



**ECKLER**

# Lakehead University Professional Pension Plan

Benefit Adequacy, Feasibility Analysis & Alternatives and Benchmarking  
Analysis

**Final Report**

November 2020

# Disclaimer

The intended users of this material are the Lakehead University Board of Governors and the Lakehead University Professional Pension Plan Advisory Board. These materials are not intended for, or necessarily suitable for, any other recipient and should not be distributed (in whole or in parts) to persons other than the intended users without consent from Eckler. Eckler does not intend to benefit any third-party recipient of this work product, even if Eckler consents to the release of its work product to such third party. Public information and industry and statistical data are from sources that we deem to be reliable, but we make no representation as to the accuracy or completeness of such information.

This report is not complete without the associated consultant commentary and actions or decisions should not be made in the absence of such commentary.

Outcomes from projections are dependent on the assumptions used. Differences between projections prepared for this report and actual amounts depend upon the extent to which future experience conforms to the assumptions used. Actual experience will not conform exactly to the assumptions; projections may be run under alternative assumptions, if desired.

Simulated investment performance results do not reflect actual trading and active management and have certain other inherent limitations. Actual financial results in future years may not be included among the outcomes presented. Asset liability modeling is one tool used to aid in plan management and decision making. Other tools and fiduciary judgment may also be necessary and appropriate. Projection results are not intended to convey any guarantees as to the future investment performance of markets, managers or the Plan.

The information herein is provided to the fiduciaries of the Plan to aid in their decision-making. Eckler Ltd. is not a Plan fiduciary and accepts no responsibility for actions taken or decisions made that produce unexpected or undesirable results.

# Executive summary

- Our review of the Lakehead University Professional Pension Plan focused on the following main components:
  - Benefit adequacy of current plan
  - Normal Form Pension Factor
  - Retirement Accounts and increases granted to annuities
  - Feasibility analysis of alternative retirement income options (mainly a transfer to an existing JSPP)
- The results of our analysis indicate that there is room to improve the benefit adequacy of the current plan, or that there are alternative retirement income options available that can improve benefit adequacy
  - We note that either would first require an increase to the employer and employee contribution rates. Once the desired contribution rate is reached, possible options can be explored, i.e. either continuing with the current plan, or transferring to a JSPP.
  - Given that the employer contribution rate is a collectively bargained item, our report does not provide recommendations with respect to such changes.
  - If increases to these rates are being contemplated, Eckler can conduct further analysis and benchmarking of member outcomes under the different options, at the level of contribution rates being considered.

# Executive summary

- We recommend that consideration be given to increasing the interest rates used to calculate the Normal Form Pension Factor
  - This will increase the initial pension and increase the attractiveness of the annuity conversion option
  - While current capital market expectations may support a modest increase in the interest rates while limiting the risk to the self-sustaining goal, further analysis (i.e., stress testing) should be conducted on future yield expectations
- Our analysis indicates that changes to the current Retirement Accounts system that grants annuity increases may be limited without negatively impacting the solvency position of the retirement accounts or increasing the cost of the plan
  - We note that given the current funded level of Retirement Account #1, there is a strong probability that it will be depleted within 10 years. Therefore, this issue will have to be addressed.
  - Although funding has been set aside in the Solvency Reserve Account to support these pensions, further review of the Income Tax Rules is required to determine the utilization of the funds in this account for the payment of these pensions.



# Benefit Adequacy

# Benefit adequacy

- To analyze the adequacy of the benefits provided by the contribution rates in the Lakehead Professional Pension Plan, we have used an approach which considers “**Living Standard Replacement Rates**” in addition to traditional “**Basic Replacement Rates**”
- Living Standard Replacement Rates (**LSRR**) evaluate a member’s estimated disposable (or net) income prior to retirement compared to estimated disposable income after retirement
  - Disposable income estimates are unique to each member, and consider factors such as earnings, payroll deductions, housing costs, taxes and health care costs by province, CPP/OAS benefits and family size



- Under this approach, the target LSRR for each member over a full career is **100%** (i.e., post-retirement disposable income/pre-retirement disposable income = 100%)
- For reference, we have also estimated traditional “Basic Replacement Rates”, which focus on gross post-retirement income relative to gross pre-retirement income
  - A typical rule of thumb is a target Basic Replacement Rate of 70%

# Member Outcomes

- The analysis of each member's LSRR is determined stochastically, meaning that we have assessed the LSRR for each of 1000 simulated scenarios for long term projections of key economic and capital market factors
  - Simulated economic and capital market factors include inflation (for example, projecting future earnings), asset class returns (for projecting the rates of return earned on member account balances), and bond yields (for determining the hypothetical income that could be generated from the account balance at retirement)
- Thus for each member, we determine 1,000 scenarios for the values of the LSRR (by determining pre-retirement and post-retirement net income under each scenario), and can thus evaluate the likelihood, or probability, that the LSRR is greater than or equal to 100%
- Where the LSRR is greater than 100% over more than 80% of the simulated scenarios, we say the member has a "very good" chance of hitting the target. Where the LSRR target of 100% is achieved over 60%-80% of scenarios, we say the member has a "good" chance", between 40%-60% is "moderate", between 20%-40% is "low", and where the target is achieved in less than 20% of scenarios, the member is deemed to have a "very low" chance of maintaining living standards



- We can also assess the actual LSRR (rather than the chance of achieving an LSRR of 100% as is described above) over the plan membership

# Data, Assumptions and Methods

- Data was provided by Lakehead at December 31, 2019. Members over aged 65 were excluded, as were members who were assumed to have terminated or whose earnings were less than \$20,000. In total, 505 members were included.
- Certain assumptions are required to be made in order to estimate net income at the household level. Key assumptions are noted below.

Assumption	Value
Retirement age	65
Marital status	Based on statement data provided by Lakehead.
No. of children when married	Married members have 2 children unless beneficiary field indicates otherwise (e.g. where the field is "Son", 1 child is assumed).
Group health insurance	100% paid by Lakehead while employed; 0% paid by Lakehead in post-retirement.
Salary increases	CPI + 1% Real Wage Inflation + Merit Scale in actuarial valuation report (i.e. 4.7% at age 25 reducing to 1.8% by age 60.)
Performance bonus	None modelled. Contribution based on annualized earnings.
Spouse's relative income	Female spouse earns 80% of Male member
Spouse's retirement benefit	Same as member, based on assumed relative income. DC Savings only.
Contribution Rates	Faculty – Member: 6.5% of earnings, Employer: 8.05% less CPP; Non-Faculty – Member 8.05% of earnings, Employer: 8.05% less CPP
ITA maximum contributions	Employee and employer contributions limited to ITA thresholds.
Asset Mix	30% Universe Bonds, 10% Mortgages, 30% Canadian Equity, 30% Global Equity
Fees	20 bps
DC Account Balances	December 31, 2019 rolled forward to June 30, 2020 based on actual fund returns
Capital Market Assumptions	As at June 30, 2020 (See appendix)

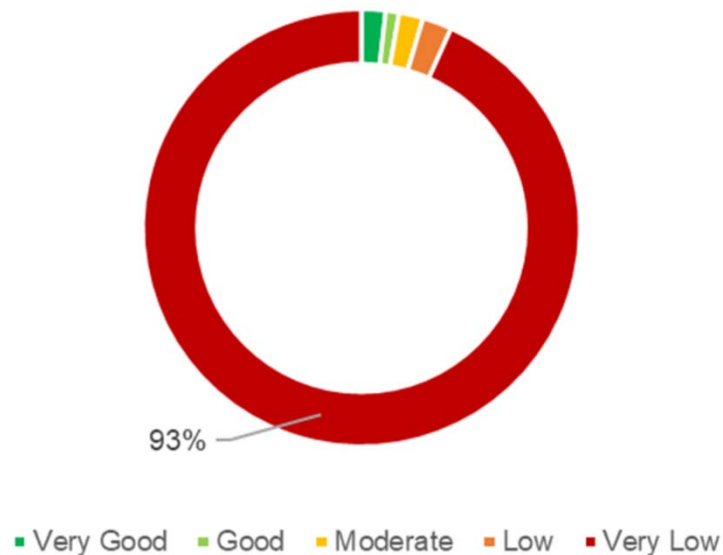


# Summary of other key LSRR model assumptions

- C/QPP and OAS based on maximum benefit for individualized earnings, reflects changes to benefits and clawbacks based on income.
- Employment deductions include C/QPP, EI, and provincial health premiums.
- Healthcare costs vary by province and increase by inflation plus 2.5%.
- Median housing price by StatCan Dissemination Area (i.e., postal code) or province, 25-year mortgage paid off at retirement. Maintenance costs are % of housing value. Total housing costs capped at 30% household gross income.
- Assume children are not dependent post-retirement.
- Retirement income: single premium immediate annuity, 2% annual increase, individual annuity commission reduces purchase balance, life-only if single, J&S 60% if married, sex distinct pricing.
- Income tax accounts for federal and provincial rates, pension credits, age credits and pension income splitting.
- Short service adjustment: government benefits assume a full career; target is prorated for term in plan assuming 35 years for a full career.
- Eckler's capital market assumptions assume passive returns, and simulated bond yields drive individual annuity pricing.

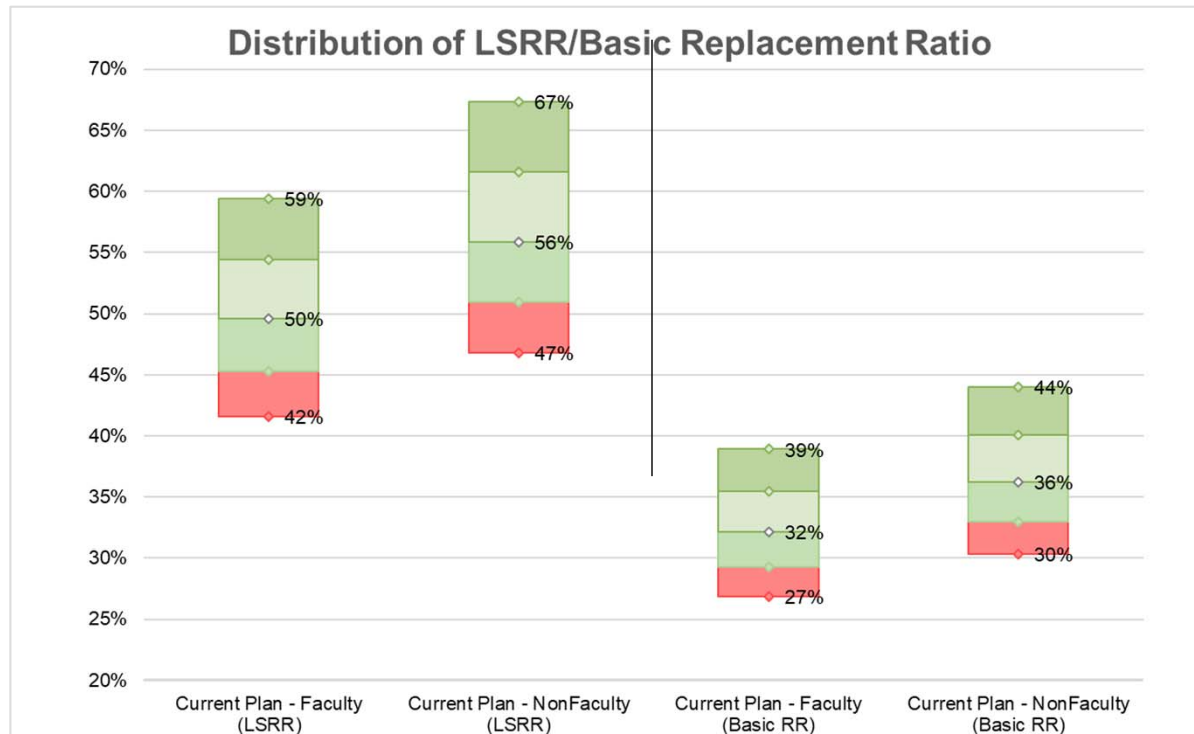
# Outcomes – Lakehead Professional Pension Plan

## Probability of Achieving LSRR Target - Overall Population



- Overall, the members of the Plan have a very low chance of maintaining living standards in retirement based on the income from government benefits and that which is estimated to be payable from accumulated Plan account balances. In other words, for 93% of members, the LSRR was less than 100% in more than 80% of scenarios.
- However, there are a number of reasons why the LSRR targets are not expected to be met, including the fact that this analysis considers only two sources of income: CPP/OAS and Plan benefits. Personal savings such as RRSPs and TFSAs are not reflected in the analysis, and it is reasonable to expect that members would contribute to their own living standards in retirement through such vehicles.
  - Given the historical pattern and level of negotiated contribution rates (i.e. at levels below ITA limits), it may be inferred that personal savings outside of the Plan have been considered to be a key component of retirement savings.
  - At a philosophical level, Lakehead may wish to consider the replacement ratio to be targeted under the Plan taking into account that members contribute to their own living standards through personal savings.
  - Also it should be noted that the target asset mix typically has an important impact on outcomes; in the Lakehead Plan, it is the same for all members.
- There were 23 members for whom the probability of achieving the LSRR target was moderate or better
  - Of these members, 21 were Non-Faculty.
  - Lower earnings also tend to correlate with higher LSRR targets (as disposable income is lower, and a larger proportion is replaced by CPP/OAS).
  - Certain members were very long service, and account balances indicate balances transfers in and/or higher levels of past service benefits.

