Liquidity Analysis

Pennsylvania Public School Employees' Retirement System (PSERS)
November 2020

Investment advice and consulting services provided by Aon Investments USA Inc.

Empower Results®

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Overview
Background

- PSERS' liquidity analysis is performed under **Portfolios A, B, C, and H** from the 2020 asset-liability study
  - Intended as a stress-testing model, incorporating the profile of the liabilities as well as expected future contributions
  - Uses different scenarios for economic environments and other relevant events
  - Shows how the portfolio's liquidity profile could evolve with a given investment strategy

- We categorized investments by liquidity into five buckets
  - ***Liquid (Risk-Reducing Assets):*** less than 3 months needed for return of capital (e.g. publicly traded securities)
  - ***Liquid (Return-Seeking Assets):*** less than 3 months needed for return of capital (e.g. publicly traded securities)
  - ***Quasi-Liquid:*** Typical lock-up of 3–12 months. Conservatively, we assumed a 1-year lock-up in most economic environments, 2 years in a Recession scenario, and 3 years in a Black Skies scenario (e.g. many hedge funds, core real estate)
  - ***Illiquid: Potential lock-up of 5–10 years***, depending on economic environment (e.g. closed-ended real estate)
  - ***Illiquid: Potential lock-up of 10+ years*** (e.g. typical private equity)

- This is intended to be a <u>conservative</u> approximation of the actual liquidity properties of the assets

- Not surprisingly, varying economic scenarios would lead PSERS' percentage allocation to alternative assets to differ from its targets due to liquidity differences in asset classes

Overview
Asset Allocation and Liquidity Category

Portfolio Studied	(A) Current Target	(B) Highest Return, Liquidity, Fixed Income & Leverage	(C) Higher Return, Liquidity & Leverage	(H) Higher Return & Liquidity / Lower Leverage
Liquid (Risk-Reducing Assets + Financing)				
U.S. / Non-U.S. Inflation Protection	19.0%	29.0%	23.0%	15.0%
U.S. Core Fixed Income	4.0%	1.0%	1.0%	1.0%
U.S. Long-Term Treasury	8.0%	7.0%	7.0%	7.0%
Net Cash + Financing	-12.0%	-26.0%	-18.0%	-10.0%
Subtotal	*19.0%*	*11.0%*	*13.0%*	*13.0%*
Liquid (Return-Seeking Assets)				
Public Equity	19.0%	27.0%	27.0%	27.0%
Public Infrastructure	4.0%	5.0%	5.0%	4.0%
REITs	2.0%	3.0%	3.0%	3.0%
Commodities	6.0%	5.0%	3.0%	3.0%
Gold	4.0%	8.0%	7.0%	7.0%
High Yield Bonds		2.0%	2.0%	2.0%
Emerging Market Debt	1.0%	1.0%	2.0%	2.0%
MLPs	1.0%			
Subtotal	*37.0%*	*51.0%*	*49.0%*	*48.0%*
Quasi-Liquid Assets				
Hedge Funds	10.0%	8.0%	8.0%	8.0%
Subtotal	*10.0%*	*8.0%*	*8.0%*	*8.0%*
Illiquid 5-10 Years				
Private Real Estate	8.0%	7.0%	7.0%	7.0%
Private Credit	10.0%	8.0%	8.0%	8.0%
Subtotal	*18.0%*	*15.0%*	*15.0%*	*15.0%*
Illiquid 10+ Years				
Private Equity	15.0%	12.0%	12.0%	12.0%
Private Infrastructure	1.0%	3.0%	3.0%	4.0%
Subtotal	*16.0%*	*15.0%*	*15.0%*	*16.0%*
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Total Illiquid and Quasi-Liquid Assets	**44.0%**	**38.0%**	**38.0%**	**39.0%**

Overview
Economic Scenarios

- **Base Case Scenario**
  - Markets perform consistent with Aon's Capital Market Assumptions (~50th percentile)

- **Recession Scenario**
  - Somewhat pessimistic outlook for the markets (~95th percentile)
  - Return-seeking assets decline in the first two years with a modest rebound in later years.

- **Black Skies Scenario**
  - Very pessimistic outlook for markets (~99th percentile)
  - Return-seeking assets decline significantly
  - The value of public equities is cut in half over three years, without an immediate rebound

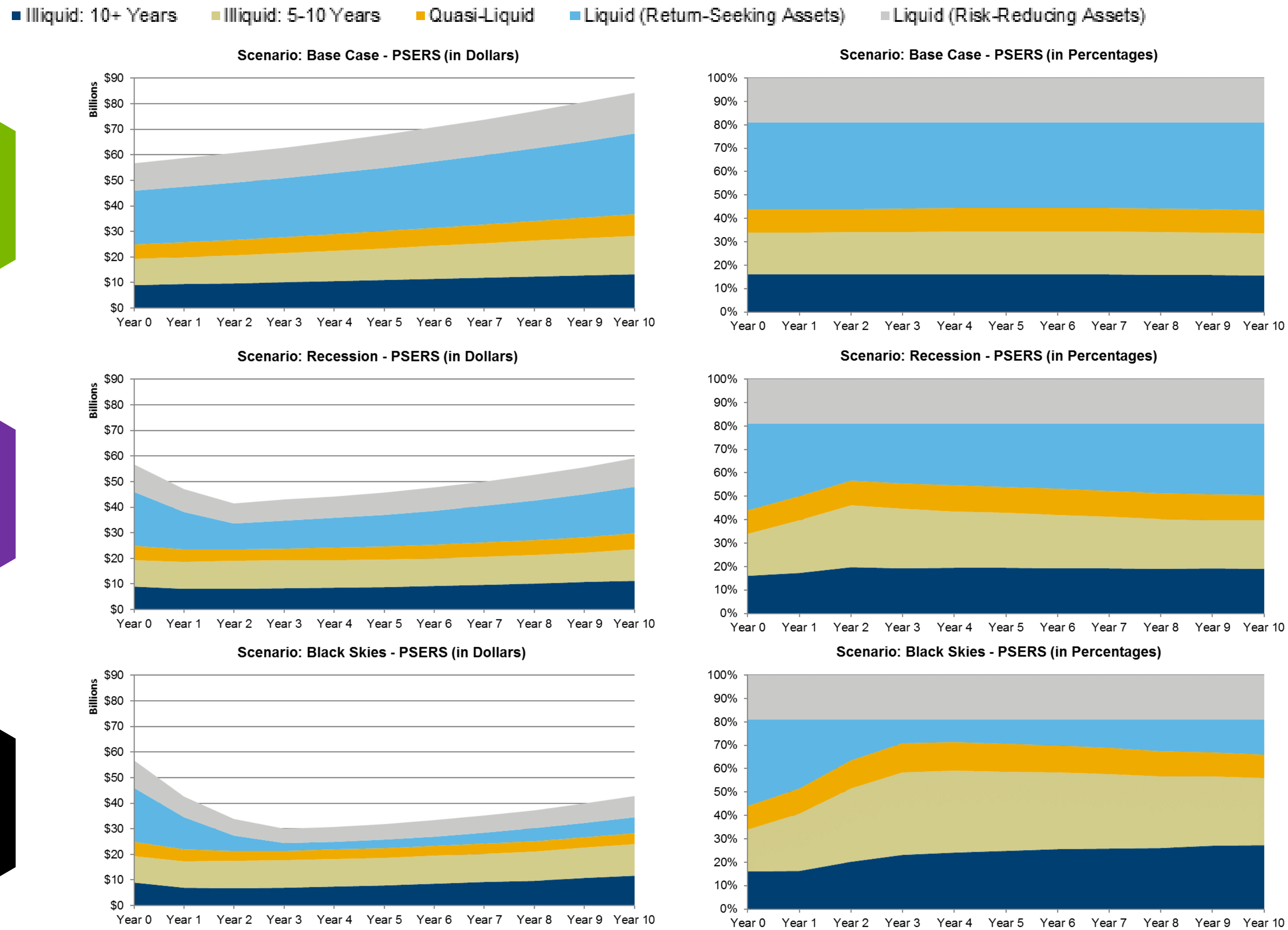
Liquidity Analysis

Summary of Results | Portfolio A: Current Target (Full Actuarial Contributions)

