funded” basis (each year the full capitalized cost of any indexing granted is transferred from IAA to Basic). Thus, it may be considered appropriate for purposes of testing the *ITA* 147.2(2) limits to recognize, in advance, the future indexing of pensions for the present plan membership. Accordingly, we carried out a subsidiary, fully indexed valuation, with modifications to the regular assumptions as described in Appendix D. On this basis, the statement of actuarial position and the future costs shown earlier are revised as shown below (only the summary totals are shown):

¹ For the purpose of this test, the *ITA* terminology, including the word “surplus”, is used.

Statement of Actuarial Position (\$,000's)	Regular Valuation	Fully-Indexed Valuation
Assets (smoothed value)		
1. Basic	1,860,741	n/a
2. IAA	381,094	n/a
3. Total Assets	2,241,835	2,241,835
Liabilities		
4. Basic sub-total with PfAD	1,456,319	n/a
5. IAA	381,094	n/a
6. Total Liabilities	1,837,413	1,867,698
Surplus (Deficit)		
7. Surplus (Deficit) = 3 - 6	404,422	374,137
8a. Funded Ratio = 1 / 4	127.8%	
8b. Funded Ratio = 3 / 6		120.0%

The following table sets out the costs of future benefits:

	Regular Non-Indexed Current Service Cost		Indexed (Maximum Current Service Cost Contributions)
	Basic	IAA	Basic and IAA Combined
Future Cost Rates (%)			
Employees	7.0 integrated	1.0	8.0 integrated
WorkSafeBC	11.11 integrated	1.0	16.68 integrated
Total	18.11 integrated	2.0	24.68 integrated
Future Cost \$			
Employees	\$16,387,000	\$2,714,000	\$19,100,000
WorkSafeBC	\$27,541,000	\$2,714,000	\$42,657,000
Total	\$43,928,000	\$5,428,000	\$61,757,000

The foregoing results indicate that the \$404,422,000 actuarial surplus in the regular valuation decreases to an actuarial surplus of \$374,137,000 when the full value of indexing is recognized on an advance-funding basis. WorkSafeBC's required current service contributions also increase from 11.11% Basic (integrated with the YMPE) plus 1% IAA, to a combined requirement of 16.68% (integrated). On the indexed basis, the *ITA* 147.2(2) surplus limit works out to \$374,137,000. Thus, the Plan does not have an excess *ITA* surplus, and WorkSafeBC contributions - total Basic plus IAA - may be made at a level not exceeding the current service cost rate (on the indexed basis), i.e. at 16.68% (in addition to the total Basic plus IAA employee contributions).

Appendix J Plausible Adverse Scenarios

The following analysis does not impact the funding requirements of the Plan under the *PBSA* and is for information purposes only.

A plausible adverse scenario is considered to be one that will occur in the short term (immediately to one year) with a likelihood of occurring between 1 in 10 and 1 in 20 based on the opinion of the actuary. The purpose of the following scenarios is to illustrate the impact on the Plan’s financial position of the following adverse but plausible assumptions relative to the best estimate assumptions selected for the Plan’s going concern valuation. The purpose of disclosing these results is to demonstrate the sensitivity of the funded status and annual current service cost between December 31, 2019 and the next valuation date to certain key risk factors affecting the Plan. The results of the scenarios selected are shown in the table below with a description of each scenario following.

(\$,000’s)	Going Concern Results at December 31, 2019	Plausible Adverse Scenario Results at December 31, 2019		
		Interest Rate Risk	Deterioration of Asset Values	Longevity Risk
Total smoothed going concern assets	2,241,835	2,246,105	2,196,741	2,241,835
Liabilities	1,837,413	1,835,099	1,829,748	1,860,076
Going concern actuarial excess (unfunded liability)	404,422	411,006	366,993	381,759
Funded Ratio (excluding IAA)	127.8%	128.3%	125.2%	125.8%
PfAD on actuarial liabilities	112,231	89,338	112,231	113,978
Accessible going concern excess	331,606	338,342	294,177	307,810
Total current service cost	18.11%	18.43%	18.11%	18.28%
Discount rate	5.65%	5.55%	5.65%	5.65%
PfAD	8.35%	6.55%	8.65%	8.65%
Market value of assets	2,358,469	2,379,817	2,132,999	2,358,469

Interest rate risk

This scenario illustrates the sensitivity of the funded status of the Plan and current service cost to an immediate change in the market interest rates underlying fixed income investments.

In order to assess the impact of a decrease in interest rates of a magnitude consistent with a 1 in 10 likelihood of occurring, we have used the same stochastic model that is used to determine the going concern discount rate (see Appendix D). The stochastic model is based on 5,000 simulations of projected financial variables, including long term yields on fixed income investments and asset class returns. Our long-term best estimates for these variables, and the going concern discount rate are based on the median values over these 5,000 simulations.

To determine the sensitivity to interest rate risk, and the resulting impact on Plan assets and liabilities, we have:

- considered the hypothetical going concern discount rate over the 500 trials where fixed income yields are lowest at the one-year horizon,
- determined the decrease in median long-term fixed income yields over the 500 trials where fixed income yields are the lowest at the one-year horizon.

As such, under the interest rate risk scenario, the going concern discount rate is decreased by 0.1% per year to 5.55% per year as of December 31, 2019.

With respect to the impact on fixed income assets, the scenario results in a decrease in long term yields on fixed income investments of 0.36%.

Based on the estimated duration of the Plan assets and liabilities, we have then determined the estimated change to the Plan's funded status under the interest rate risk scenario.

Deterioration of asset values

This scenario illustrates the sensitivity of the funded status of the Plan to short-term shock which causes a reduction in the market value of assets, with no change to the liabilities of the Plan. This scenario is assumed not to impact the current expectation of the long-term rate of return, and consequently, the going concern discount rate.

In order to assess the impact of a decrease in asset values of a magnitude consistent with a 1 in 10 likelihood of occurring, we have used the same stochastic model that is used to determine the going concern discount rate (see Appendix D). The stochastic model is based on 5,000 simulations of projected financial variables, including long term yields on fixed income investments and asset class returns.

To determine the sensitivity to a deterioration in asset values, based on the Plan's target asset mix, we have:

- determined the decrease in median investment returns over the 500 trials where investment returns are the lowest at the one-year horizon.

As such, under the deterioration of asset values scenario, the actuarial value of assets (smoothed assets) is decreased by 2.01% as of December 31, 2019. Note that market value of assets is assumed to decrease by 9.56%; the use of smoothed assets decreases the immediate effect of the asset shock.

Longevity risk

This scenario illustrates the sensitivity of the funded status of the Plan to pension plan members living longer than expected. The impact of this scenario was determined using a mortality scaling factor of 90% to the mortality table used for the going concern valuation as of December 31, 2019, that is, a more conservative mortality assumption than currently employed.