# Outcomes – Lakehead Professional Pension Plan



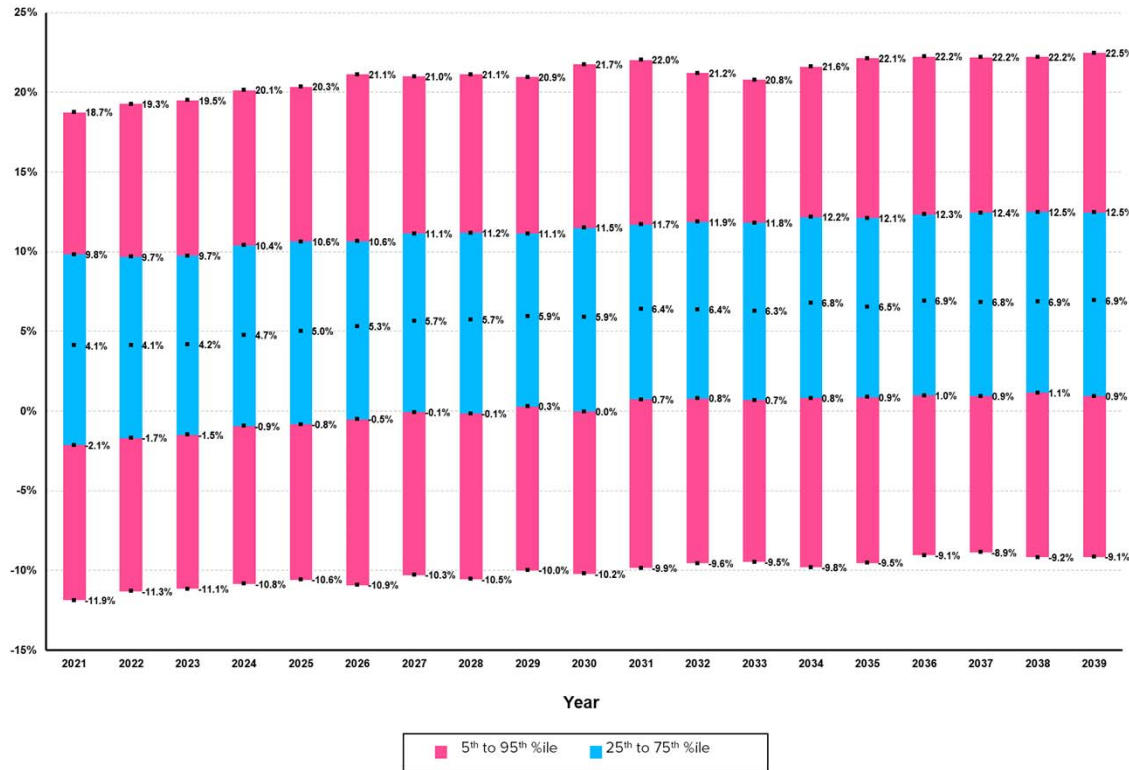
- While the prior slide illustrated that for most Plan members, the LSRR target of 100% would not be achieved through Plan and government benefits, the chart to the left illustrates the range of replacement ratios on both an LSRR basis, as well as based on traditional Basic Replacement Ratios.
- The breakpoints shown represent the 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup> (“median” or “expected”), 75<sup>th</sup> and 90<sup>th</sup> percentiles of outcomes.
- For example, for Faculty Members, the expected LSRR was 50% (i.e., about half of net income was replaced by Plan and government benefits). At the 90<sup>th</sup> percentile, the LSRR was 59%; such scenarios would be represented by strong investment returns, for example.
- For Non Faculty Members, the LSRR was slightly higher, with an expected value of 56%. The higher expected replacement rates are due to the higher member contribution rates for this group.
- For reference and comparison, we have also shown the range of Basic Replacement Ratios (Gross Member Post-retirement income/Gross Member Pre-retirement income). For Faculty members, the expected Basic Replacement Ratio was 32% and for Non Faculty Members, the expected Basic Replacement Ratio was 36%.
- As previously noted, the figures referenced above only include estimated income from the Plan and from CPP/OAS.



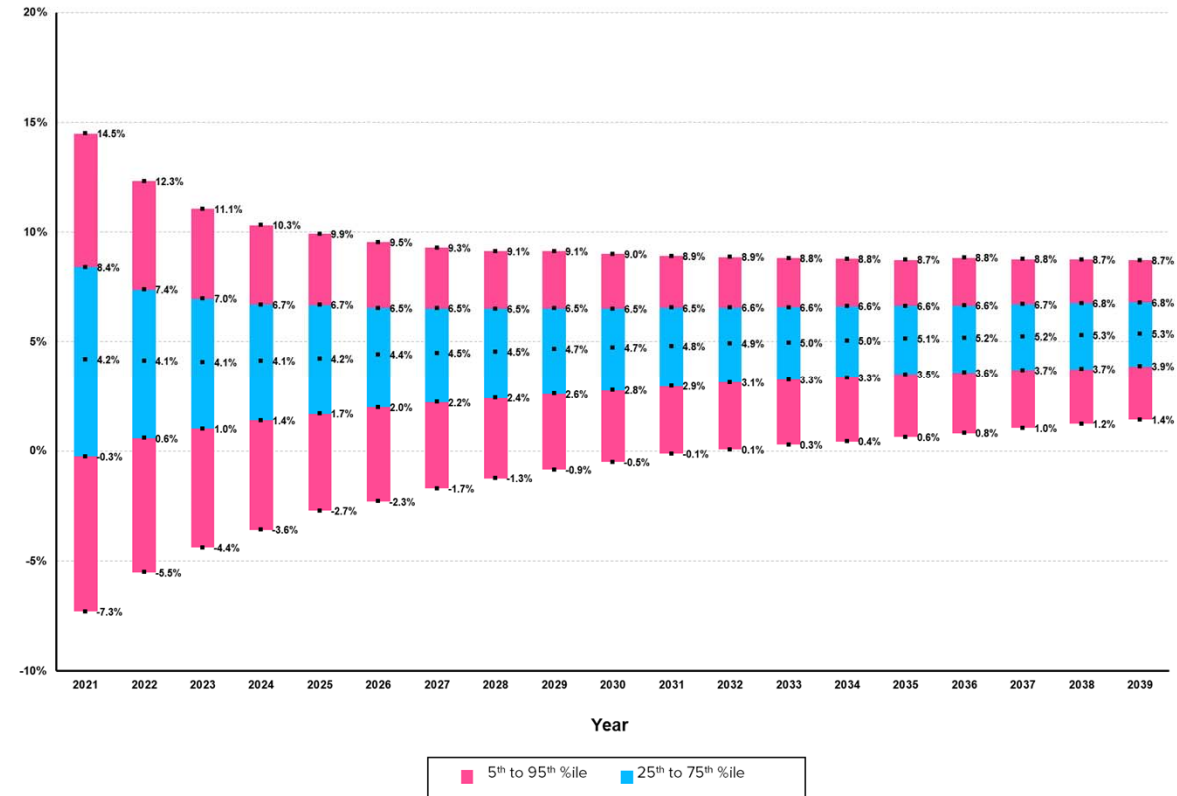
# Analysis of Retirement Accounts and the Normal Form Pension Factor

# Projected Fund Returns

20 Year Projection of Annual Investment Returns



20 Year Projection of Annualized Investment Returns



- Based on target asset allocation (30% Universe Bonds, 10% Mortgages, 30% Canadian equity and 30% Global equities), and Eckler’s Capital Market Assumptions at June 30, 2020 (see Appendix), we have estimated a distribution of future annual fund returns
- The chart on the left shows the distribution of **annual** fund returns, while the chart on the right shows the distribution of **annualized** fund returns over time
- For example, the expected (median) 20 year annualized fund return is 5.3% (before expenses)
- Fund returns in the short term (e.g., up to 2026) are expected to be below the discount rate of 5.7% used in the preliminary actuarial valuation report at December 31, 2019

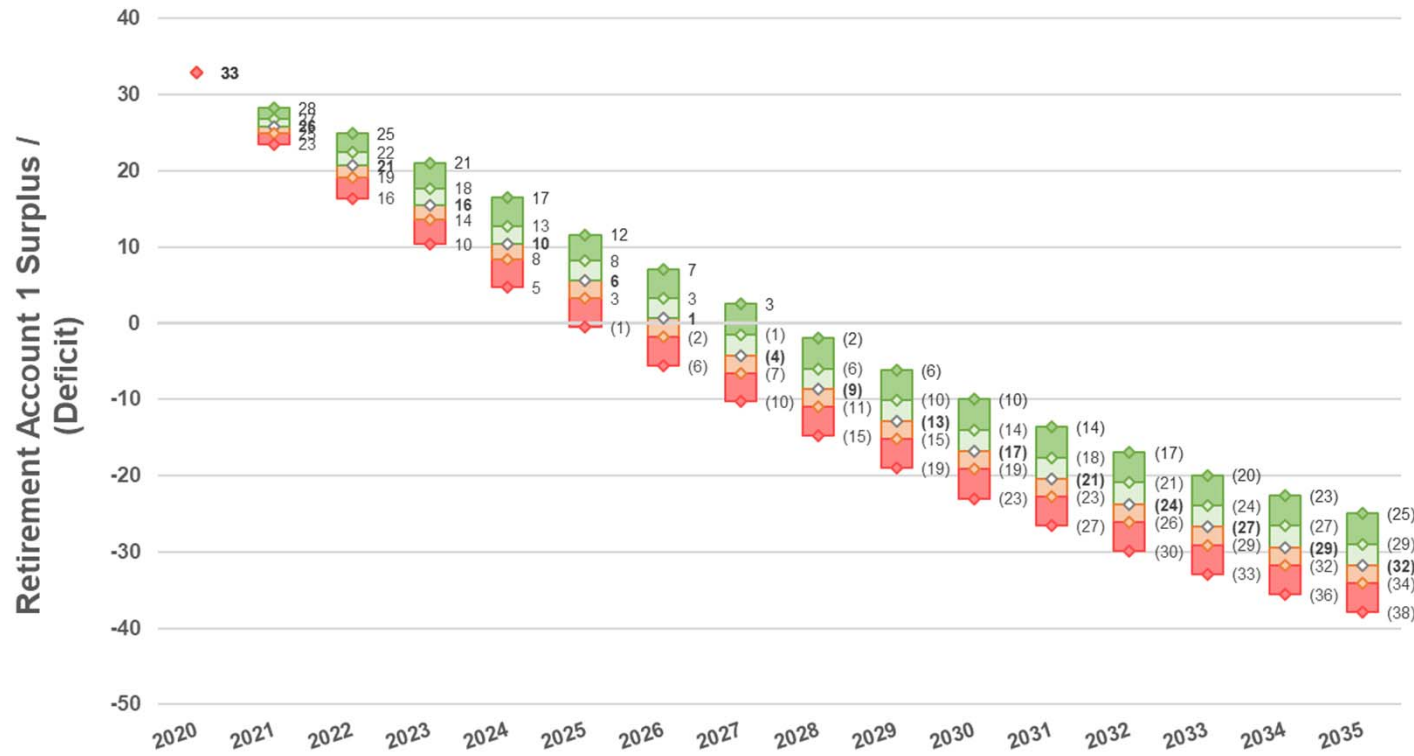
# Retirement Account #1

- Members who retired prior to January 1, 2008 form Retirement Account #1
- Members covered under this group form a closed group that is expected to decrease in size over time as the membership ages; the funds in Retirement Account #1 are expected to pay benefits to the closed group for their remaining lifetimes
- The demographic profile of the group is presented in the table below:

Projected Membership Statistics																
Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Count	122	119	115	111	107	102	98	93	87	81	76	70	64	57	51	46
Average Age	81.5	82.2	82.9	83.6	84.3	85.0	85.7	86.4	87.1	87.7	88.4	89.0	89.7	90.3	90.9	91.5
Average Monthly Pension	\$ 4,184	\$ 4,150	\$ 4,116	\$ 4,080	\$ 4,044	\$ 4,007	\$ 3,969	\$ 3,931	\$ 3,891	\$ 3,851	\$ 3,810	\$ 3,768	\$ 3,725	\$ 3,680	\$ 3,634	\$ 3,587

- Pensions for members in Retirement Account #1 are increased each year by the 4-year arithmetic average return on the fund in excess of the rate used to determine the pension at retirement, subject to there being sufficient funds in Retirement Account #1, and subject to a test of full funding on the solvency and going concern valuations
- Based on current interpretation of Income Tax Rules, additional contributions are not permitted to be made into Retirement Account #1; special contributions are currently being held accumulated in a Solvency Reserve Account

# Retirement Account #1



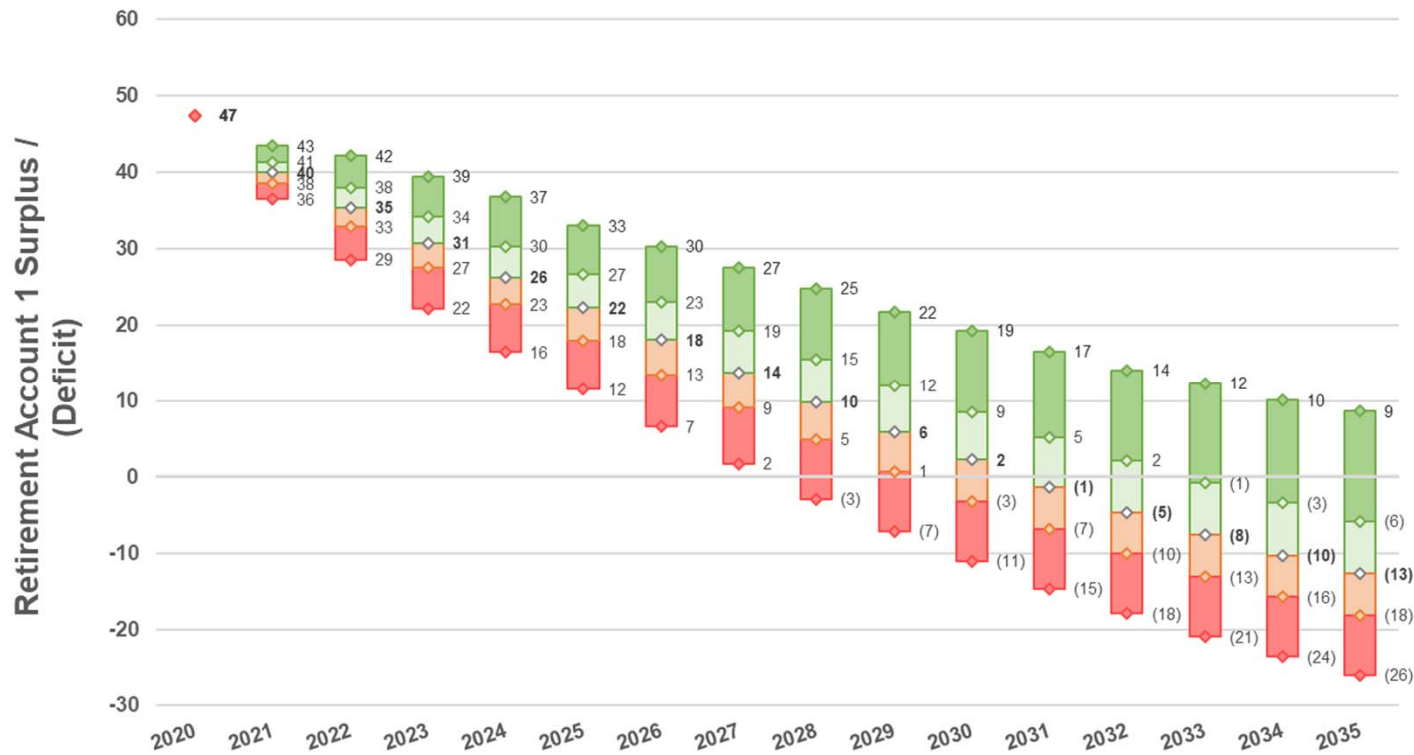
- The breakpoints shown represent the 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup> (“median” or “expected”), 75<sup>th</sup> and 90<sup>th</sup> percentiles of the projected values for Retirement Account #1, **excluding the value of the Solvency Reserve Account**
- In this projection, we have assumed that pension amounts remain level
- Based on the current value of Retirement Account #1, and without the Solvency Reserve Account, there is approximately a 43% chance the fund will be depleted 2026
- The probability increases to 100% by 2029

Probability Account 1 is Depleted																
Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Probability	0.0%	0.0%	0.0%	0.0%	0.1%	6.7%	42.6%	84.0%	97.7%	99.8%	99.9%	100.0%	100.0%	100.0%	100.0%	100.0%