Base Case

Recession

Black Skies



Note: Year 0 represents a starting point of June 30, 2020

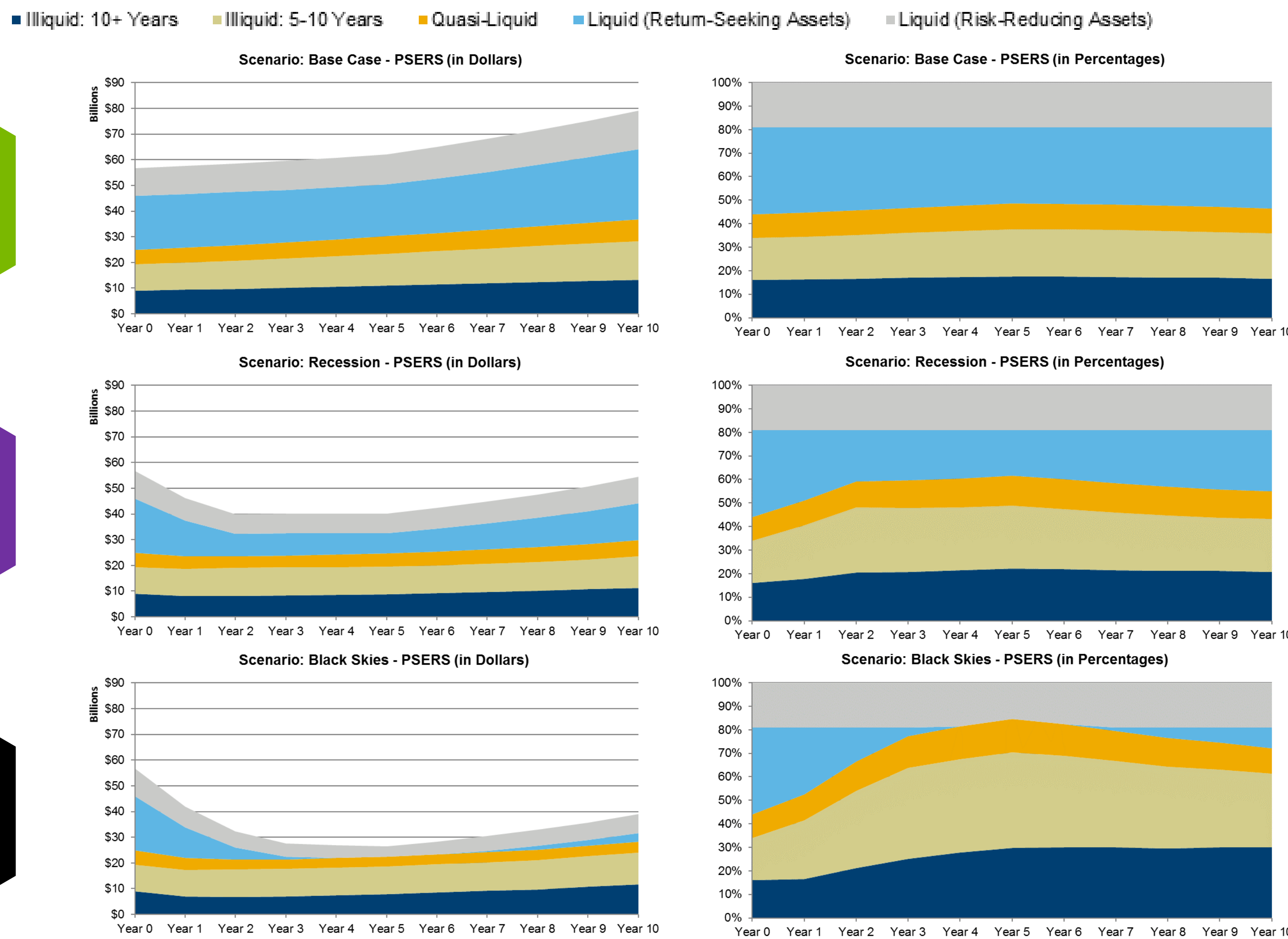
Liquidity Analysis

Summary of Results | Portfolio A: Current Target (5 Years of 80% Actuarial Contributions)

Base Case

Recession

Black Skies



Note: Year 0 represents a starting point of June 30, 2020

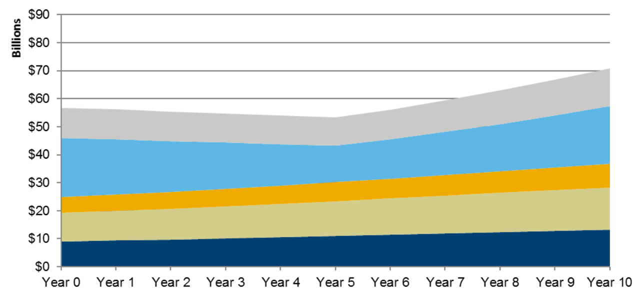
Liquidity Analysis

Summary of Results | Portfolio A: Current Target (5 Years of 50% Actuarial Contributions)

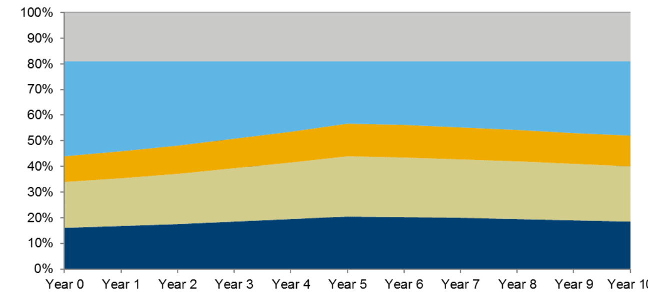
Illiquid: 10+ Years | Illiquid: 5-10 Years | Quasi-Liquid | Liquid (Return-Seeking Assets) | Liquid (Risk-Reducing Assets)

Base Case

Scenario: Base Case - PSERS (in Dollars)

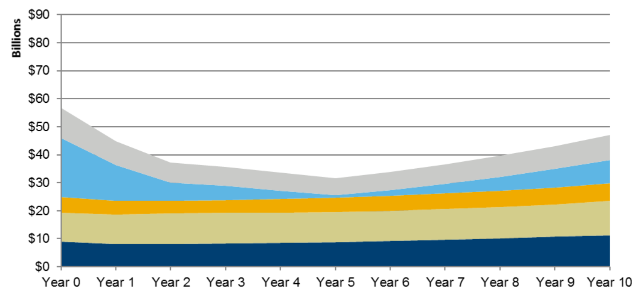


Scenario: Base Case - PSERS (in Percentages)

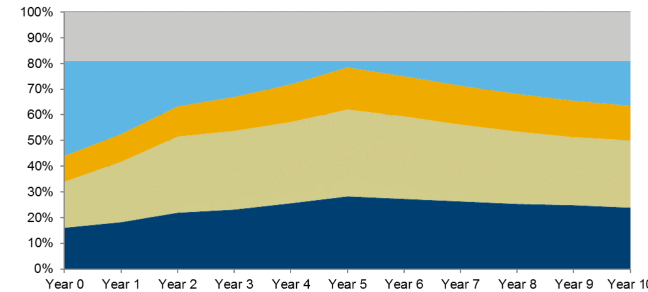


Recession

Scenario: Recession - PSERS (in Dollars)

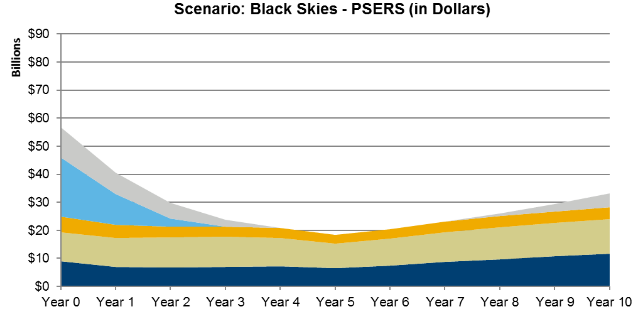


Scenario: Recession - PSERS (in Percentages)

