NORTH DAKOTA RETIREMENT AND INVESTMENT OFFICE
Teachers' Fund for Retirement
State Investment Board

Segal Consulting

North Dakota Teachers' Fund for Retirement

Plan Management Policy Score Update
Based on the June 30, 2019 Actuarial Valuation

December 20, 2019

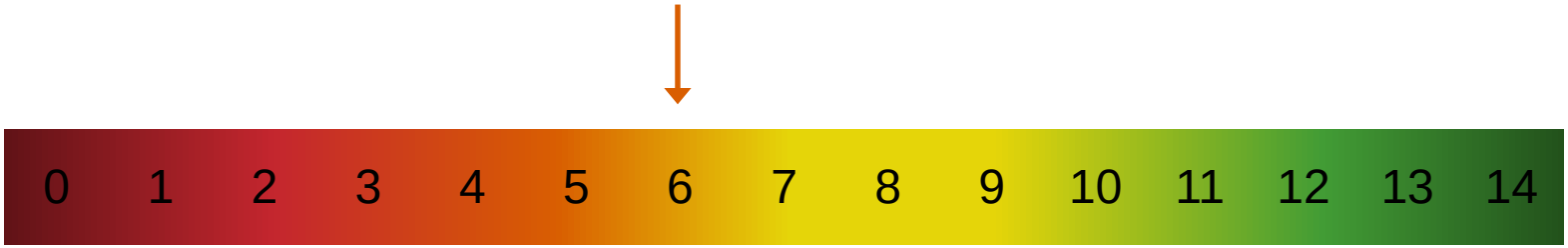
Summary Score based on July 1, 2019 Actuarial Valuation

- Composite summary score equal to **6**

Assessment:

Summary score of 11 to 14:	**Objectives being met or likely to be met**
Summary score of 7 or 10:	**Objectives may be met over longer period**
Summary score of 4 to 6:	**Continue to monitor**
Summary score of 0 to 3:	**Changes should be considered**

Based on a summary score of 6: Orange



The summary score has not changed from last year's valuation results. However, the summary score will be updated based on the results of the experience study currently in progress.

Plan Funding Policy vs. Plan Management Policy

The funding policy sets actuarially sound contribution rates

- TFFR's funding policy serves as a benchmark, which compares the actuarially determined contribution rate to the fixed employer contribution rate
- Actuarially determined contribution is equal to Normal Cost plus 24 year amortization of Unfunded Accrued Liability (as of 7/1/2019)
  - Amortization targets 100% funding in 24 years
  - TFFR's amortization method is 30 year closed period that began on July 1, 2013

The plan management policy monitors the ongoing plan health

- Objective criteria have been established to evaluate health of TFFR
- Market volatility and contribution inadequacy risks are illustrated through stochastic modeling
- Board is able to evaluate the probabilities of future funded ratios
- Serves as advance warning tool

The TFFR plan management policy is a more robust way to evaluate the ongoing health and sustainability of TFFR.

Using the Plan Management Policy

- Initially, the Policy Score will be updated subsequent to each valuation and experience study
- The Policy Score provides context for likelihood of future positive or negative events
  - For example, if funded ratio is projected to be at an unacceptable level with a high likelihood, the Board can explore ways to address this
- The Policy Score will be part of the actuarial analysis of proposed legislation
  - Will proposed legislation improve, retain, or worsen the Policy Score?

The July 1, 2019 Policy Score is determined on the basis of:

- **The June 30, 2019 actuarial valuation**
- **The Horizon Actuarial Services, LLC *Survey of Capital Market Assumptions (2019 Edition)***

Stochastic Modeling of Investment Return

- Modeling of future simulated return trials is based on:
  - The Horizon Survey of Capital Market Assumptions (2019 Edition)
    - This survey compiles and averages the capital market assumptions of 34* investment consultants
  - TFFR's current target asset allocation, shown below:

	Asset Class	Target Allocation
Fixed/Alternative	US Core	16%
	Real Estate	10%
	High Yield	7%
	Commodities/Timber	2%
	Infrastructure	6%
	Cash	1%
Equity	US Large Cap	24%
	US Small Cap	7%
	International Developed	17%
	Emerging Markets	4%
	Private Equity	6%

* Our analysis is based upon the 16 respondents that provided "long-term" (20+ years) assumptions