Projected Membership Statistics																
Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Count	122	119	115	111	107	102	98	93	87	81	76	70	64	57	51	46
Average Age	81.5	82.2	82.9	83.6	84.3	85.0	85.7	86.4	87.1	87.7	88.4	89.0	89.7	90.3	90.9	91.5
Average Monthly Pension	\$ 4,184	\$ 4,150	\$ 4,116	\$ 4,080	\$ 4,044	\$ 4,007	\$ 3,969	\$ 3,931	\$ 3,891	\$ 3,851	\$ 3,810	\$ 3,768	\$ 3,725	\$ 3,680	\$ 3,634	\$ 3,587



# Retirement Account #1, Including Solvency Reserve Account



- The breakpoints shown represent the 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup> (“median” or “expected”), 75<sup>th</sup> and 90<sup>th</sup> percentiles of the projected values for Retirement Account #1, including the value of the Solvency Reserve Account
- In this projection, we have continued to assume that pension amounts remain level
- Based on the current combined value of Retirement Account #1 and the Solvency Reserve Account, funds are expected to be sufficient until 2030
  - At that time, there is estimated to be 76 remaining members with an average age of 88.4 years
  - Additional contributions would be required to be made into the Solvency Reserve Account

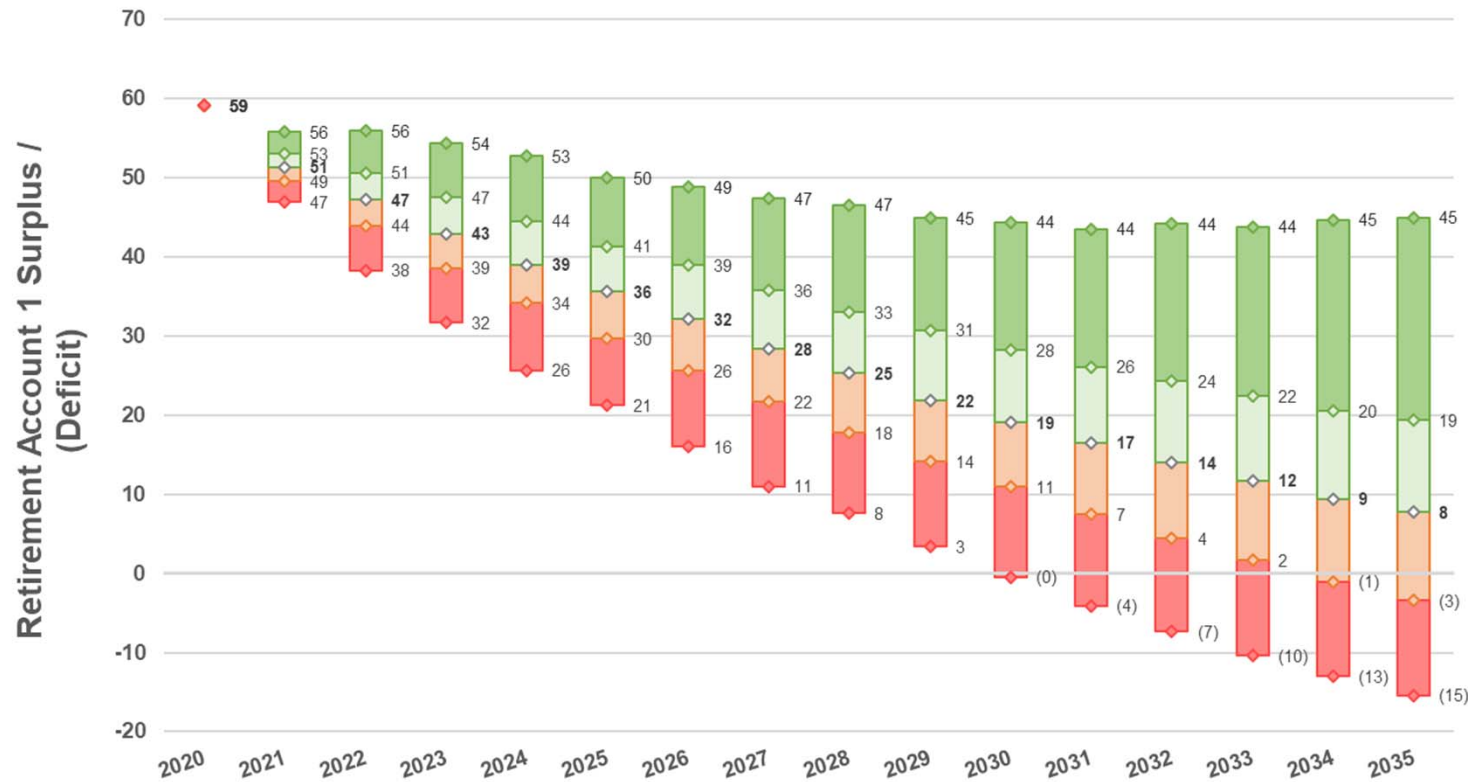
Probability Account 1 is Depleted																
Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Probability	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	2.2%	9.6%	21.6%	38.1%	55.8%	67.4%	77.7%	83.9%	87.5%

Projected Membership Statistics																
Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Count	122	119	115	111	107	102	98	93	87	81	76	70	64	57	51	46
Average Age	81.5	82.2	82.9	83.6	84.3	85.0	85.7	86.4	87.1	87.7	88.4	89.0	89.7	90.3	90.9	91.5
Average Monthly Pension	\$ 4,184	\$ 4,150	\$ 4,116	\$ 4,080	\$ 4,044	\$ 4,007	\$ 3,969	\$ 3,931	\$ 3,891	\$ 3,851	\$ 3,810	\$ 3,768	\$ 3,725	\$ 3,680	\$ 3,634	\$ 3,587



# Retirement Account #1, Including Solvency Reserve Account, Excess Fund Account and Full funding of Wind-up Deficit



- The breakpoints shown represent the 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup> (“median” or “expected”), 75<sup>th</sup> and 90<sup>th</sup> percentiles of the projected values for Retirement Account #1, including the value of the Solvency Reserve Account, and the Excess Fund Account (~\$3.7M) and assuming that the wind-up deficit of approximately \$8M identified in the preliminary actuarial valuation report at December 31, 2019 is funded in a lump sum and no further contributions are made
- In this projection, we have continued to assume that pension amounts remain level
- At the median level, assets are not expected to be depleted before 2035
- With incorporation of the Solvency Reserve Account, Excess Fund Account and with full initial funding of the current estimated wind-up deficit, there is 67% chance that the fund will not be depleted through 2035

Probability Account 1 is Depleted																	
Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	
Probability	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.9%	2.4%	5.3%	10.2%	15.8%	20.8%	27.8%	33.4%	

Projected Membership Statistics																	
Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	
Count	122	119	115	111	107	102	98	93	87	81	76	70	64	57	51	46	
Average Age	81.5	82.2	82.9	83.6	84.3	85.0	85.7	86.4	87.1	87.7	88.4	89.0	89.7	90.3	90.9	91.5	
Average Monthly Pension	\$ 4,184	\$ 4,150	\$ 4,116	\$ 4,080	\$ 4,044	\$ 4,007	\$ 3,969	\$ 3,931	\$ 3,891	\$ 3,851	\$ 3,810	\$ 3,768	\$ 3,725	\$ 3,680	\$ 3,634	\$ 3,587	

# Normal Form Pension Factor

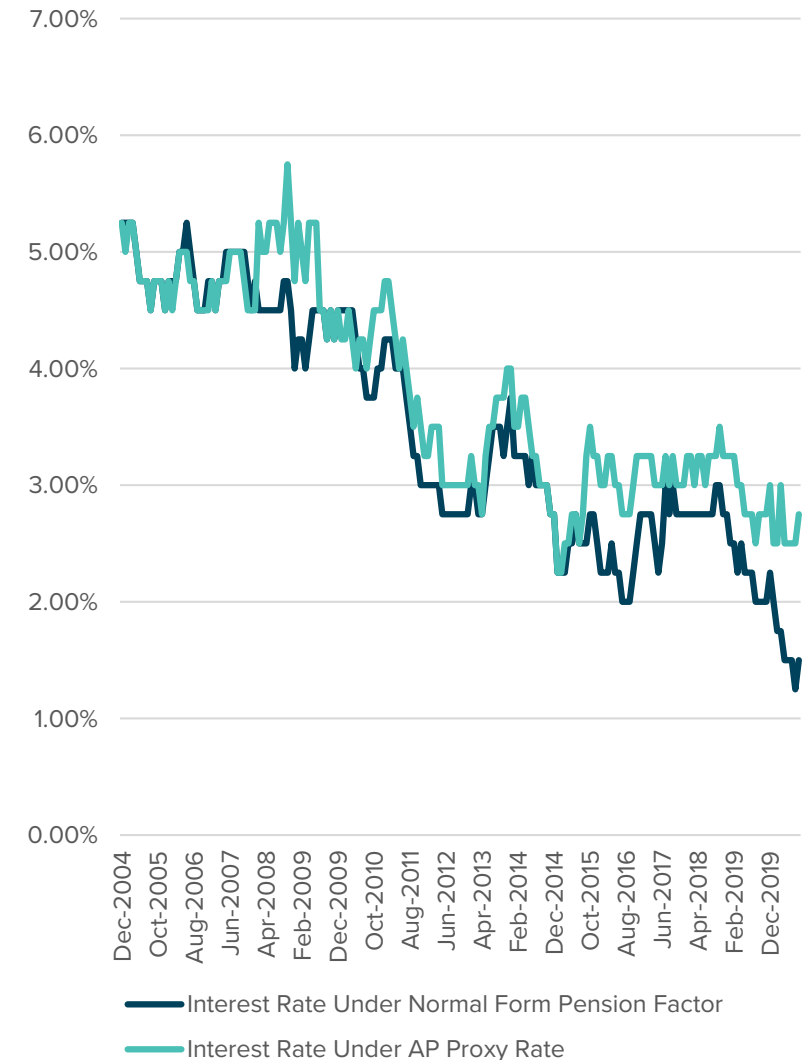
- The Normal Form Pension Factor is used in the conversion of Account Balances to annuities
- The interest rate used is determined as the lesser of 6% per year, and the yield on long-term Government of Canada marketable bonds over 10 years (CANSIM series - V122487) plus 0.5%, rounded to the nearest multiple of 0.25%
- For Retirement Account #2 (members retiring after January 1, 2008, and with respect to contributions made before January 1, 2008), pensions are increased each year by the 4-year geometric average return on the fund in excess of the rate used to determine the pension amount at retirement, subject to there being sufficient funds in Retirement Account #2
- For Retirement Account #3 (members retiring after January 1, 2008, and with respect to contributions made after January 1, 2008), pensions are adjusted positively or negatively each year by 80% of the 4-year geometric average return on the fund in excess of the rate used to determine the pension amount at retirement, subject to there being sufficient funds in Retirement Account #3. Pensions are not decreased such that they fall below the level of pension at retirement
- A **lower** interest rate in the Normal Form Pension Factor would result in a **lower** initial pension being paid, with larger expected future increases
- A **higher** interest rate in the Normal Form Pension Factor would result in a **higher** initial pension being paid, with smaller expected future increases
  - There is additional risk management incorporated into Retirement Account #3 since pensions can be adjusted downwards if fund returns are lower than the conversion rate

# Normal Form Pension Factor

- In order for the conversion of account balances to annuities in the Plan to be self-sustaining, the basis for the determination of the Normal Form Pension Factor should incorporate the following considerations:
  - There should be a high level of certainty that fund returns will exceed the conversion rate (particularly for Retirement Account #2 where pensions cannot be adjusted downwards)
  - Since a solvency deficit may occur where the solvency discount rate falls below the conversion rate, there should be a high level of certainty that the conversion rate remains below the solvency discount rate
  - The mortality table used in the Normal Form Pension Factor should reflect current expectations for mortality. If longevity is better than assumed or improves more than assumed in the Normal Form Pension Factor, losses to the Plan will occur because the pension was undervalued. At the same time, caution should be taken with respect to including conservatism in order to avoid overpricing the annuities.
- An increase in the spread over yields on Government bonds in the calculation of the interest rate for the Normal Form Pension Factor may make the resulting annuities more attractive for retiring plan members
  - However, this reduces the likelihood that fund returns will exceed the conversion rate, and would also increase the probability that solvency rates may fall below the conversion rate
- The mortality table used in the calculation of the Normal Form Pension Factor should be reviewed regularly. While the CPM Public table is still current, the CPM-B projection scale has been superseded by MI-2017 improvement scale. Updating for MI-2017 would modestly increase Normal Form Pension Factor.

# Normal Form Pension Factor

- The Annuity Purchase Proxy is a rate set based on guidance published by the Canadian Institute of Actuaries quarterly
  - It is intended to provide a proxy for group annuity pricing by Canadian Insurers and it the basis on which solvency liabilities are valued
  - The Annuity Purchase proxy is also set based on a spread over the yield on long term Government bonds
  - The spread (for non-indexed annuities) was 45bps in 2005 and was between 110bps and 130bps in 2019 (it has been higher in 2020 but this could be considered as temporary and as a result of COVID19)
  - The spread has been adjusted over time for changes in mortality assumptions; currently the Annuity Purchase Proxy incorporates the CPM table
  - The use of a similar spread in the Normal Form Pension Factor may increase the attractiveness of the conversion of Plan balances
  - However, the spread in the Normal Form Pension Factor should not be increased such that the conversion rate would be expected to be greater than the Annuity Purchase Proxy rate (and thus the solvency discount rate)
    - Solvency deficits would emerge were the solvency discount rate to be less than the conversion rate
  - We have considered an increase in the spread incorporated in the rate up to 100bps (from 50bps)