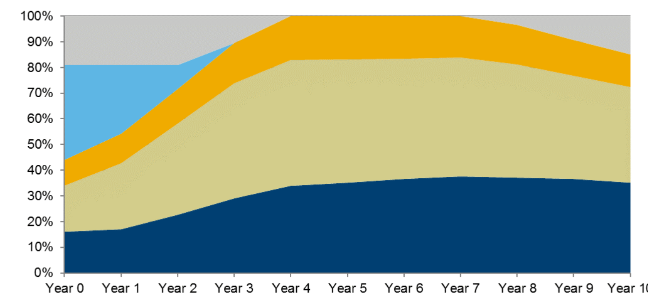


Black Skies

Scenario: Black Skies - PSERS (in Dollars)



Scenario: Black Skies - PSERS (in Percentages)



Note: Year 0 represents a starting point of June 30, 2020

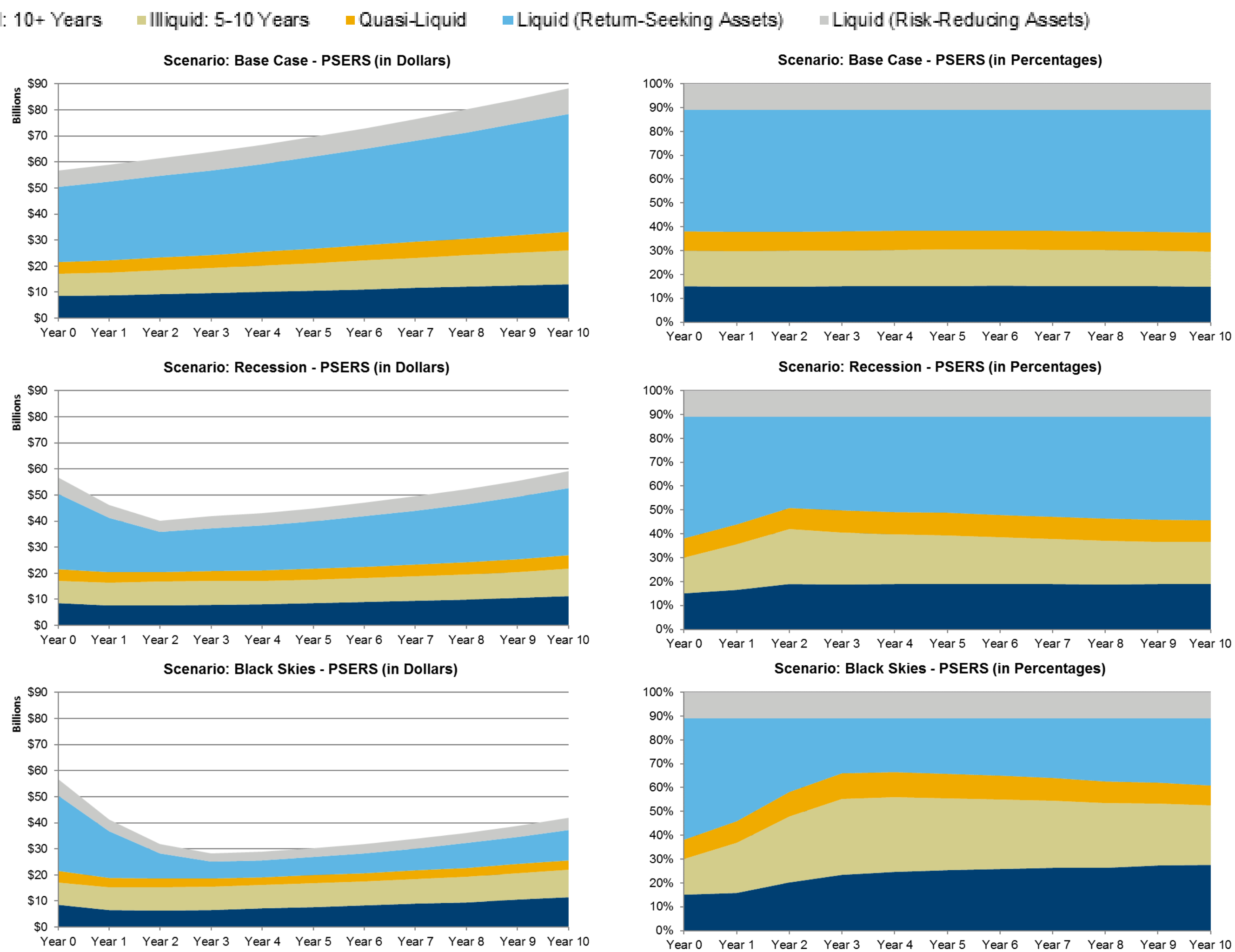
Liquidity Analysis

Summary of Results | Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage (Full Actuarial Contributions)

Base Case

Recession

Black Skies



Note: Year 0 represents a starting point of June 30, 2020

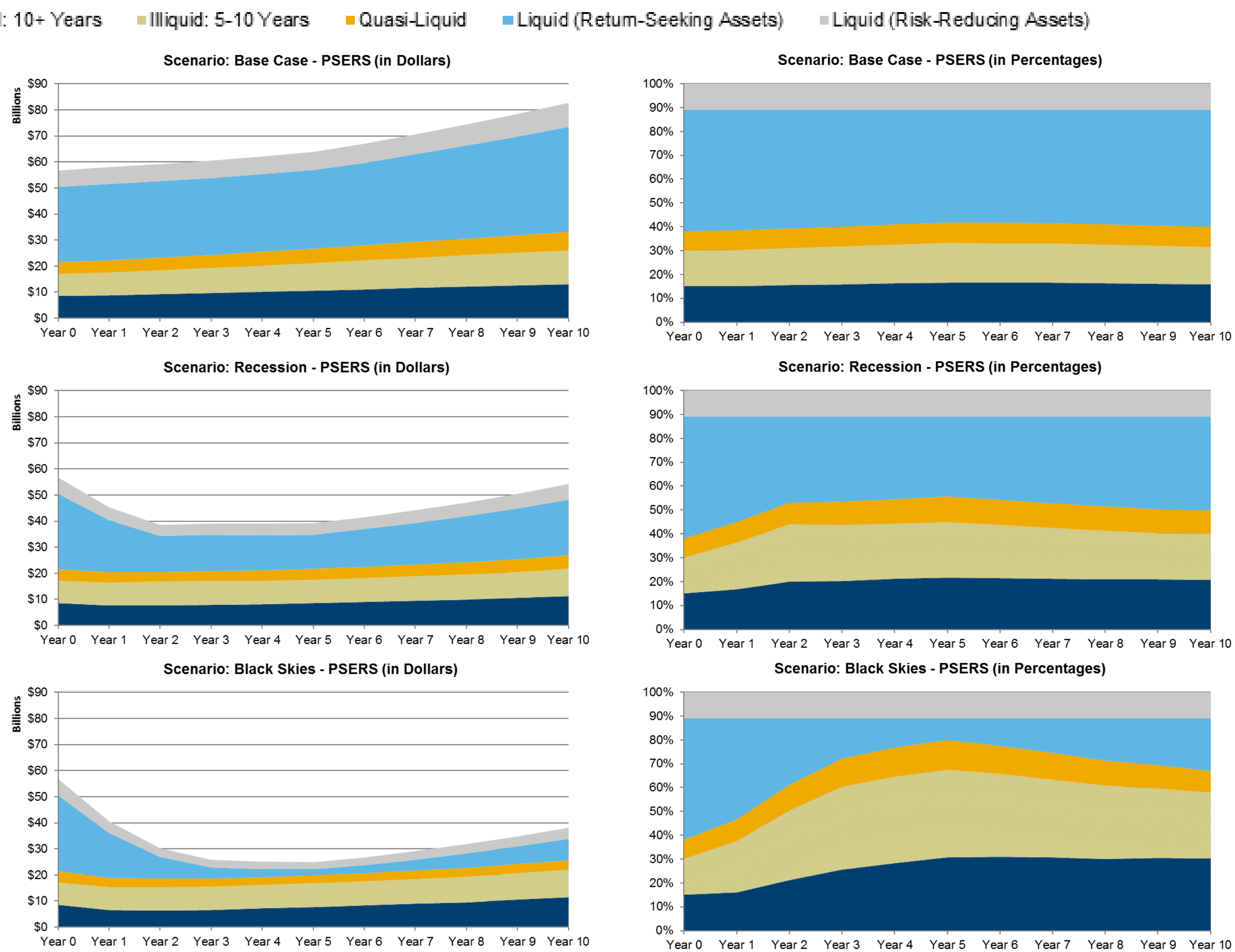
Liquidity Analysis

Summary of Results | Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage (5 Years of 80% Actuarial Contributions)