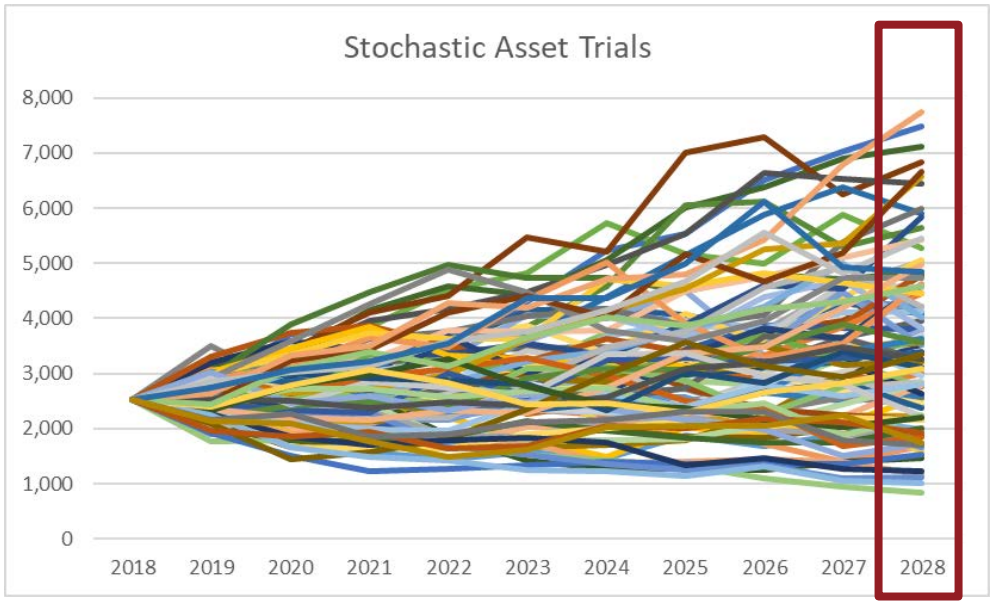
Capital Market Assumptions

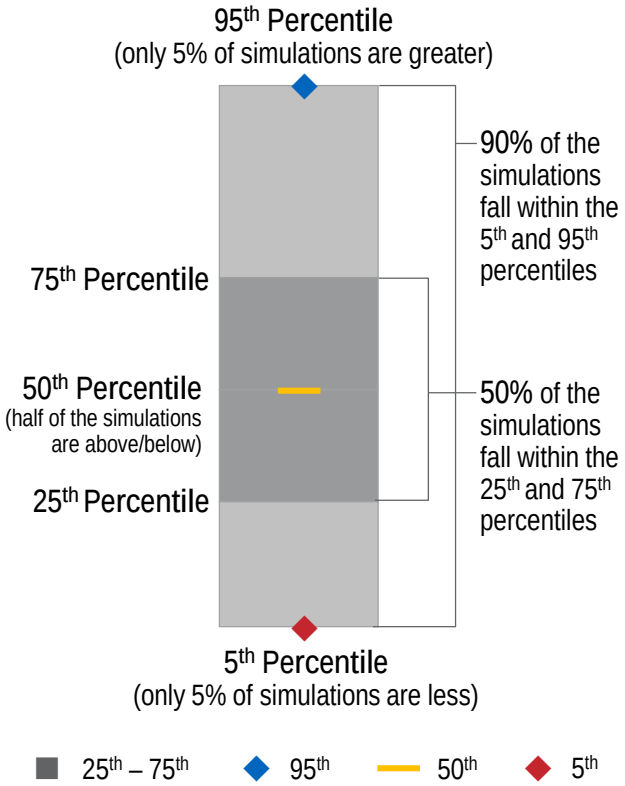
	Asset Class	Expected Return*/ Standard Deviation		Target Allocation	Weighted Return
Fixed/Alternative	US Core	4.5%	5.5%	16%	0.72%
	Real Estate	7.9%	15.0%	10%	0.79%
	High Yield	6.4%	10.1%	7%	0.45%
	Commodities/Timber	6.3%	17.7%	2%	0.13%
	Infrastructure	8.5%	14.4%	6%	0.51%
	Cash	3.1%	2.3%	1%	0.03%
Equity	US Large Cap	8.3%	16.2%	24%	1.99%
	US Small Cap	9.5%	20.2%	7%	0.67%
	International Developed	9.3%	18.2%	17%	1.58%
	Emerging Markets	11.7%	24.7%	4%	0.47%
	Private Equity	12.8%	22.1%	6%	0.77%
	Total			**100%**	**8.10%**
	Adjustment to Geometric				(0.63%)
	Total Long-term Return				**7.47%**