# Illustration

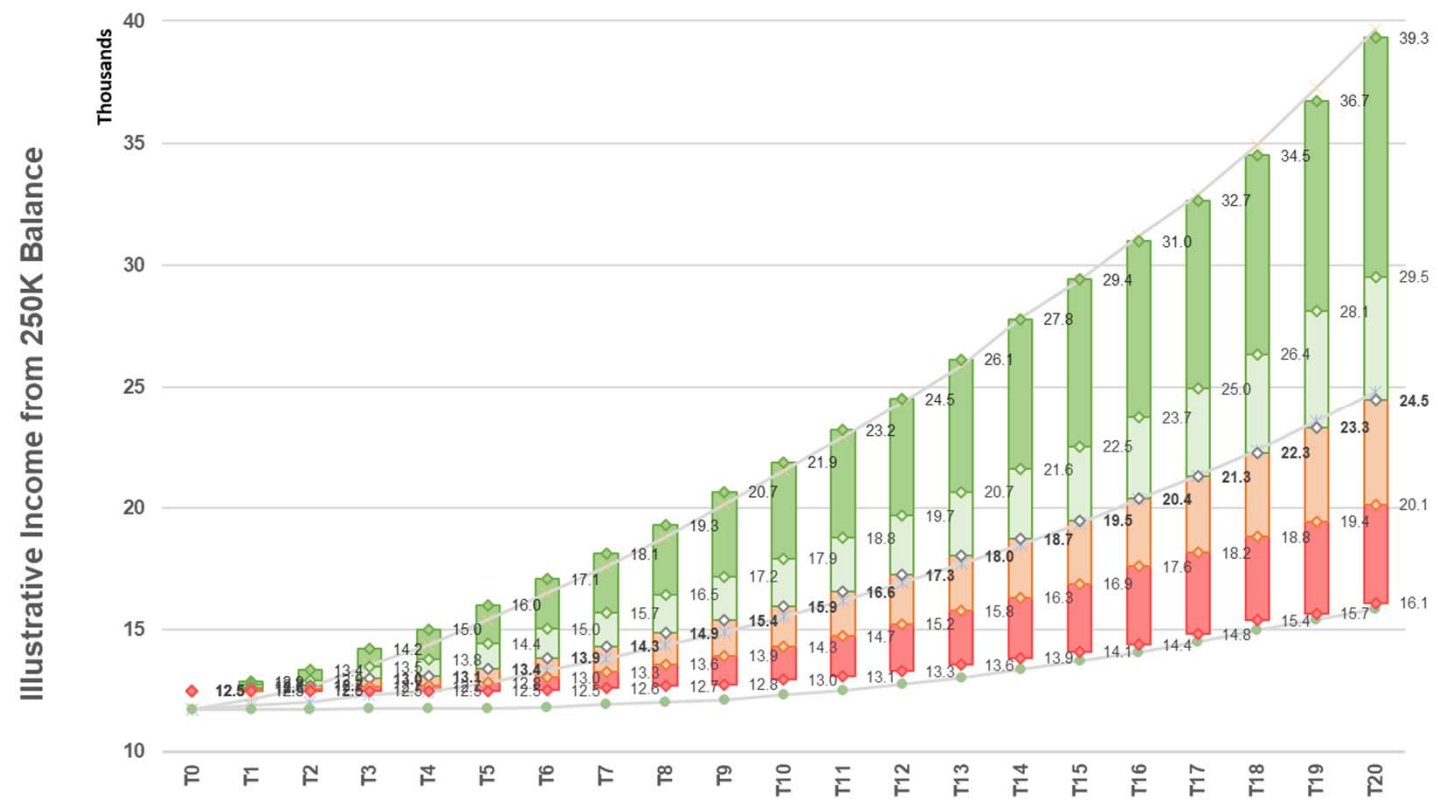
- At June 30, 2020, interest rate under Normal Form Pension Factor is 1.5%

Probability Return Exceeds 1.5%															
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Probability	17%	62%	62%	64%	67%	68%	68%	68%	68%	70%	69%	70%	70%	71%	72%

- The table below considers the scenario where the spread were increased to 1.0%, and thus the interest rate were increased to 2.0%

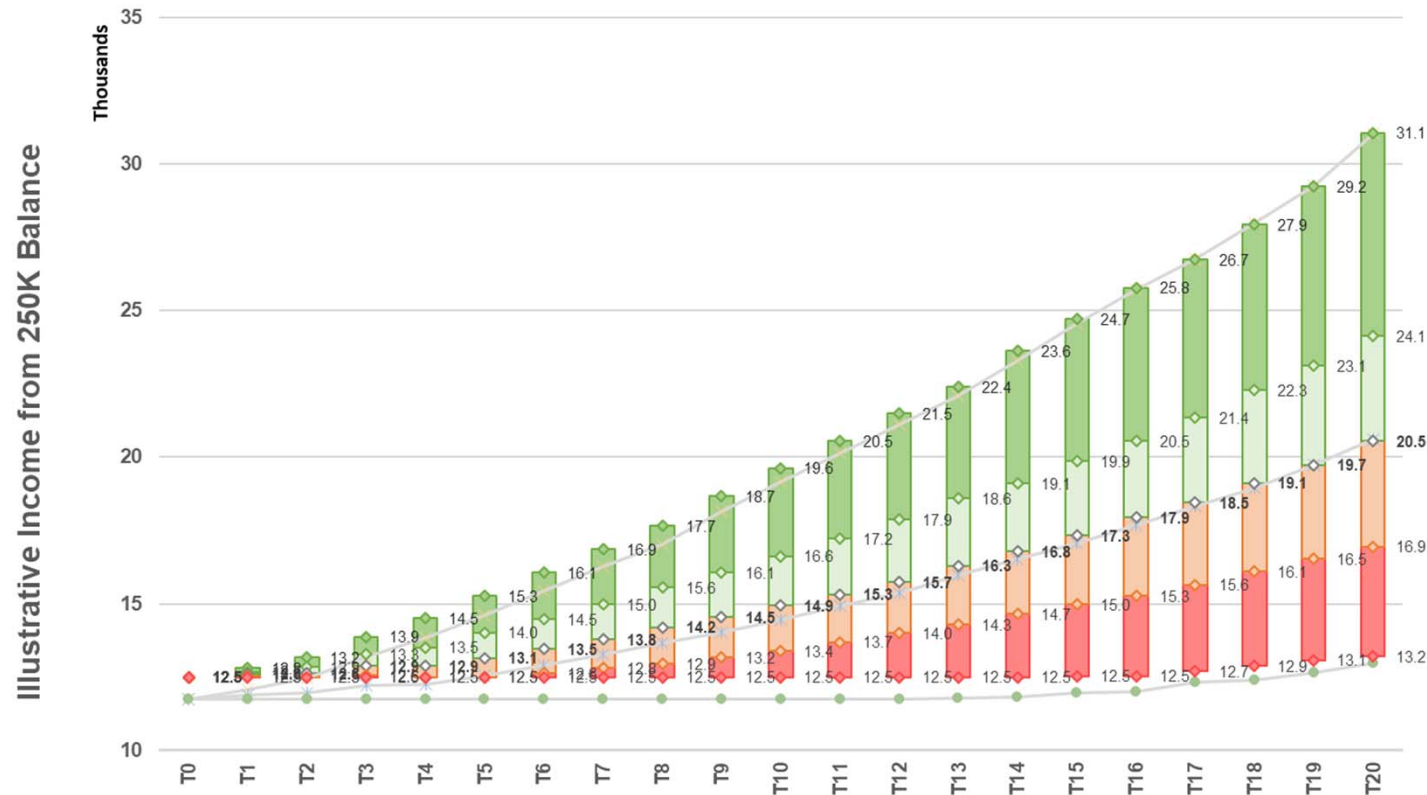
Probability Return Exceeds 2%															
Time	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Probability	15%	60%	59%	62%	65%	66%	65%	66%	65%	69%	67%	67%	69%	69%	70%

# Illustration – 250K balance converted at 1.5% and 2.0% Retirement Account #2



- Grey lines show income at 5<sup>th</sup>, 50<sup>th</sup> and 95<sup>th</sup> percentiles converted at 1.5%
- Floating bars show projected income converted at 2%
- Income based on 2% conversion is initially higher (approximately 6%), but the differential decreases over time, approaching nil by time 15

# Illustration – 250K balance converted at 1.5% and 2.0% Retirement Account #3



- Grey lines show income at 5<sup>th</sup>, 50<sup>th</sup> and 95<sup>th</sup> percentiles converted at 1.5%
- Floating bars show projected income converted at 2%
- Given that pensions can be adjusted downwards in Retirement Account 3, and only 80% of the excess return is granted as a COLA, expected income is lower than under Retirement Account 2
- However, as with Retirement Account 2, higher interest rates result in higher initial pensions
  - The differential decreases over time, approaching nil by Time 17



# Commentary

- An increase to the interest rates used to determine the Normal Form Pension Factor:
  - Would serve to increase the initial pension and increase the attractiveness of the annuity conversion option
- However, there should be high level of certainty that the earned rates of return will be greater than the interest rates at conversion, since:
  - Retirement Account 2 does not permit for negative adjustments of pensions
  - Communicating negative adjustments on Retirement Account 3 may be undesirable
- While current capital market expectations may suggest that a modest increase in the underlying spread may be undertaken further analysis should consider how future yield expectations impact fund returns (i.e., stress testing)
- In addition, while current spreads implicit in the Annuity Purchase Proxy rate (on which the solvency discount rate is based) are greater than 100bps, should these spreads fall below that implicit in the Normal Form Pension Factor, solvency rates may fall below conversion rates resulting in solvency deficits would arise
  - The current spread of 50bps provides some buffer against this outcome





# Feasibility Analysis and Alternatives

# What is a JSPP?

- A JSPP is a contributory DB pension plan in which the employers and pension plan members share responsibility for the plan's governance and funding. The main characteristics of a JSPP are:
  - Joint governance, through a Board of Trustees, where employer and member representatives have an equal say in plan design, funding, and administration
  - Sharing of risk between employers and plan members
  - Generally stable and predictable contributions, jointly funded by employers and members
  - Relief from solvency funding (for existing JSPPs, but would have to be granted for any new JSPP)
  - Efficiencies and economies of scale. A much larger plan means greater efficiency in plan administration and access to higher-return investment opportunities
- The following options are available for a single employer pension plans to participate in a JSPP:
  - A plan can convert to a JSPP
  - Members of a single employer plan can join an already established JSPP if that JSPP approves it. Some JSPPs allow single employer plans to transfer past service liabilities and assets into the JSPP, with the approval of the Board of Trustees.

# What is a JSPP?

- The following table summarizes how JSPPs compare to other types of registered pension plans in terms of benefit, risk assumption and governance

Plan type	Benefit	Risk Assumption	Typical Governance
DB	Pension	Employer bears 100%	100% Employer
JSPP	Pension	Shared, generally 50/50	Shared, generally 50/50
Hybrid	Pension	Shared, risk allocation depends on level of DB base benefit	100% Employer
DC	Lump sum	Members bear 100%	100% Employer

# Joining a JSPP

- There are three JSPPs that are possible options to explore for employees of Lakehead University:
  - University Pension Plan of Ontario (UPP)
  - CAAT Pension Plan in either:
    - the original “DBprime” offering; or
    - the new “DBplus” offering
  - OPTrust Pension Plan in the new “Select” offering
- Two of these plans, the UPP and CAAT, could potentially allow the transfer of past liabilities into the plan, subject to approval by the plan’s Trustees.
- Should seek legal review of the options and compliance with regulatory requirements when considering joining a JSPP

# Joining a JSPP for Future Service only

- Joining a JSPP for future service would require the following steps:
  1. Inquire with the JSPP about the possibility of members of the Lakehead University Professional Pension Plan (LUPP) joining the plan
  2. Determine the terms for joining the JSPP – contribution rate (if a choice is provided), start date, etc.
  3. Get University and member/union support for joining the JSPP
  4. Amend the collective agreements
  5. Complete a participation agreement with the JSPP
  6. Amend the LUPP to stop future accrual
  7. JSPP onboards new members

# Considerations regarding joining a JSPP for future service

- Contribution level?
  - Of the 4 possible JSPPs, 3 have contribution rates in excess of current employer required rates, some as high as 4 times the current rate
  - Of the 4 possible JSPPs, 2 have contribution rates in excess of current member required rates and a third offers a range of contributions in which the current rates fall
- How do the benefits provided under the JSPP compare to the benefits in the LUPP?
- Do the benefits provided under the JSPP provide an adequate retirement income?
- Joining a JSPP means relinquishing control over pension benefits
  - Only one JSPP allows an employer to choose the contribution rate
  - Unlikely that Lakehead University or LUPP members would have a seat on the Board of Trustees of the JSPP
- JSPPs have a different pension promise than LUPP – a defined pension instead of a defined contribution (or hybrid for a portion of service)
- All the JSPPs have post-retirement indexation conditional on the funded status of the plan

# Considerations regarding joining a JSPP for future service

- Past service benefits remain in the LUPP
  - Members retain both their pre-97 DC/DB hybrid benefits and post-97 Individual Accounts in the LUPP
  - May be able to amend the LUPP to remove the ability to convert Individual Accounts into a pension to reduce future risk to the University – should seek a legal opinion
  - The University retains the risks (investment risk, interest rate risk, longevity risk, etc.) associated with pre-97 hybrid benefits and pensions currently in pay
    - University will have to maintain all funding requirements, including payments to fund current deficiency, and any future deficiencies that may arise
  - Ongoing administrative, actuarial and regulatory fees to maintain the LUPP
  - Plan will diminish in size since benefits will be paid out and no new benefits are accruing
    - Fees as a percent of assets will grow

# Considerations regarding joining a JSPP for future service

- Past service benefits remain in the LUPP
  - Winding-up the LUPP is an option, but is there a risk it could be ordered by FSRA?
    - Could require a significant contribution to the plan, depending on the wind-up funded status at the time of the wind-up (\$8M hypothetical wind-up deficit at 31.12.2019 based on preliminary results)
    - Depending on the terms of the pension plan and legal opinion, may have to include estimated future salary increases in wind-up values for pre-97 benefits
- Other considerations? For example, does Bill 124 impose any limitations?



# Transferring past service to a JSPP

- Transferring past service benefits to a JSPP would require the following steps:
  1. Inquire with the JSPP about the possibility of:
    - merging the LUPP's pre-97 benefits and current pensions in pay (collectively "DB benefits") into the JSPP; and
    - allowing members to choose to transfer their post-97 Individual Accounts into the JSPP to purchase past service
  2. Determine the terms for the merger with the JSPP
  3. Get University support for merging the LUPP into the JSPP
  4. Get member/union support for merging the LUPP into the JSPP
  5. Amend the collective agreements
  6. Complete a transfer agreement with the JSPP
  7. Provide regulatory notice to members with DB benefits which includes the same information as an annual statement plus additional disclosures

# Transferring past service to a JSPP

## 8. Obtain member consent:

- At least 2/3 of active members must give consent
  - Union consents on behalf of its members
- No more than 1/3 of inactive members can object
  - Union cannot consent on behalf of inactive members

SEPP to JSPP



9. Amend the LUPP to stop future accrual and allow for the transfer of pre-97 benefits and pensions in pay to the JSPP
10. File asset transfer application for DB benefits with FSRA for CEO's approval
11. After FSRA approval, transfer DB assets and liabilities to the JSPP
12. JSPP responsible for managing past and future DB benefits
13. Wind-up the remaining DC plan and provide members with the option to transfer their Individual Accounts to the JSPP to purchase past DB benefits, or an individual locked-in retirement account

# Considerations regarding transfer of past service to a JSPP

- Past benefits would not change
- Could CAAT administer the LUPP's pre-97 benefits and post-retirement indexation provisions?
  - It is expected that UPP would assume these provisions
- What would be the terms of the merger? There is typically a “cost” to transfer pension plan risk to another party.
  - The assumptions used by CAAT to value the liabilities being transferred are conservative and CAAT requires incoming plans to have the same funded ratio. Additional funding from the university likely required.
  - UPP would probably require LU to “own” any deficit that arises on the past benefits for 10 years, similar to what the 3 universities establishing the UPP have agreed to
- The process may be long, arduous and costly but all pension risk (other than the possibility of future contribution increases beyond the control of the University and its employees) would be transferred to the JSPP
- Resolution to the 2000 plan amendment likely required before FSRA would consider granting approval to the transfer