Base Case

Recession

Black Skies



Note: Year 0 represents a starting point of June 30, 2020

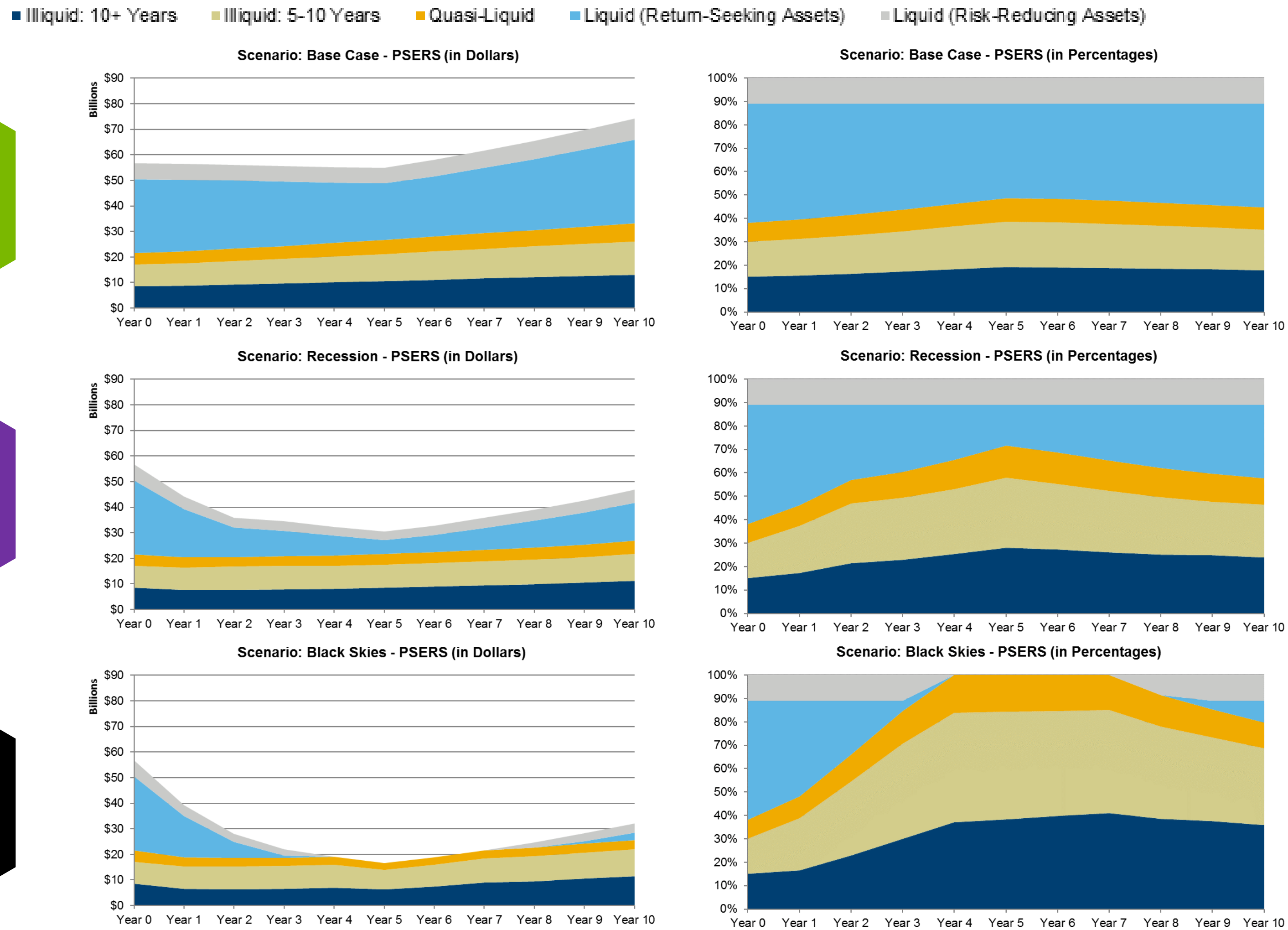
Liquidity Analysis

Summary of Results | Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage (5 Years of 50% Actuarial Contributions)

Base Case

Recession

Black Skies



Note: Year 0 represents a starting point of June 30, 2020

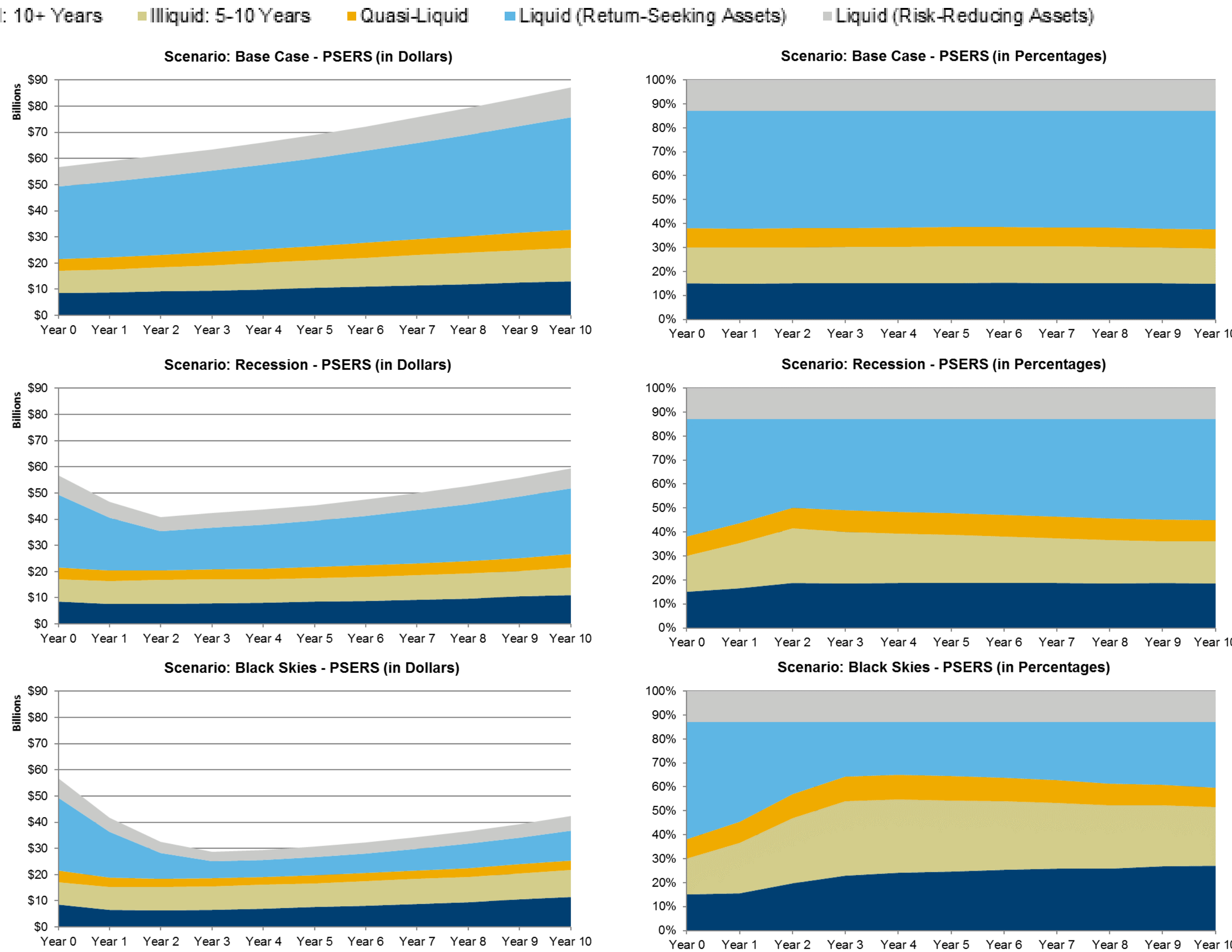
Liquidity Analysis

Summary of Results | Portfolio C: Higher Return, Liquidity & Leverage (Full Actuarial Contributions)