* Based on 20-year arithmetic assumptions and reflects long-term inflation of 2.29%

Summarizing Stochastic Results

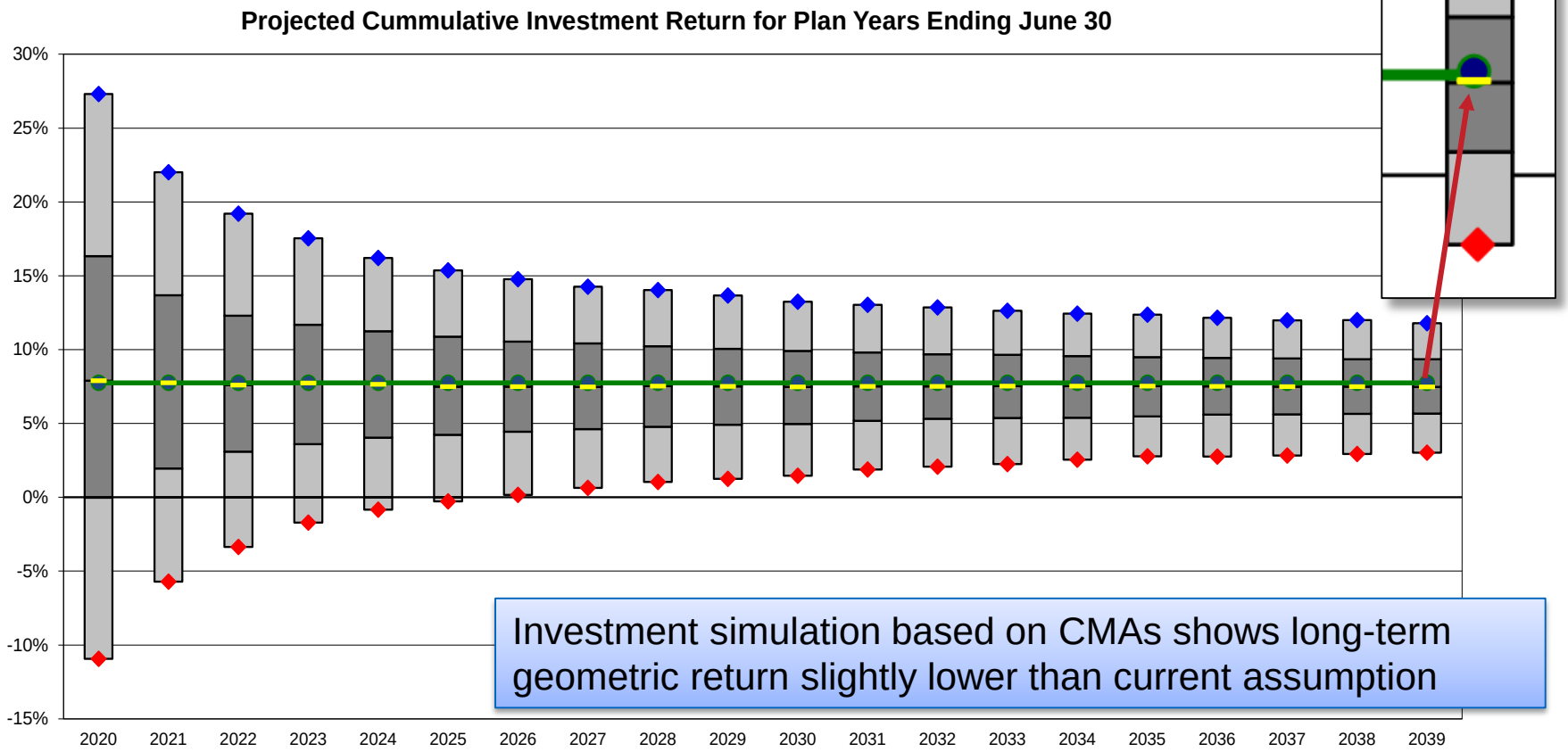
- The individual trials are grouped into percentiles and summarized as a range