# Comparison of JSPPs

# Summary of JSPPs

	Lakehead University Professional Plan	UPP	CAAT DBprime	CAAT DBplus	OPTrust Select
<b>Open to</b>	Academic staff and senior administrative or support staff	Ontario universities (with member support) Accruals start July 2021 Unknown when it will be open to other universities	All employers	All employers	Employers in Ontario's Broader Public Sector and charitable and non-profit organizations that operate in Ontario
<b>Sponsors</b>	Lakehead University	Employer Sponsor (currently: UofT, Queen's University, University of Guelph) Employee Sponsor (currently: UTFa, QUFA, UGFA, USW, CUPE)	OPSEU Ontario College Administrative Staff Association Ontario Colleges	OPSEU Ontario College Administrative Staff Association Ontario Colleges	OPSEU Ontario Government
<b>Trustees</b>	n/a	UPP's governing bodies are:  The Joint Sponsors: <ul style="list-style-type: none"> <li>determines contributions and benefits</li> <li>sets funding policy</li> <li>appoints Board of Trustees</li> </ul> The Board of Trustees: <ul style="list-style-type: none"> <li>sets the investment strategy</li> <li>establishes policies for administering benefits</li> <li>approves valuations</li> </ul>	CAAT's governing bodies are:  The Sponsors' Committee: <ul style="list-style-type: none"> <li>approves Plan amendments</li> <li>files actuarial valuations</li> </ul> The Board of Trustees: <ul style="list-style-type: none"> <li>sets the investment strategy</li> <li>establishes policies for administering benefits</li> </ul>	CAAT's governing bodies are:  The Sponsors' Committee: <ul style="list-style-type: none"> <li>approves Plan amendments</li> <li>files actuarial valuations</li> </ul> The Board of Trustees: <ul style="list-style-type: none"> <li>sets the investment strategy</li> <li>establishes policies for administering benefits</li> </ul>	OPSEU Pension Plan has 10 Trustees, five appointed by OPSEU and five appointed by the Government of Ontario  Board of Trustees has overall responsibility for the administration of the plan and the management of the assets

# Summary of JSPPs

	Lakehead University Professional Plan	UPP	CAAT DBprime	CAAT DBplus	OPTrust Select
<b>Ability to transfer LUPP into plan</b>	n/a	With Board of Trustees approval and under their terms	With CAAT approval and under their terms	With CAAT approval and under their terms	No
<b>Member eligibility</b>	Full-time: required immediately Part-time: required upon meeting eligibility requirements	Set by terms of agreement with the Plan Sponsors	Full-time: required immediately Part-time: eligible immediately to join DBplus	Subject to terms of Participation Agreement	Full time: required immediately if under 65 Part time: eligible immediately
<b>Contribution rate</b>	Member: Academic: 6.5% Non-academic: 8.05% University: 8.05% less CPP contributions CPP contributions are currently 5.25%	Member and Employer (each): 9.2%/11.5% of pensionable salary below and above the YMPE*  *effective January 1, 2025, the YMPE will be replaced with the YAMPE	Member and Employer (each): 11.2%/14.8% of pensionable salary below and above the YMPE	Member: 5% to 9% (set by employer) Employer: Matches member contributions and may contribute more	Member and Employer (each): 3%  Employer contributes additional 0.2% for first two years
<b>Benefit formula</b>	Post-96 service: Pension that can be bought with account balance Pre-97 service: Minimum benefit (Basic Pension) of: 1.2% of HAE5 up to YMPE5 + 1.75% of HAE5 above YMPE5 Pension is limited to \$1,722 per year of service	1.6% of HAE4* up to the AYMPE4** + 2.0% of HAE4 above the AYMPE4*  *HAE4 – Average of highest 4 years of earnings (non-consecutive)  **including YAMPE after 2024  (i.e. 8.7%/8.7% of contributions)	1.3% of HAE5* up to the AYMPE5 + 2.0% of HAE5 above the AYMPE5  *HAE5 - Average of highest 5 consecutive years of earnings  (i.e. 5.8%/6.75% of contributions)	8.5% of contributions (i.e. 0.85% to 1.53% of pensionable pay)	10% of contributions (i.e. 0.6% of pensionable pay)

# Summary of JSPPs

	Lakehead University Professional Plan	UPP	CAAT DBprime	CAAT DBplus	OPTrust Select
<b>Retirement dates</b>	Normal Retirement Date (NRD) = June 30 <sup>th</sup> or December 31 <sup>st</sup> coincident with or immediately following 65 <sup>th</sup> birthday  May retire early at any time prior to NRD	NRD = 65  Earliest Retirement Date (ERD) = 55  Earliest Unreduced Retirement Date (EURD) = earlier of: <ul style="list-style-type: none"> <li>• age 60 with 80 points</li> <li>• age 65</li> </ul>	NRD = 65  ERD = earlier of: <ul style="list-style-type: none"> <li>• 55</li> <li>• 50 with 20 years of pensionable service</li> </ul> EURD = earlier of: <ul style="list-style-type: none"> <li>• age 60 with 20 years of pensionable service</li> <li>• 85 points</li> <li>• age 65</li> </ul>	NRD = 65  ERD = 50	NRD = 65  ERD = 55
<b>Early retirement subsidy</b>	Basic pension reduction of 6% per year prior to NRD	Early retirement reduction of 5% per year prior to NRD	Early retirement reduction of 3% per year prior to EURD	Early retirement reduction is between 3% and 5% (based on the Plan's Funding Policy) for each year prior to age 65. Currently, the reduction is 3%	No early retirement subsidy
<b>Postponed retirement pension increases</b>	Basic pension is increased by 9% per year after NRD				
<b>Bridge benefits</b>	None	None	0.7% of FAE5 up to AYMPE5	None	None

# Summary of JSPPs

	Lakehead University Professional Plan	UPP	CAAT DBprime	CAAT DBplus	OPTrust Select
<b>Transfer in past service benefits on an individual basis</b>	Member may transfer amounts from a previous employer If member was previously in the Employee Plan, account balance is transferred in from this plan	Can purchase past service under certain conditions	Can purchase past service under certain conditions	Can purchase past service under certain conditions	Can purchase past service under certain conditions
<b>Pre-retirement Indexation</b>	n/a	n/a Best average earnings formula so not needed while employed	In deferment period, the indexation is up to 75% of annual CPI, conditional on funded status	During employment, benefits may be increased up to the annual change in the AIW, conditional on funded status.	During employment, benefits may be increased up to the lesser of the annual change in the AIW or increase in CPI, conditional on funded status.
<b>Post-retirement Indexation</b>	Conditional on funded status: Pre-2008 service: excess investment return Post-2007 service: 80% of excess investment return Investment return is averaged over 4 years	In retirement, the indexation is up to 75% of annual CPI, conditional on plan experience Guaranteed until 2028	In retirement, the indexation is up to 75% of annual CPI, conditional on funded status	In retirement, the indexation is up to 75% of annual CPI, conditional on funded status	In retirement, the indexation is up to 100% of annual CPI, conditional on funded status
<b>Post-retirement death benefits</b>	Single member: lifetime pension with 10-year guarantee Married member: Joint & Survivor 60% pension	Single member: lifetime pension with 10-year guarantee Married member: Joint & Survivor 50% pension	Single member: lifetime pension with 5-year guarantee Married member: Joint & Survivor 60% pension with 5-year guarantee	Single member: lifetime pension with 5-year guarantee Married member: Joint & Survivor 60% pension with 5-year guarantee	Lifetime pension with a guarantee that benefits paid at least equal contributions with interest at retirement





# Benchmarking Analysis

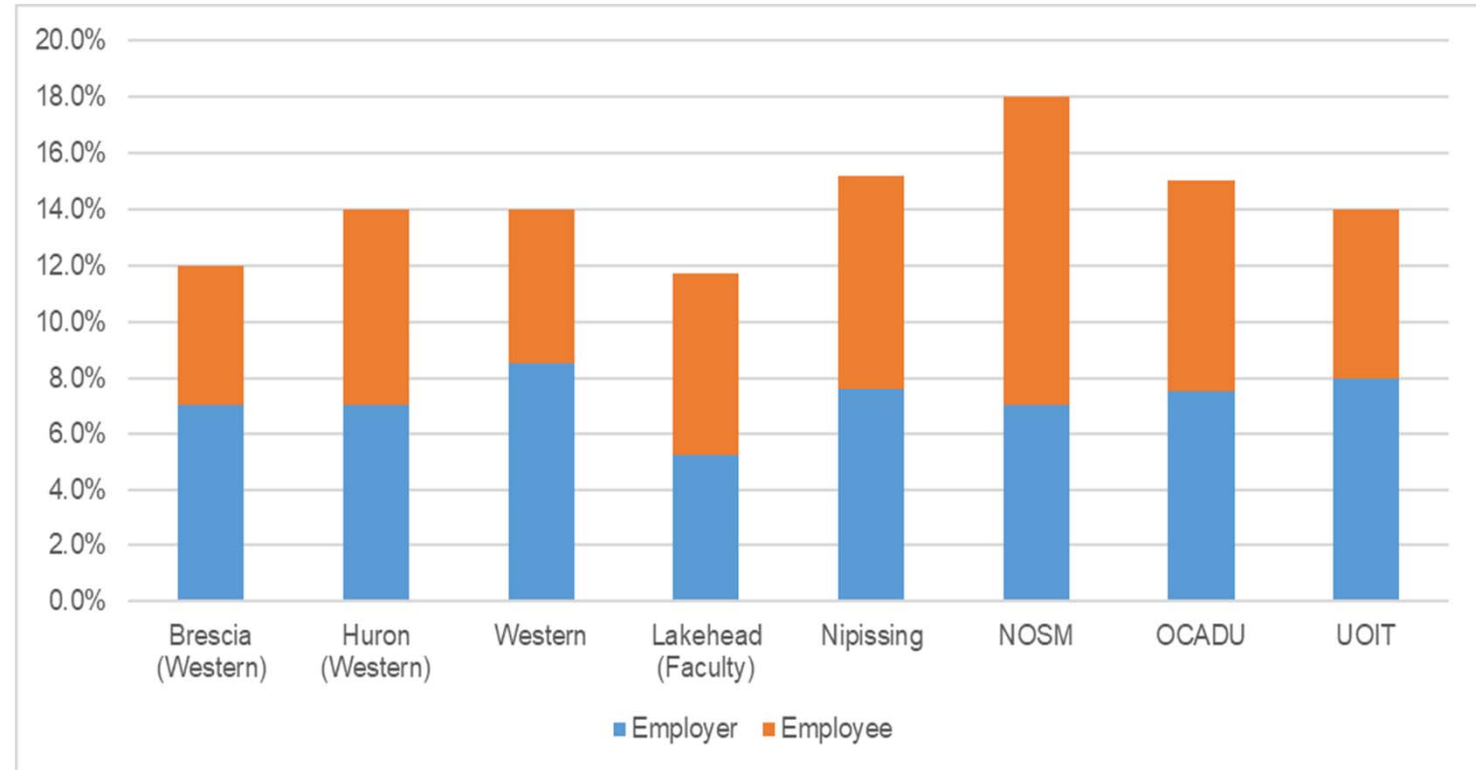
# Benchmarking Analysis

- Thus far, we have focused on evaluating the adequacy of benefits provided under the Plan (considering both Living Standard Replacement Ratio and Basic Replacement Rates)
- We may also consider expected outcomes considering changes to contribution rates, with contribution rates similar to the pension plan of other universities, and even under the benefit levels of defined benefit JSPPs
- For such analysis, we have focused on future service only, considering outcomes for “new entrant” sample members
- The profiles of the sample new entrants are as follows:

Immediate enrolment in plan	Earnings		
<b>Sample Employee – Hired at age 30:</b> Married with two kids.	<b>Non-Faculty 30:\$75K</b>	<b>Non-Faculty 30:\$100K</b>	<b>Faculty 30: \$100K</b>
<b>Sample Employee – Hired at age 45:</b> Married with two kids	<b>Non-Faculty 45: \$75K</b>	<b>Non-Faculty 45: \$100K</b>	<b>Faculty 45: \$100K</b>

# Contribution Rates for Comparator University Plans

University	Employer Contribution Rate	Employee Contribution Rate <sup>2</sup>
Brescia (Western)	7.0%	5.0%
Huron (Western)	7.0%	7.0%
Western	8.5%	5.5%
Lakehead <sup>1</sup>	5.2%	6.5%/8.05% <sup>3</sup>
Nipissing <sup>1</sup>	7.6%	7.6%
NOSM	7.0%	11.0%
OCADU	7.5%	7.5%
UOIT	8.0%	6.0%



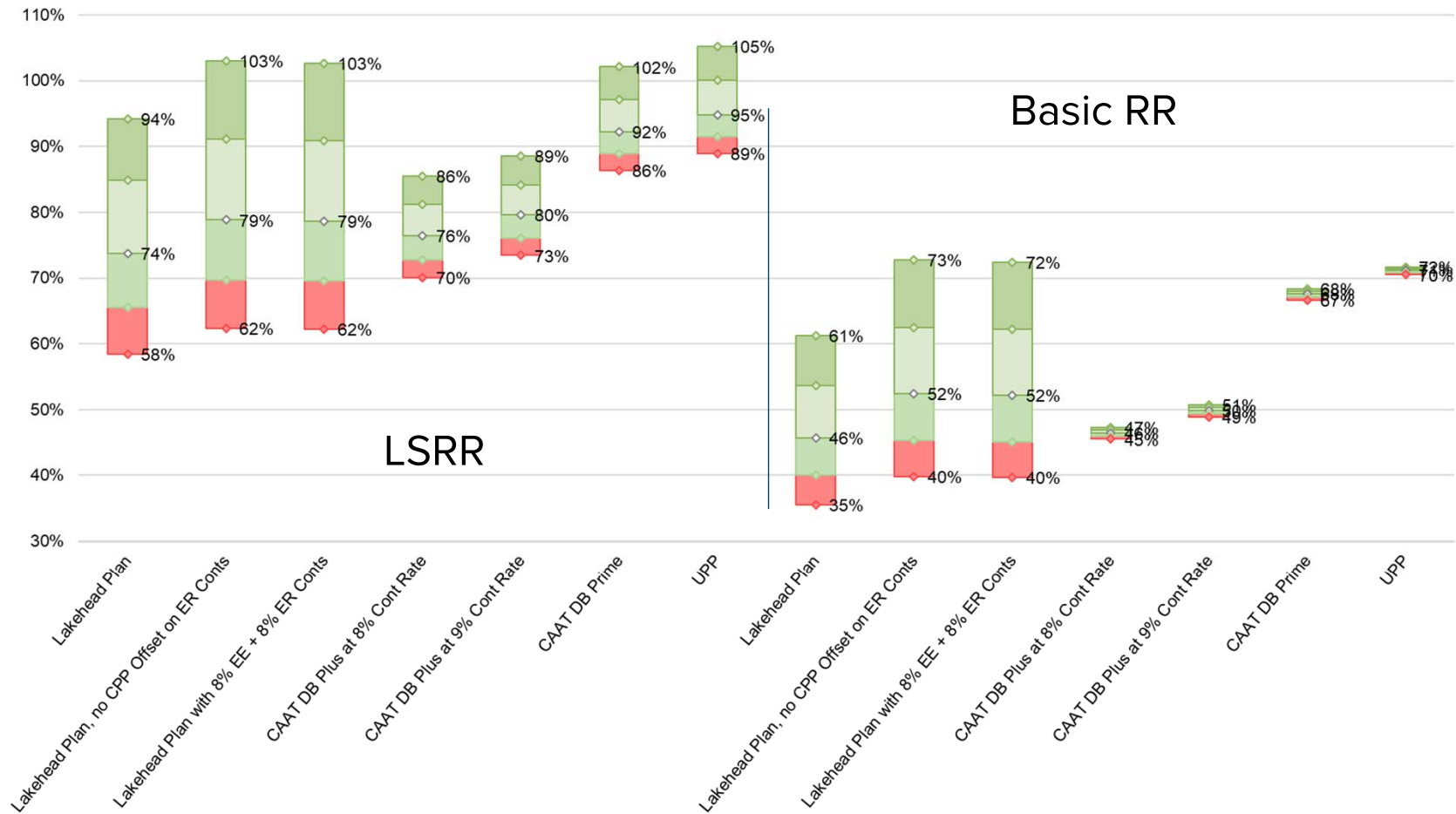
<sup>1</sup>Adjusted for CPP offset. Rate shown based on \$100,000 earnings.  
<sup>2</sup>Assumes employees elect maximum rate, where choice is available  
<sup>3</sup>Faculty rate/Non-faculty rate