Base Case

Recession

Black Skies



Note: Year 0 represents a starting point of June 30, 2020

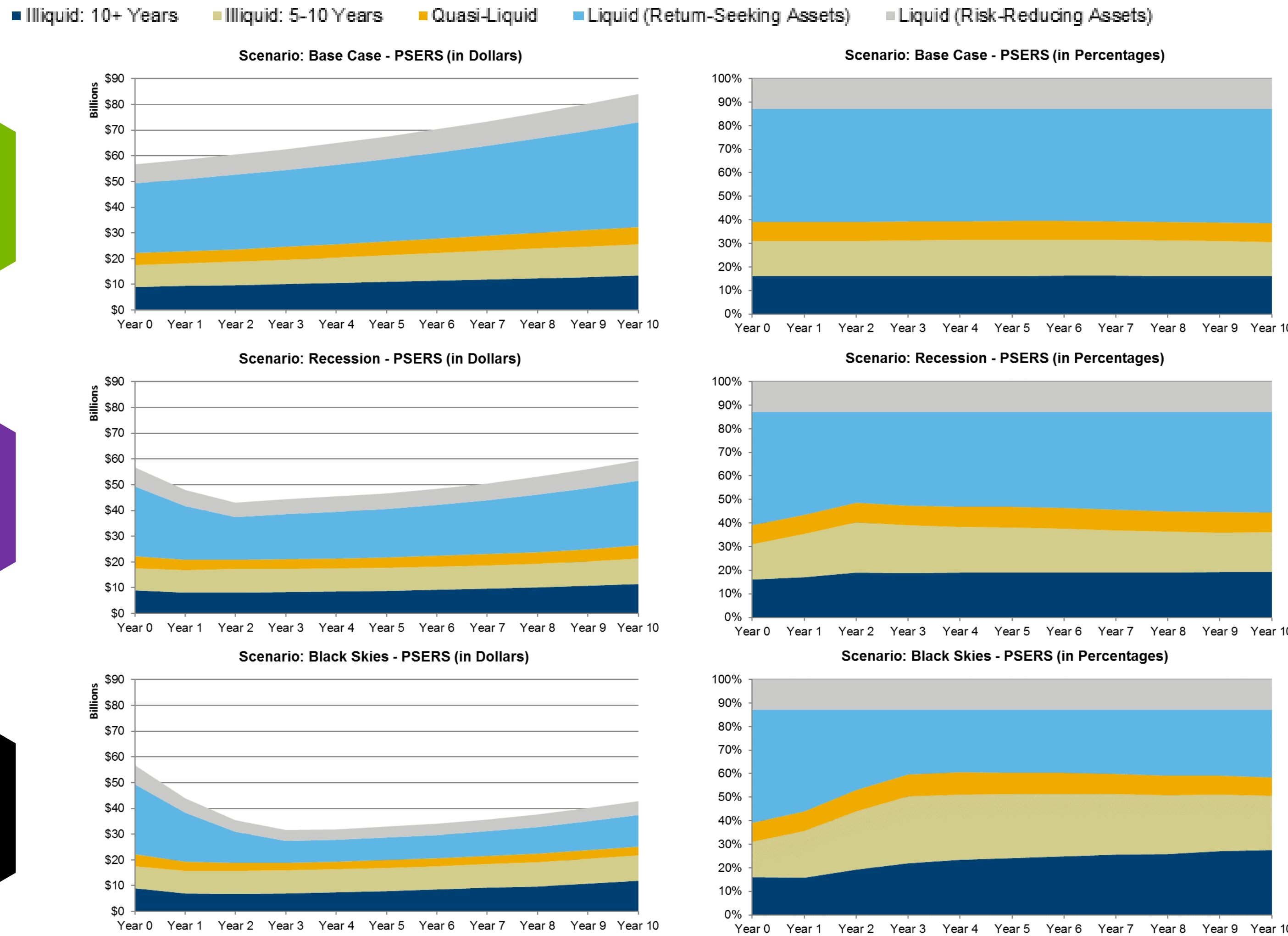
Liquidity Analysis

Summary of Results | Portfolio H: Higher Return & Liquidity / Lower Leverage (Full Actuarial Contributions)

Base Case

Recession

Black Skies



Note: Year 0 represents a starting point of June 30, 2020

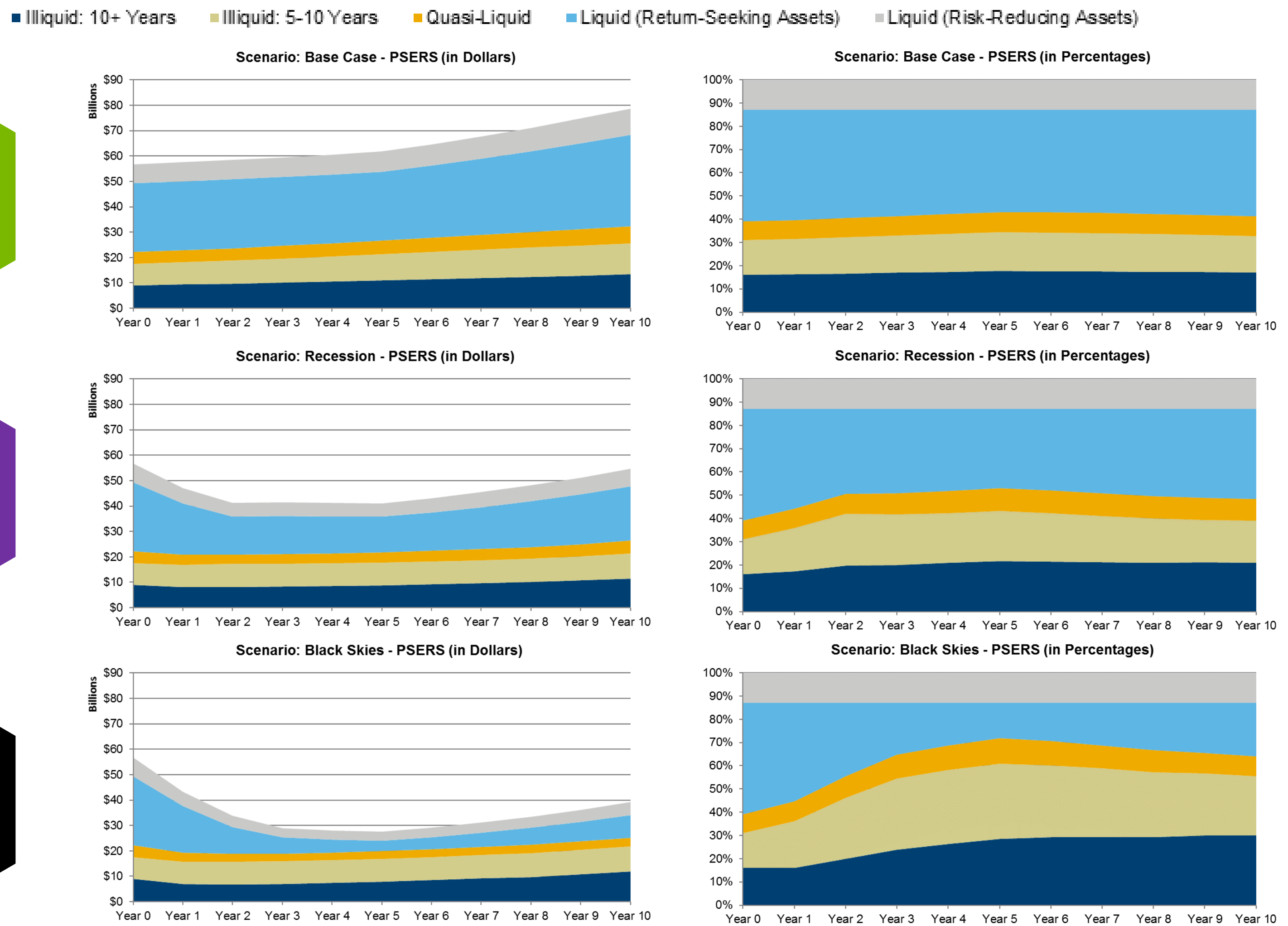
Liquidity Analysis

Summary of Results | Portfolio H: Higher Return & Liquidity / Lower Leverage (5 Years of 80% Actuarial Contributions)