- The median is represented by the yellow line at the center of the distribution
- The dark gray shaded rectangle represents 50% of all outcomes around the median
- The large, light gray rectangle (inclusive of the dark gray area) represents 90% of all outcomes around the median
- Other percentile results/probabilities are calculated from the underlying data

Investment Return



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
95th	27.3%	22.0%	19.2%	17.5%	16.2%	15.4%	14.8%	14.3%	14.0%	13.7%	13.2%	13.0%	12.9%	12.6%	12.4%	12.4%	12.2%	12.0%	12.0%	11.8%
75th	16.3%	13.7%	12.3%	11.7%	11.2%	10.9%	10.5%	10.4%	10.2%	10.0%	9.9%	9.8%	9.7%	9.7%	9.6%	9.5%	9.4%	9.4%	9.4%	9.4%
50th	7.9%	7.8%	7.6%	7.7%	7.7%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%
25th	0.0%	1.9%	3.1%	3.6%	4.0%	4.2%	4.4%	4.6%	4.8%	4.9%	5.0%	5.2%	5.3%	5.4%	5.4%	5.5%	5.6%	5.6%	5.7%	5.7%
5th	-10.9%	-5.7%	-3.4%	-1.7%	-0.8%	-0.3%	0.2%	0.6%	1.0%	1.3%	1.5%	1.9%	2.1%	2.3%	2.6%	2.8%	2.8%	2.8%	2.9%	3.0%
	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%	7.75%

Current investment return assumption

Metrics for Plan Management Policy Scoring System

Current funded ratio

- The Fund's current funded ratio is one of the most visible metrics
- A high current funded ratio should be recognized in the scoring

Downside funded ratio in 2030

- In the short-term, the Fund should avoid an "undesirable" funded ratio with relatively high probability

Target funded ratio in 2040

- Over a longer term, the Fund should be on the path to achieving its goals with reasonable probability

Improvement in funded ratio over a 10-year period

- Regardless of where the Fund sits today, it should seek an increasing funded ratio over time

Ability to recover from/withstand a market downturn

- In situations where the financial markets experience a downturn, the scoring should recognize when the funded ratio improves relative to the impact after the downturn

For purposes of the Policy scoring, the market value of assets is used when determining the funded ratio.

Policy Scoring System

Criteria 1

Based on current year funded ratio

- If current ratio is 90% or higher: **+3**
- If current ratio is between 80% to 90%: **+2**
- If current ratio is between 70% to 80%: **+1**
- If current ratio is less than 70%: **+0**

Criteria 2

Downside funded ratio in 2030

- Under 65% funded ratio with less than 20% probability: **+3**
- Under 65% funded ratio with less than 30% probability: **+2**
- Under 65% funded ratio with less than 40% probability: **+1**
- Under 65% funded ratio with more than 40% probability: **+0**

Criteria 3

Target funded ratio in 2040

- 85% or higher with more than 50% probability: **+4**
- 80% or higher with more than 50% probability: **+3**
- 75% or higher with more than 50% probability: **+2**
- 70% or higher with more than 50% probability: **+1**
- Not more than 70% with more than 50% probability: **+0**

Criteria 4

Improvement over 10 years

- Funded ratio improves by +5% over 10 years with 66% probability: **+2**
- Funded ratio improves by +5% over 10 years with 50% probability: **+1**
- Ratio does not improve by +5% over 10 years with 50% probability: **+0**

Criteria 5

Ability to recover from market downturn*

- Funded ratio after downturn improves by +5% over 10 years with 50% probability: **+2**
- Funded ratio after downturn improves by +5% over 10 years with 33% probability: **+1**
- Ratio after downturn does not improve by +5% over 10 years with 33% probability: **+0**

* “Market downturn” defined as a two-year compound average return of -10% or worse

Policy Scoring System *(continued)*

- Total summary score ranged from 0 to 14
  - Metrics focus on funded ratio measures
- Summary "health" is summed up as follows:
  - **Green** (score of 11 to 14) indicates *"objectives being met or likely to be met"*
  - **Yellow** (score of 7 to 10) indicates *"objectives may be met over longer period"*
  - **Orange** (score of 4 to 6) indicates *"continue to monitor"*
  - **Red** (score of 0 to 3) indicates *"changes should be considered"*