# Alternatives for consideration

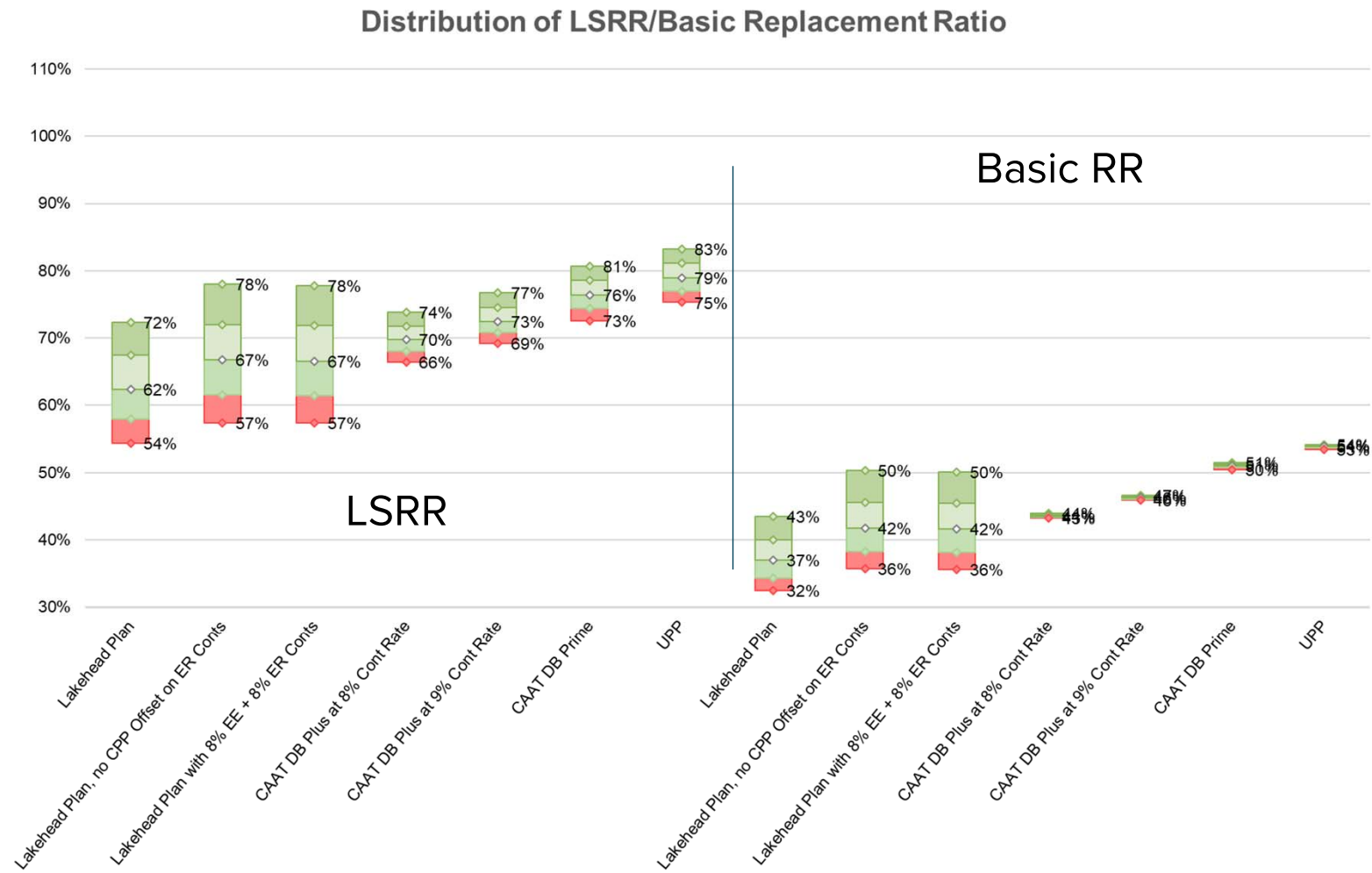
- The alternatives analyzed include
  - Continuing with the current LUPP at increased contribution rates, and
  - Transfer to an existing JSPP
- For benchmarking purposes, we have analyzed member outcomes under the following plan design scenarios (for future service only):
  - Continue with LUPP
    1. Current Lakehead Plan
    2. Lakehead Plan but without CPP offset on Employer contributions
    3. Lakehead Plan with contributions of 8% employee and 8% employer for all members; no CPP offset
  - Transfer to an existing JSPP
    4. CAAT DB Plus, 8% employee/employer contribution rate
    5. CAAT DB Plus, 9% employee/employer contribution rate
    6. CAAT DB Prime Plan
    7. University Pension Plan

# Non Faculty 30, \$75,000 Earnings

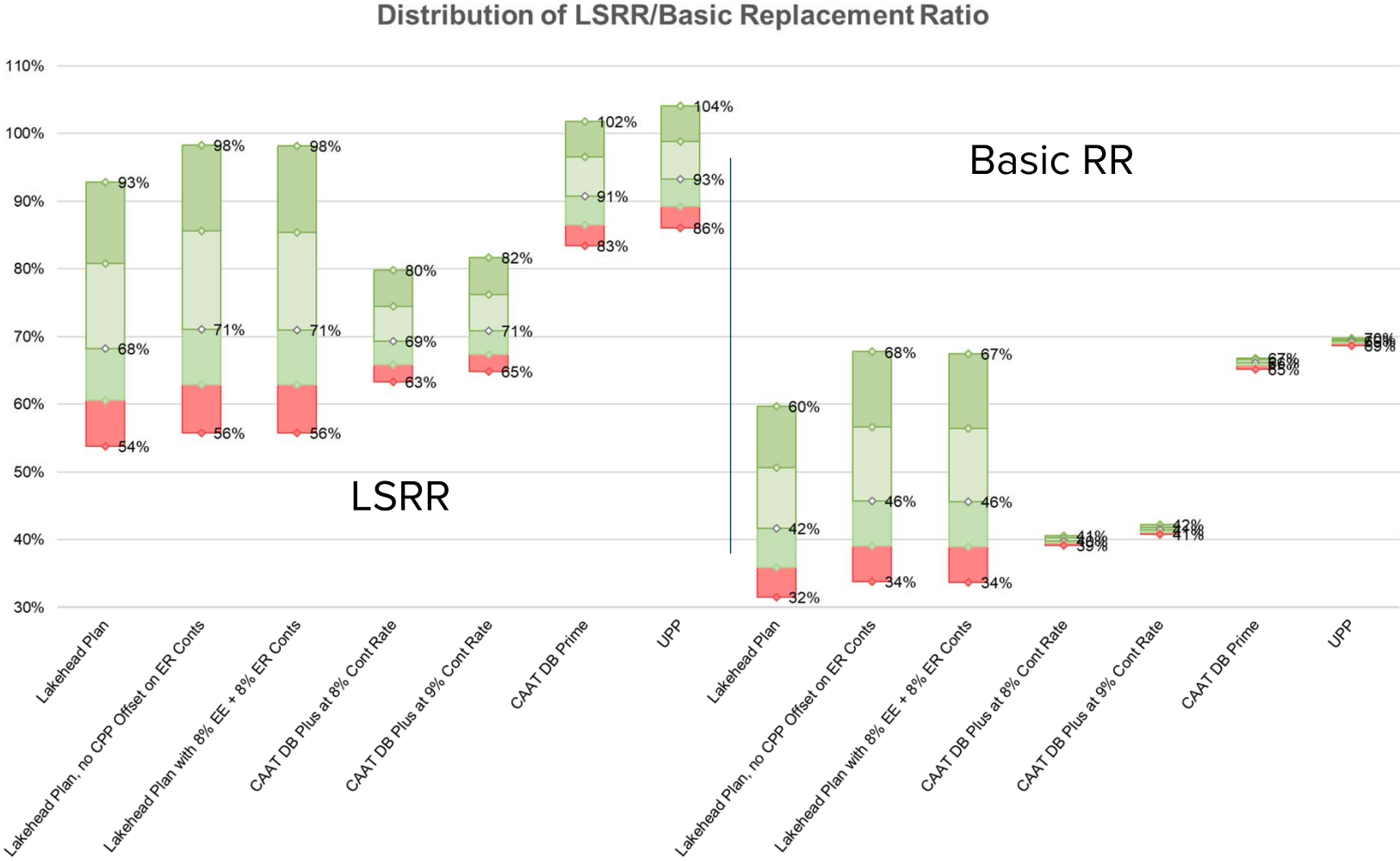
Distribution of LSRR/Basic Replacement Ratio