Base Case

Recession

Black Skies



Note: Year 0 represents a starting point of June 30, 2020

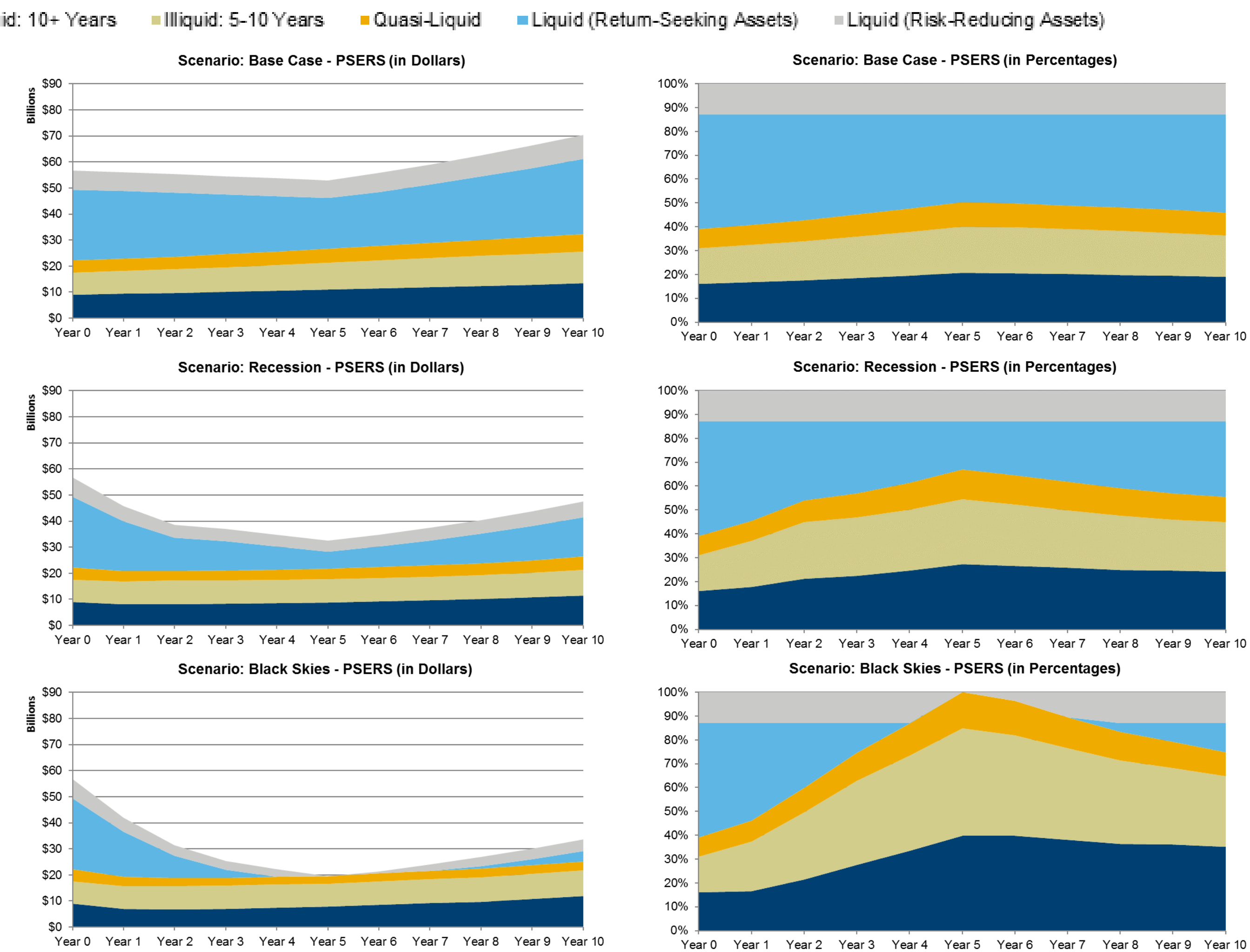
Liquidity Analysis

Summary of Results | Portfolio H: Higher Return & Liquidity / Lower Leverage (5 Years of 50% Actuarial Contributions)

Base Case

Recession

Black Skies



Note: Year 0 represents a starting point of June 30, 2020

Conclusions

- **PSERS has sufficient liquidity in the modeled Base Case, Recession, and Black Skies scenarios across Portfolios A, B, C, and H assuming full actuarial contributions are received**
  - In pessimistic Black Skies scenarios, the asset allocation could drift far from its target allocation
    - Given the extension of the time horizon for the realization of the illiquid assets, there will not be enough liquidity even with the redemption of quasi-liquid assets to re-balance back to target
    - Under these scenarios, PSERS may want to pare back future commitments to stay closer to the target allocations; in these cases, PSERS may be scaling back its alternative asset allocations at a time when the opportunity is greatest

- The impact of the change in leverage from Portfolio B,C, and H is minimal for purposes of this liquidity analysis

- Lower contributions put more pressure on liquidity; in such scenarios, PSERS can look to manage the pace of future commitments

- This analysis is highly sensitive to the assumed contributions
  - If PSERS receives less contributions than assumed, especially in a Black Skies environment, then the potential liquidity issue could be worse than projected here

Appendix

Background

Aon Investments' Approach to Analyzing Liquidity Risk from Alternatives

- Intended as a stress-testing model
- Develops multi-year projections of assets and spending needs
- Uses different scenarios for economic environments and other relevant events
- Shows how the portfolio's liquidity profile could evolve with a given investment strategy
- Incorporates the profile of the liabilities as well as expected future contributions

Background
Process Inputs and Outputs

Background
Modeling Parameters – Degrees of Illiquidity

- We categorized investments by liquidity into five buckets
  - **Liquid (Risk-Reducing Assets):** less than 3 months needed for return of capital (e.g. publicly traded securities)
  - **Liquid (Return-Seeking Assets):** less than 3 months needed for return of capital (e.g. publicly traded securities)
  - **Quasi-Liquid:** Typical lock-up of 3–12 months. Conservatively, we assumed a 1-year lock-up in most economic environments, 2 years in a Recession scenario, and 3 years in a Black Skies scenario (e.g. many hedge funds, core real estate)
  - **Illiquid: Potential lock-up of 5–10 years**, depending on economic environment (e.g. closed-ended real estate)
  - **Illiquid: Potential lock-up of 10+ years** (e.g. typical private equity)

- This is intended to be a <u>conservative</u> approximation of the actual liquidity properties of the assets

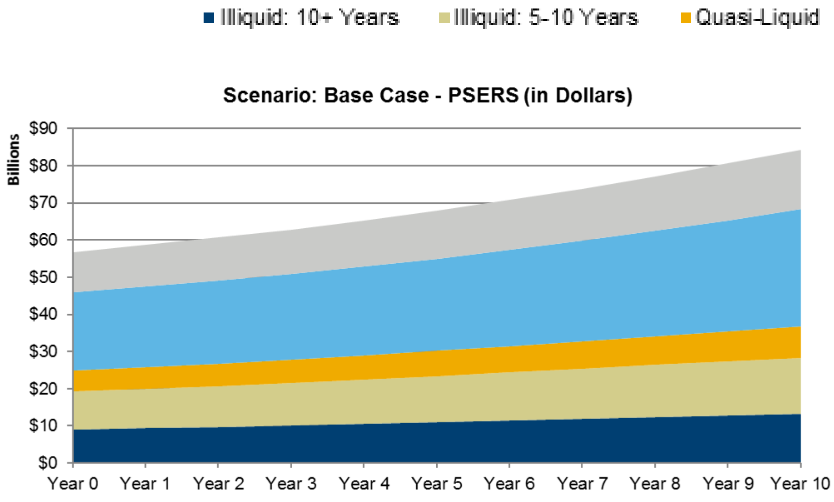
- We started with the target asset allocations, then see how the actual allocations would change in different economic scenarios, continuing new commitments to private assets, as expected.