Policy Scoring System *(continued)*

Criteria 1

Current year funded ratio is 66%

- If current ratio is 90% or higher: **+3**
- If current ratio is between 80% to 90%: **+2**
- If current ratio is between 70% to 80%: **+1**
- If current ratio is less than 70%: **+0**

+0

Criteria 2

37% probability of funded ratio <65% in 2030

- Under 65% funded ratio with less than 20% probability: **+3**
- Under 65% funded ratio with less than 30% probability: **+2**
- Under 65% funded ratio with less than 40% probability: **+1**
- Under 65% funded ratio with more than 40% probability: **+0**

+1

Criteria 3

51% probability of funded ratio >80% in 2040

- 85% or higher with more than 50% probability: **+4** (47% probability)
- 80% or higher with more than 50% probability: **+3** (51% probability)
- 75% or higher with more than 50% probability: **+2** (56% probability)
- 70% or higher with more than 50% probability: **+1** (60% probability)
- Not more than 70% with more than 50% probability: **+0**

+3

Criteria 4

55% probability of improvement over 10 years

- Funded ratio improves by +5% over 10 years with 66% probability: **+2**
- Funded ratio improves by +5% over 10 years with 50% probability: **+1**
- Ratio does not improve by +5% over 10 years with 50% probability: **+0**

+1

Criteria 5

39% probability of recovering from market downturn*

- Funded ratio after downturn improves by +5% over 10 years with 50% probability: **+2**
- Funded ratio after downturn improves by +5% over 10 years with 33% probability: **+1**
- Ratio after downturn does not improve by +5% over 10 years with 33% probability: **+0**

+1

+6

* 892 scenarios contain -10% average or worse over 2 years (in the first 10 years), 346 of which “recover”

Notable Differences from Prior Analysis

- The 2019 Horizon Survey CMAs result in a lower 50th percentile long-term geometric return compared to the 2018 study
  - 7.47% versus 7.55%
- The liability projection from the 2019 actuarial valuation is negligibly higher compared to the projection based upon the 2018 actuarial valuation
  - Demographic experience during fiscal 2019 had a very minor impact on the modeling results
- For the most part, the probabilities on which the scoring is based remained similar to the prior analysis
  - Notably, for Criteria 3, where +3 points is given in both this analysis and the prior analysis, the probability of the funded ratio >80% in 2040 decreased from 53% to 51%
    - 50% is the threshold cutoff, so this is a criteria that is close to moving from a “+3” to a “+2”

Other External Factors

- Other factors outside of TFFR could have an effect on the directional trend of future Policy Scores
  - Projected economic conditions
  - Market cycles
  - North Dakota economy
- Taking into consideration the results of the July 1, 2019 actuarial valuation and relevant information used to develop the valuation results and various projections, the Policy score is 6. The stochastic projections on which most of the scoring elements are based rely on composite capital market expectations of several investment consulting firms. These expectations may reflect the potential for near-term market influences to some degree. However, there are other external forces not explicitly factored into the capital market assumptions, which may have an impact on the Policy score in the short-term. Many economists believe that the US economy is ripe for a recession. Several leading indicators, such as an inverted yield curve, slowing GDP growth, and declining corporate profits are pointing towards a recession in the near future. A recession could negate some of the investment gains that TFFR has seen in recent years. In addition, an election year coming up in 2020 and continued trade issues between the U.S. and China also create unrest in investment markets. Typically, the economy in North Dakota tends to weather national recessions well. However, it remains to be seen if the factors that contribute to this would hold true for another recession, if it were to occur.

Caveats

- *The projections are based on the results of the July 1, 2019, actuarial valuation performed for the Board of Trustees of the North Dakota Teachers' Fund for Retirement. The actuarial valuation report has information on the plan provisions, data, methods and assumptions used in the valuation.*
- *Projections, by their nature, are not a guarantee of future results. The projections modeled are intended to serve as estimates of future financial outcomes that are based on the information available to us at the time the modeling is undertaken and completed, and the agreed-upon assumptions and methodologies described herein. Emerging results may differ significantly if the actual experience proves to be different from these assumptions or if alternate methodologies are used.*