# Non Faculty 45, \$75,000 Earnings

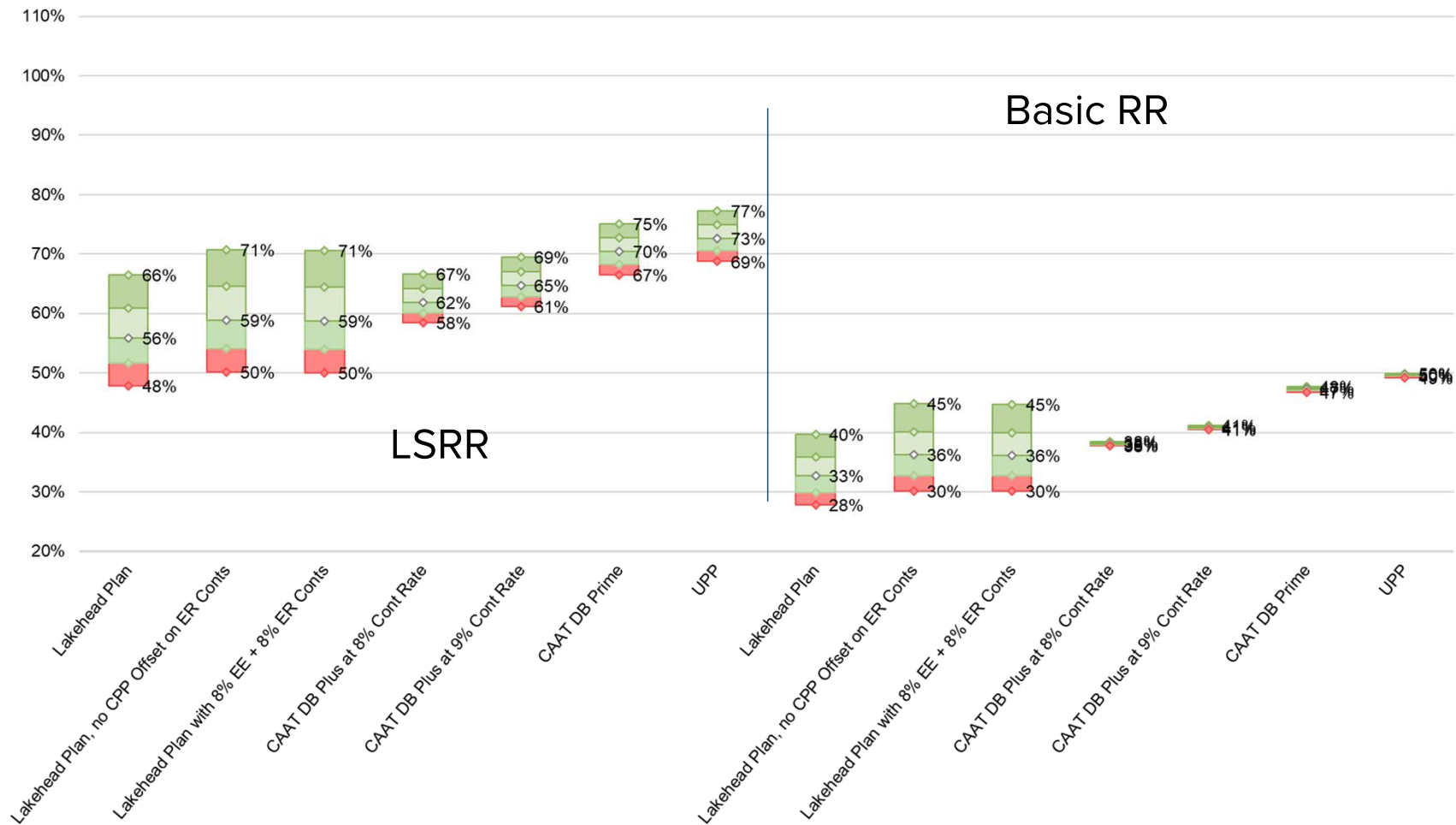


# Non Faculty 30, \$100,000 Earnings



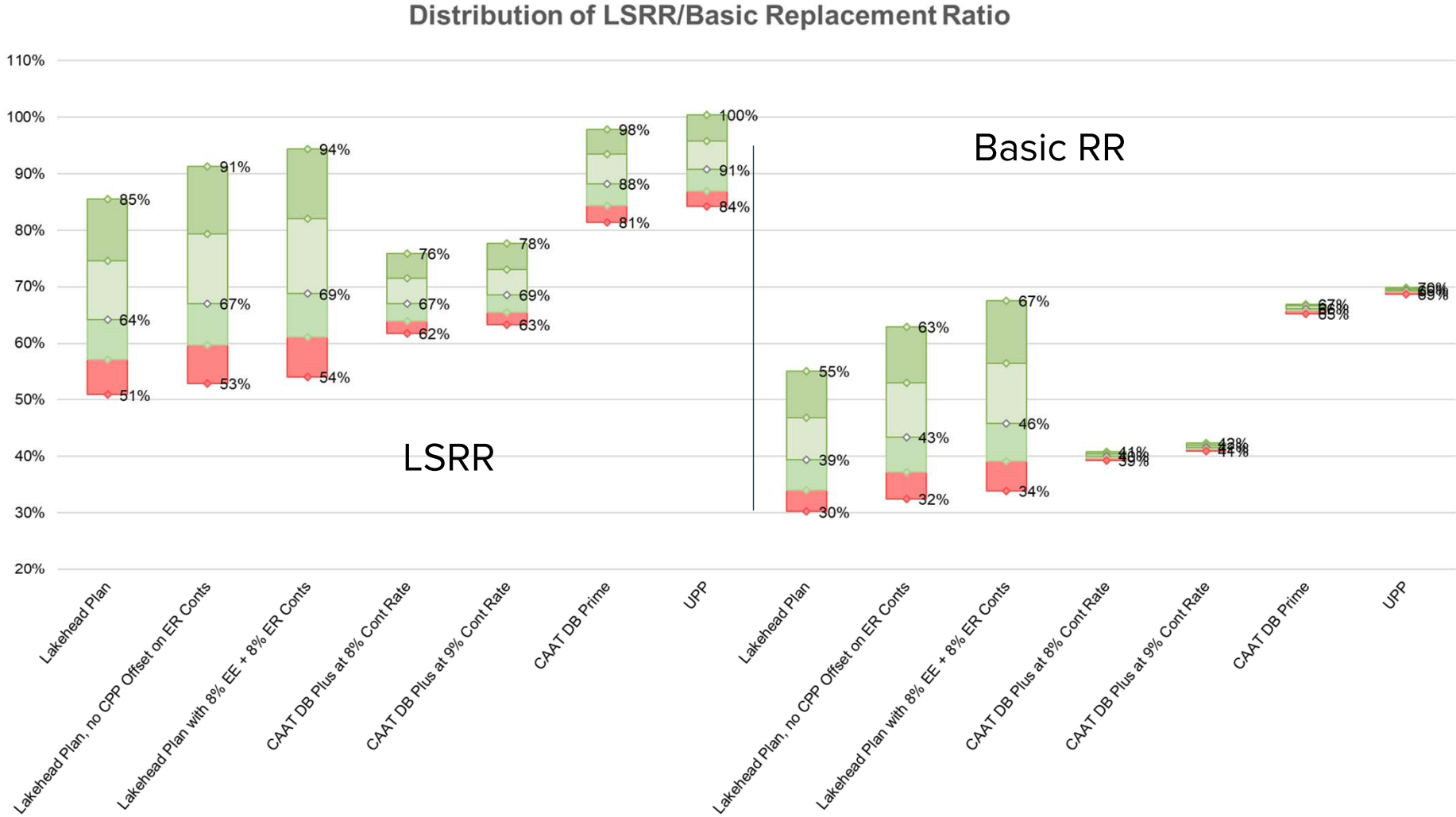
# Non Faculty 45, \$100,000 Earnings

Distribution of LSRR/Basic Replacement Ratio

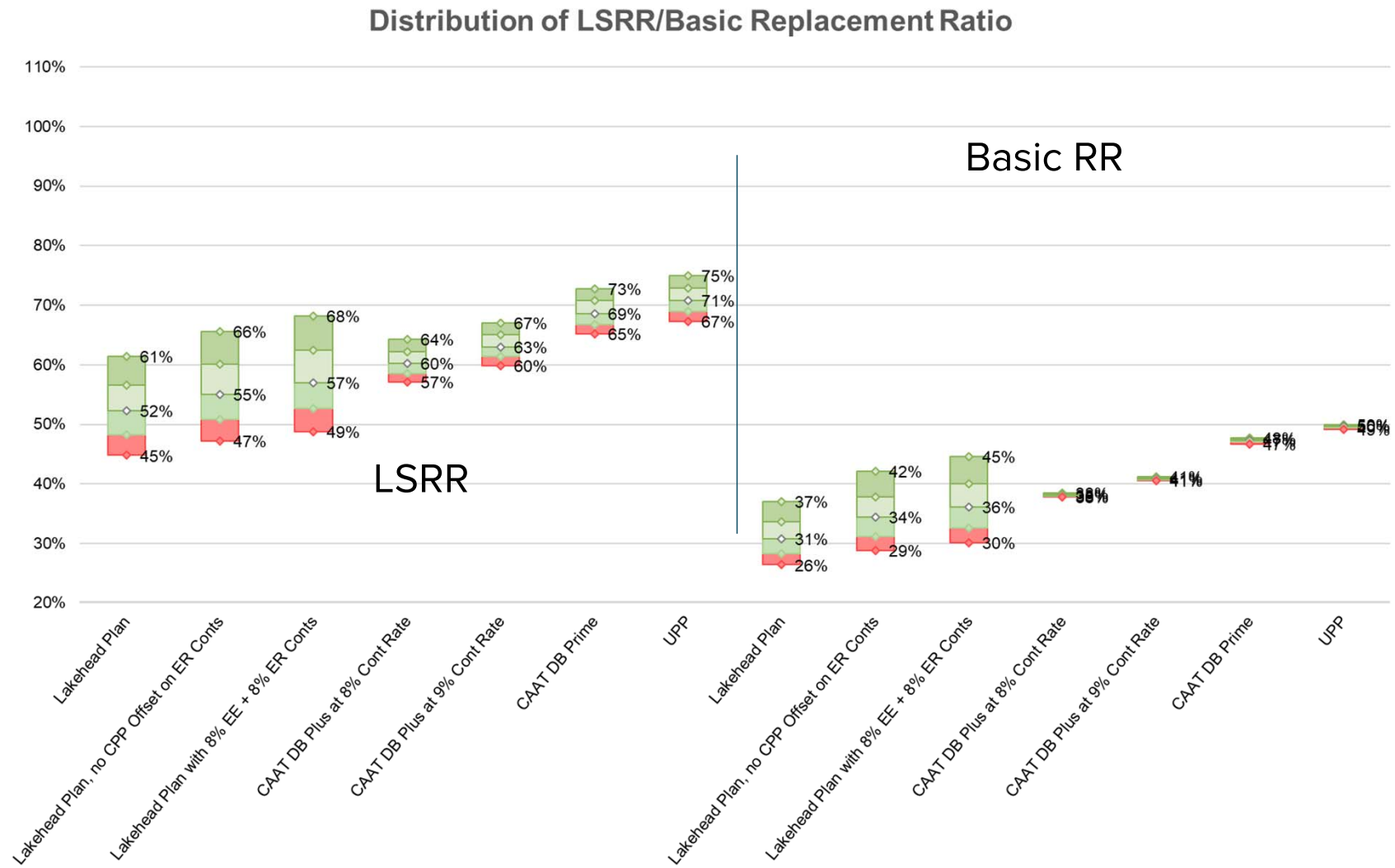




# Faculty 30, \$100,000 Earnings



# Faculty 45, \$100,000 Earnings



# Observations

- Member outcomes under the Lakehead Plan are improved with removal of the Employer CPP offset, with the median replacement ratios increasing by 3-5%
  - An additional increase of approximately 2% can be seen by increasing Faculty employee contributions to 8%
- Participation in the CAAT DB Plus Plan reduces the volatility of member outcomes, and provides median replacement rates that are up to 10% higher than the current Lakehead plan, depending on the contribution rate selected
  - Outperformance at the median level is related to the age of the member with more consistency in outcomes between the plans for younger members
  - While median replacement rates are higher under the CAAT DB Plus Plan, there is the opportunity for LUPP to outperform the CAAT DB Plus Plan in top quartile scenarios
  - It should be noted that both CAAT DB Plus options modelled reflect contribution rates that are higher than current Lakehead contribution rates
- JSPPs such as CAAT DB Prime or UPP provide significantly higher replacement rates, given that they are DB plans with benefits that reflect highest average earnings, and higher contribution rates (that may go above 18% money purchase limits)



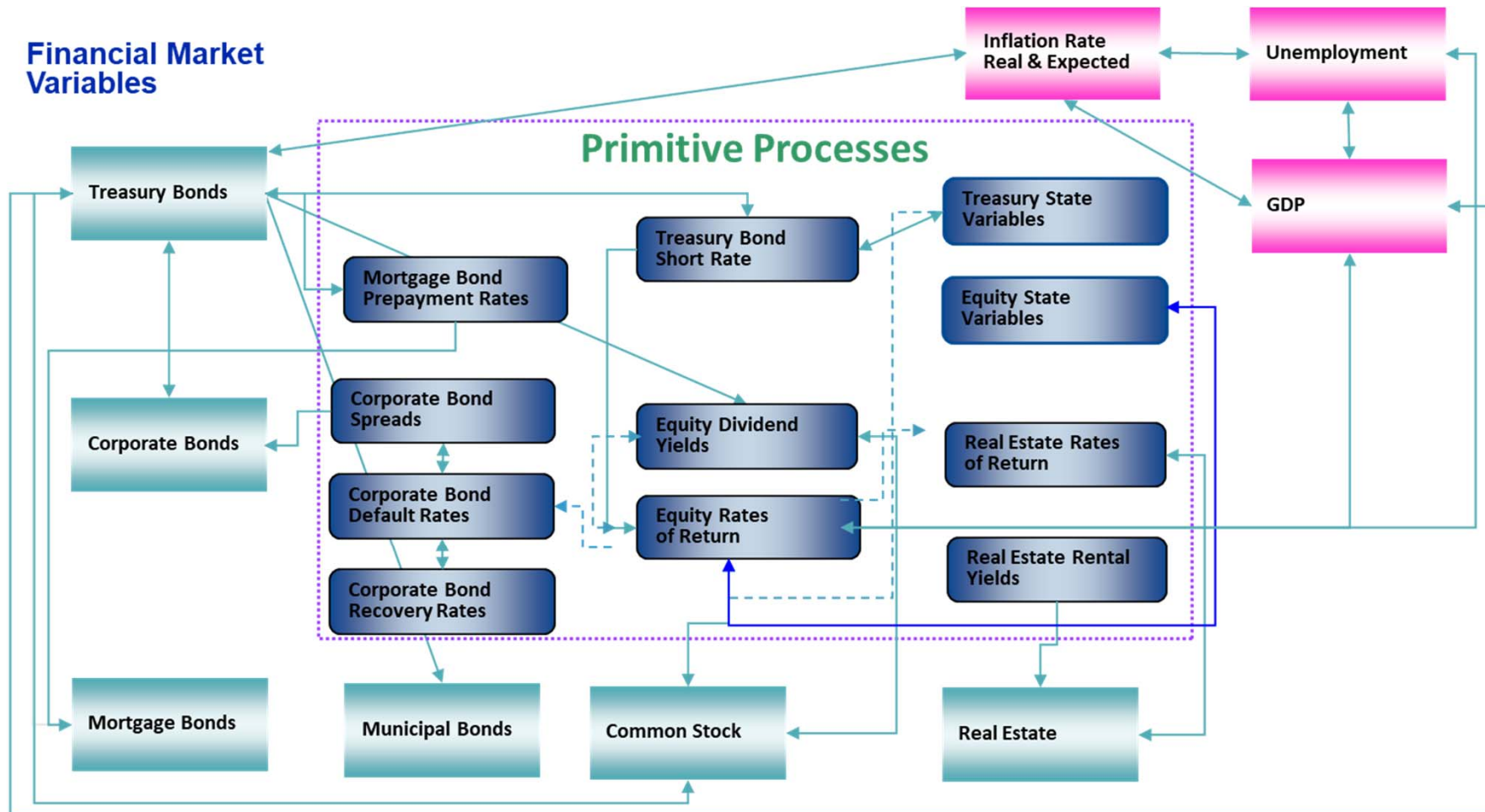
# Appendix A

Eckler Economic Scenario Generator (GEMS®) and Capital Market Assumptions

## About GEMS®

- State-of-the-art Economic Scenario Generator which enables users to simulate future states of the global economy and financial markets. It uses advanced modeling and estimation technology to produce empirically validated, realistic economic behavior
- Developed by Conning, a leading global investment management firm with a long history of serving the insurance industry
- Models developed by Conning's team of quantitative finance experts
- Advantages of the model:
  - Cascade structure, which introduces joint behaviour into the generated scenarios (e.g. a link between interest rates and equities or interest rates and inflation)
  - Integration and transparency
  - Realistic real world tail events

# GEMS® Internal Structure and Relationships



# GEMS® Models

- The GEMS scenario generator aims to model not just individual economies or key economic variables within each economy but importantly the joint behaviour of variables across economies.
- Each economy and each economic model form a network of individual models that are interconnected and together create a coherent set of scenarios on a global basis.
- The models chosen to implement GEMS reflect Conning's desire to use enough sophistication to reproduce actual market dynamics and actual pricing.
- In GEMS, the risk-free term structure is modeled through the short rate. The zero-bond yield curve and coupon curves are derived from the short rate. The short rate is driven by an  $n$  dimensional affine square root diffusion process. The model was chosen by Conning's for the following primary reasons:
  - Realistic and stable interest rates
  - Captures key factors that drive interest rate risk
  - Accurate and efficient derivatives pricing.
- For each of the primary models, the table on the following slide describes the key attributes.

# GEMS® Models

Model	Type	Key Attributes
Interest Rates	3-factor Affine Model	<ul style="list-style-type: none"> <li>• Realistic yield distributions</li> <li>• Produces all commonly observed yield curve shapes including inversions</li> <li>• No exploding yields</li> <li>• The ability of the model to fit the initial yield curve</li> </ul>
Corporate Bonds	GEMS Corporate Security Model	<ul style="list-style-type: none"> <li>• Model of individual bonds</li> <li>• Stochastic spreads and stochastic transition and default incorporated</li> <li>• Issuer concentration risk can be captured</li> </ul>
	GEMS Corporate Yield Model	<ul style="list-style-type: none"> <li>• Stochastic spreads</li> <li>• Realistic transition and default dynamics</li> <li>• Ability to produce the jump-like behavior in spreads observed during the 2008 crisis (RW)</li> <li>• Market-consistent fits to the initial spread curves</li> <li>• Imperfect correlations between spreads</li> </ul>
Equity	SVJ (Stochastic Volatility with Jumps)	<ul style="list-style-type: none"> <li>• Realistic return and volatility behavior</li> <li>• Jump process produces crisis-like events</li> </ul>
Inflation	4-factor Affine Model	<ul style="list-style-type: none"> <li>• Realistic interest rate and inflation dynamics</li> <li>• Realistic real yield curve dynamics</li> <li>• Inflation derivatives priced</li> </ul>
Foreign Exchange	Heston	<ul style="list-style-type: none"> <li>• Stochastic volatility of FX rates incorporated</li> <li>• FX derivatives priced</li> </ul>
GDP	VarX	<ul style="list-style-type: none"> <li>• Real and nominal GDP modeled</li> <li>• Direct link between GDP and other variables (e.g., interest rates)</li> </ul>



# Capital Market Assumption Setting

- Start with GEMS<sup>®</sup> capital market model
  - Calibrated quarterly based on historical experience
  - Back testing and validation report provided
  - Academic assessment and review
- Incorporate Eckler subjective views
  - Bank of Canada inflation controls and target
    - Impacts expected levels and volatility
  - Calibrate average treasury yield curve progression (rate and reversion)
    - Under the base GEMS definition, the equilibrium yield curve is based on historical data that dates to the 1940s. Eckler re-calibrates both the equilibrium yield curve and the speed of mean reversion. In particular, the equilibrium yield curve is calibrated to be more in-line with post inflation control data (post 1991) and the speed of mean reversion is slowed in comparison to the GEMS baseline definition.
    - Informed based on historical calculated real short rates (i.e., nominal rates less inflation) and short-long term premiums
  - Calibrate other asset classes
    - Primarily target long-term median return levels
    - Initially focus on equities and then look at alternatives