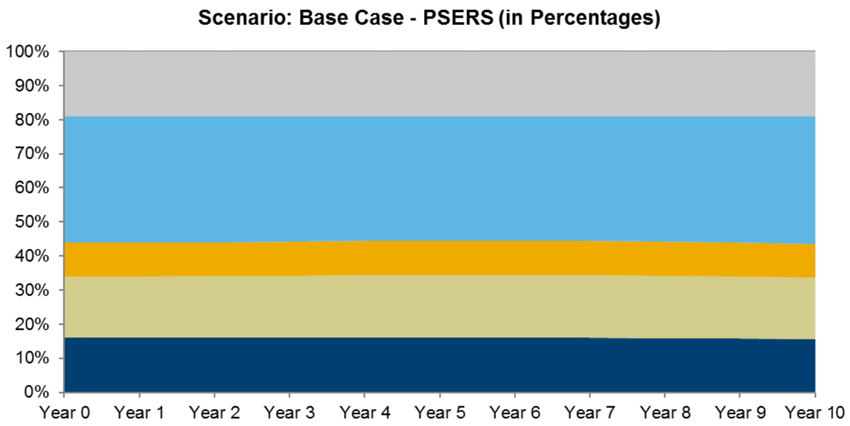
- Assumptions
  - Asset-liability information based on the June 30, 2019 actuarial valuation report
  - Preliminary asset experience through June 30, 2020 was included and this represents our starting point of the liquidity analysis
  - The plan's contribution policy is determined in accordance with the methodology used by the plan actuary
  - Assumes the portfolio starts at the target asset allocation levels for illiquid assets, maintaining close to the portfolio targets over the next 10 years

Liquidity Analysis: Base Case Economic Scenario

Portfolio A: Current Target (Assuming Full Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Current Target allocation in the Base Case economic scenario, assuming commitments are continued as expected





- **Key Takeaway:**
  - Total illiquid and quasi-liquid assets are projected to stay near 44% of the Plan and can be maintained near the target with no cash flow problems

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Base Case Economic Scenario (continued)

Portfolio A: Current Target (Assuming Full Actuarial Contributions)

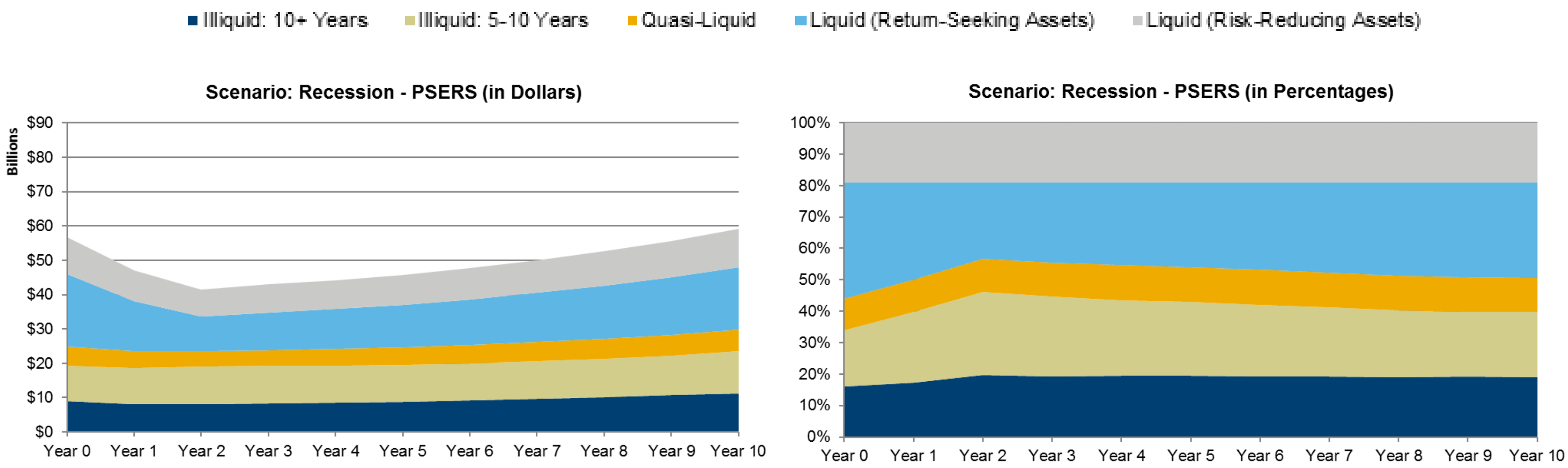
- The exhibit below shows the projected liquidity lock-up of the Current Target allocation in a Base Case scenario

Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%
Liquid Return-Seeking	37	37	37	37	37	37	37	37	37	37	37
Total Liquid	**56%**	**56%**	**56%**	**56%**	**56%**	**56%**	**56%**	**56%**	**56%**	**56%**	**56%**
Quasi-Liquid	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Illiquid: 5-10 Year Lock-up	18	18	18	18	18	18	18	18	18	18	18
Illiquid: 10+ Year Lock-up	16	16	16	16	16	16	16	16	16	16	16
Total Quasi + Illiquid	**44%**	**44%**	**44%**	**44%**	**44%**	**44%**	**44%**	**44%**	**44%**	**44%**	**44%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Recession Economic Scenario
Portfolio A: Current Target (Assuming Full Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Current Target allocation in the Recession economic scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Commitments to illiquid alternatives are maintained at the steady state level, but recessionary markets cause the total portfolio to shrink
  - Total illiquid and quasi-liquid assets are projected to reach as high as 57% of the Plan due to the shrinking market value of the total Plan in this scenario
  - There would not be a concern with the ability to pay benefits
  - PSERS may need to redeem some quasi-liquid assets to stay close to its target allocation (44% illiquid assets)

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Recession Economic Scenario (continued)

Portfolio A: Current Target (Assuming Full Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Current Target allocation in a Recession scenario

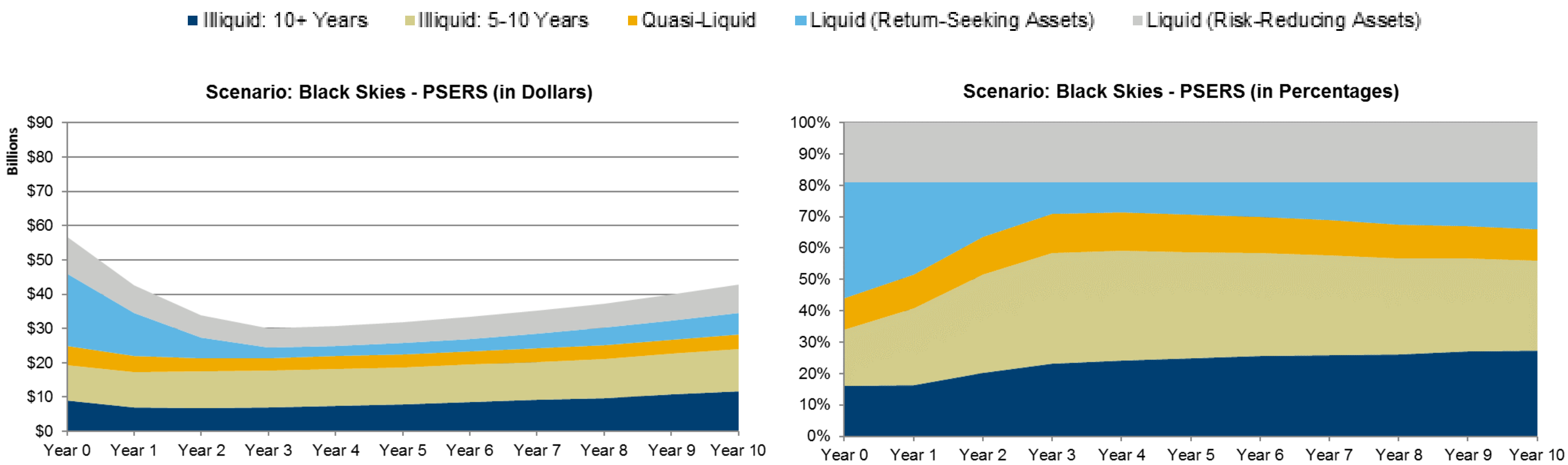
Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%
Liquid Return-Seeking	37	31	24	26	26	27	28	29	30	30	30
Total Liquid	**56%**	**50%**	**43%**	**45%**	**45%**	**46%**	**47%**	**48%**	**49%**	**49%**	**49%**
Quasi-Liquid	10%	10%	11%	11%	11%	11%	11%	11%	11%	11%	11%
Illiquid: 5-10 Year Lock-up	18	22	27	25	24	23	23	22	21	21	21
Illiquid: 10+ Year Lock-up	16	17	20	19	19	19	19	19	19	19	19
Total Quasi + Illiquid	**44%**	**50%**	**57%**	**56%**	**55%**	**54%**	**53%**	**52%**	**51%**	**51%**	**51%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Black Skies Economic Scenario