# 30.06.2020 CMAAs - 10, 20 and 30 Year Expectations

## 30.06.2020 Capital Market Assumptions

Asset Class	Geometric Return 10 Yr	Geometric Return 20 Yr	Geometric Return 30 Yr	Standard Deviation 10 Yr	Standard Deviation 20 Yr	Standard Deviation 30 Yr	
Inflation	1.6%	1.8%	1.9%	1.0%	1.2%	1.2%	
Fixed Income	Cash/Short Term	0.9%	1.5%	1.8%	1.3%	1.6%	1.7%
	Universe Bonds	0.8%	2.0%	2.6%	3.8%	4.3%	4.5%
	Short Bonds	1.3%	2.1%	2.6%	2.1%	2.5%	2.6%
	Mid Bonds	1.2%	2.3%	2.9%	3.9%	4.3%	4.5%
	Long Bonds	-0.2%	1.5%	2.5%	6.2%	6.9%	7.2%
	Corporate Bonds	1.7%	2.7%	3.3%	3.5%	3.9%	4.0%
	Real Return Bonds	-0.4%	1.3%	2.3%	6.0%	7.0%	7.1%
	High Yield Bonds	2.8%	4.2%	4.9%	10.5%	10.5%	10.5%
	Mortgages	2.1%	2.8%	3.2%	3.6%	3.8%	3.8%
	Core Plus Bonds	1.5%	2.7%	3.3%	3.5%	3.9%	4.1%
	EM Debt	2.8%	4.4%	5.2%	9.6%	10.1%	10.3%
	Private Debt	3.4%	4.4%	4.9%	4.5%	4.6%	4.7%
	Equities	Canadian Equity	6.4%	6.7%	7.0%	17.7%	17.7%
US Equity		6.4%	6.8%	7.0%	16.8%	17.1%	17.2%
International Equity		6.6%	6.9%	7.0%	18.1%	18.4%	18.4%
Global Equity		6.6%	6.9%	7.1%	17.0%	17.3%	17.3%
Small Cap Equity		7.5%	7.9%	8.0%	19.5%	19.5%	19.4%
EM Equity		7.4%	8.4%	8.9%	21.0%	21.4%	21.5%
USD	US Equity	6.7%	6.9%	7.1%	14.9%	15.1%	15.2%
	International Equity	6.9%	7.0%	7.1%	15.9%	16.1%	16.1%
	Small Cap Equity	7.7%	8.0%	8.1%	17.8%	17.7%	17.6%
	High Yield Bonds	3.1%	4.3%	5.0%	6.0%	5.9%	5.8%
Alternative	Real Estate	5.6%	5.6%	5.6%	8.2%	8.3%	8.3%
	Infrastructure	5.6%	6.2%	6.3%	11.3%	11.2%	11.2%
	Private Equity	8.1%	8.6%	9.0%	20.5%	20.8%	20.8%
	Hedge Funds	4.9%	5.6%	6.0%	10.6%	10.7%	10.7%

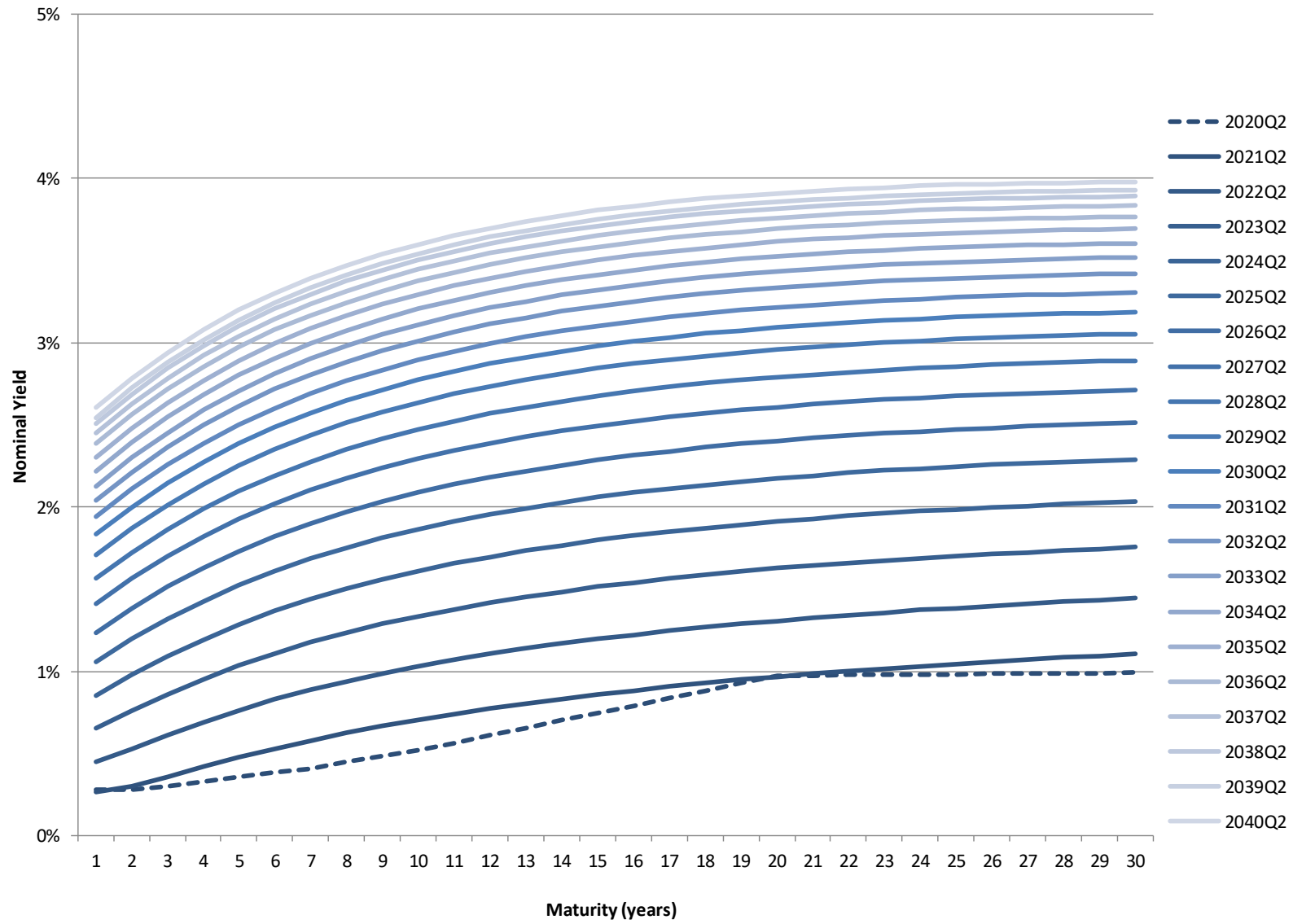
# 30.06.2020 CMAs - 20 Year Correlation Table

## 20 Year Correlations

		Fixed Income												Equities						Alternatives			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Fixed Income	1 Inflation	1.00																					
	2 Cash	0.37	1.00																				
	3 Universe Bonds	0.07	0.37	1.00																			
	4 Short Bonds	0.15	0.60	0.94	1.00																		
	5 Long Bonds	0.03	0.25	0.98	0.86	1.00																	
	6 Corporate Bonds	0.07	0.38	0.99	0.94	0.97	1.00																
	7 Real Return Bonds	0.21	0.27	0.94	0.81	0.96	0.91	1.00															
	8 High Yield Bonds	0.03	0.17	0.24	0.26	0.22	0.25	0.19	1.00														
	9 Mortgages	0.07	0.31	0.57	0.59	0.54	0.57	0.51	0.15	1.00													
	10 Core Plus Bonds	0.08	0.40	0.93	0.89	0.90	0.92	0.85	0.56	0.63	1.00												
	11 Emerging Market Debt	0.08	0.23	0.26	0.28	0.23	0.27	0.22	0.66	0.16	0.53	1.00											
	12 Private Debt	0.07	0.30	0.49	0.52	0.46	0.50	0.42	0.84	0.66	0.77	0.59	1.00										
Equities	13 Canadian Equity	0.04	0.10	0.05	0.06	0.04	0.08	0.02	0.17	0.04	0.15	0.41	0.15	1.00									
	14 US Equity	0.04	0.08	0.04	0.05	0.03	0.06	0.02	0.55	0.03	0.28	0.75	0.43	0.66	1.00								
	15 EAFE Equity	0.06	0.07	-0.04	-0.03	-0.04	-0.02	-0.04	0.50	-0.02	0.19	0.67	0.37	0.59	0.92	1.00							
	16 Global Equity	0.05	0.07	0.01	0.02	0.00	0.03	-0.01	0.54	0.01	0.25	0.73	0.42	0.64	0.99	0.97	1.00						
	17 US Small Cap Equity	0.04	0.07	0.04	0.05	0.03	0.06	0.02	0.49	0.03	0.25	0.65	0.39	0.74	0.87	0.80	0.86	1.00					
	18 Emerging Market Equit	0.10	0.14	-0.02	0.01	-0.03	0.00	-0.02	0.38	0.00	0.17	0.56	0.29	0.59	0.78	0.74	0.78	0.76	1.00				
Alts	19 Real Estate	0.07	0.07	-0.06	-0.04	-0.07	-0.06	-0.05	0.00	-0.03	-0.05	0.04	-0.02	0.10	0.07	0.07	0.07	0.08	0.08	1.00			
	20 Global Infrastructure	0.08	0.10	-0.06	-0.03	-0.07	-0.06	-0.06	0.71	-0.03	0.21	0.53	0.53	0.07	0.47	0.50	0.49	0.43	0.37	0.05	1.00		
	21 Private Equity	0.05	0.09	0.04	0.06	0.04	0.07	0.02	0.46	0.03	0.26	0.70	0.37	0.83	0.97	0.88	0.95	0.90	0.78	0.09	0.37	1.00	
	22 Hedge Fund	0.06	0.14	0.16	0.17	0.16	0.19	0.14	0.41	0.10	0.34	0.65	0.37	0.90	0.90	0.84	0.89	0.88	0.74	0.09	0.29	0.97	1.00

High Correlation
Medium Correlation
Low Correlation

# 30.06.2020 CMAAs - Progression of Avg Nominal Treasury Yield Curve



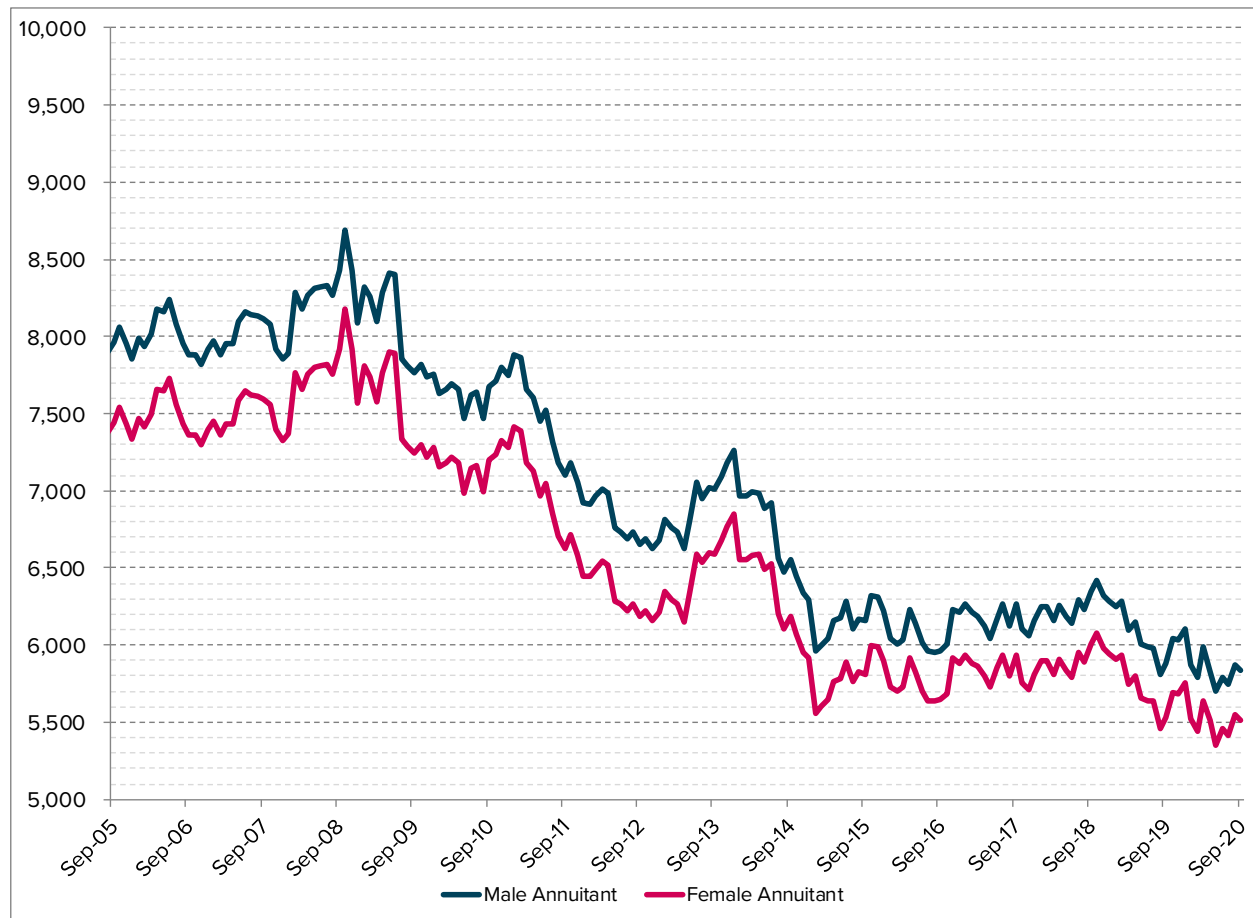


# Appendix B

Illustration - Impact of Changing Interest Rates on Annuities

# Impact of Changes in Interest Rates

## Income from a \$100,000 Account Balance



**Male** - \$5,837.49 per year / \$486.46 per month at September 30, 2020

**Female** - \$5,510.71 per year / \$459.23 per month at September 30, 2020

- As interest rates fall, the amount of income that can be provided from accumulated account balances falls
- The chart to the left shows the amount of income that can be provided from \$100,000. That amount has fallen from approximately \$7,500/\$8,000 at September 30, 2005 for females/males to \$5,500/\$5,800 at September 30, 2020
- These estimates are illustrative, and are based on an annual lifetime annuity under the following assumptions:
  - Annuitant who is age 65
  - Annuity purchase rate consistent with the Canadian Institute of Actuaries' Annuity Purchase Proxy
  - 10-year guarantee period, no survivor benefit, no indexation and no commission

# ECKLER