Portfolio A: Current Target (Assuming Full Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Current Target allocation in a Black Skies scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Commitments to illiquid alternatives are maintained at the steady state level, but subpar markets cause the total portfolio to shrink
  - Total illiquid and quasi-liquid assets are projected to reach as high as 71% of the Plan due to the shrinking market value of the total Plan in this scenario
  - In this Black Skies scenario, PSERS may want to redeem some quasi-liquid assets and pare back future commitments to stay closer to the target allocations (44% illiquid assets); however, the allocation would still be significantly different from target

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Black Skies Economic Scenario (continued)

Portfolio A: Current Target (Assuming Full Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Current Target allocation in a Black Skies scenario

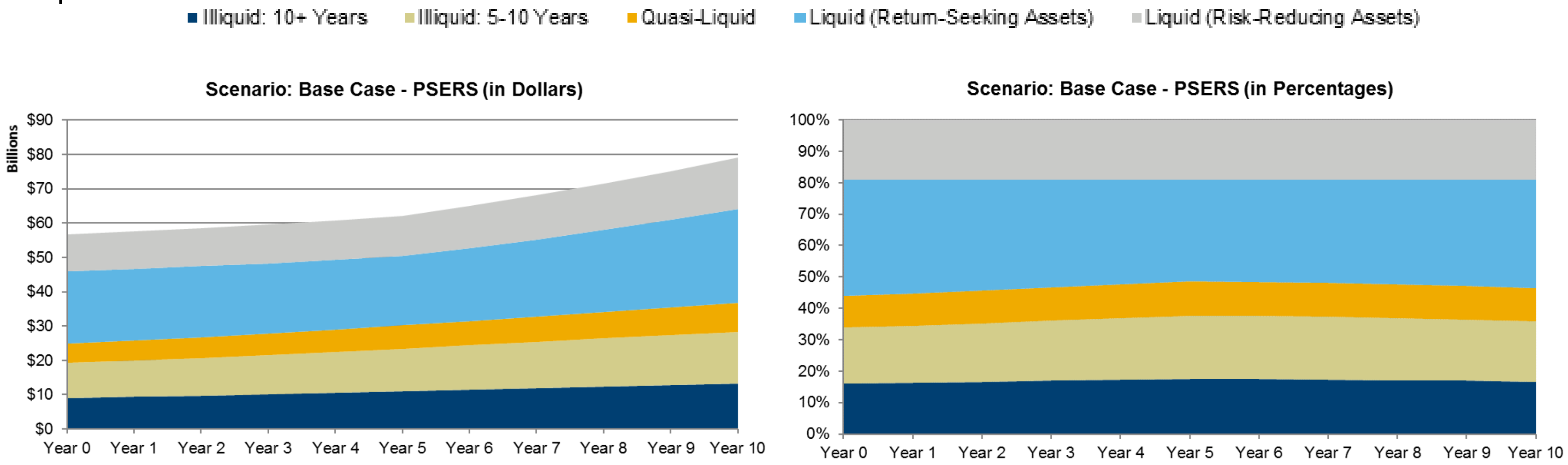
Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%
Liquid Return-Seeking	37	29	18	10	10	10	11	12	14	14	15
Total Liquid	**56%**	**48%**	**37%**	**29%**	**29%**	**29%**	**30%**	**31%**	**33%**	**33%**	**34%**
Quasi-Liquid	10%	11%	12%	12%	12%	12%	12%	11%	11%	10%	10%
Illiquid: 5-10 Year Lock-up	18	24	31	35	35	34	33	32	31	30	29
Illiquid: 10+ Year Lock-up	16	16	20	23	24	25	26	26	26	27	27
Total Quasi + Illiquid	**44%**	**52%**	**63%**	**71%**	**71%**	**71%**	**70%**	**69%**	**68%**	**67%**	**66%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Base Case Economic Scenario

Portfolio A: Current Target (5 Years of 80% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Current Target allocation and 80% of the Actuarially Determined Employer Contribution in the Base Case economic scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Total illiquid and quasi-liquid assets are projected to reach as high as 49% of the Plan in this scenario
  - There would not be a concern with the ability to pay benefits
  - PSERS may need to redeem some quasi-liquid assets to stay close to its target allocation (44% illiquid assets)

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Base Case Economic Scenario (continued)
Portfolio A: Current Target (5 Years of 80% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Current Target allocation and 80% of the Actuarially Determined Employer Contribution in a Base Case scenario

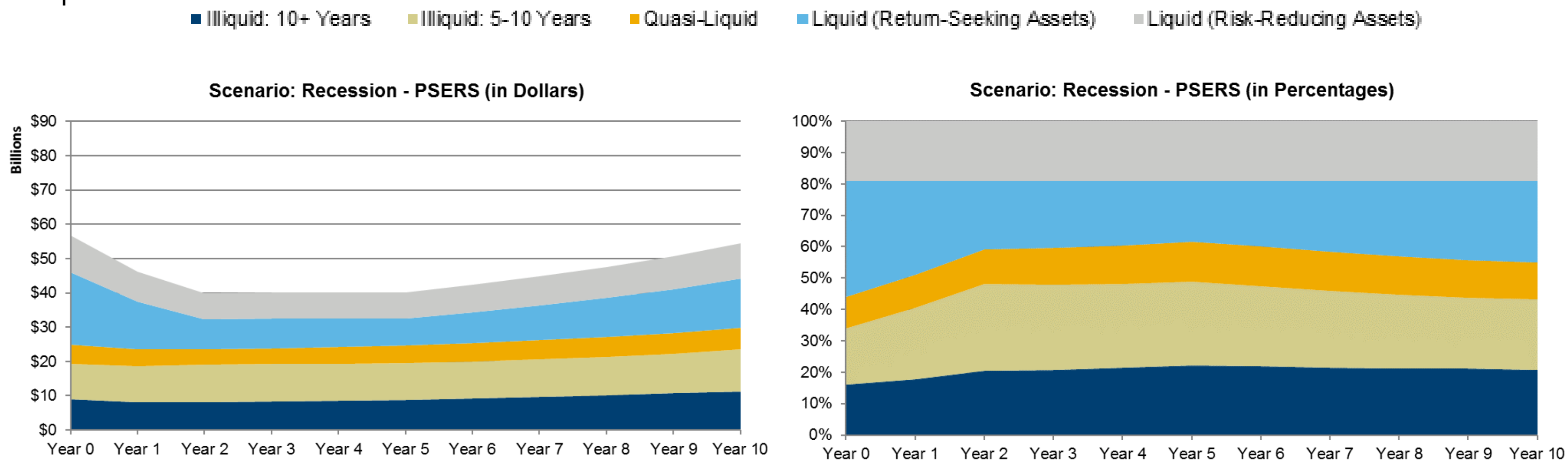
Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%
Liquid Return-Seeking	37	36	35	34	33	32	33	33	33	34	35
Total Liquid	**56%**	**55%**	**54%**	**53%**	**52%**	**51%**	**52%**	**52%**	**52%**	**53%**	**54%**
Quasi-Liquid	10%	10%	10%	11%	11%	11%	11%	11%	11%	11%	11%
Illiquid: 5-10 Year Lock-up	18	18	19	19	20	20	20	20	20	19	19
Illiquid: 10+ Year Lock-up	16	16	17	17	17	18	17	17	17	17	17
Total Quasi + Illiquid	**44%**	**45%**	**46%**	**47%**	**48%**	**49%**	**48%**	**48%**	**48%**	**47%**	**47%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Recession Economic Scenario

Portfolio A: Current Target (5 Years of 80% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Current Target allocation and 80% of the Actuarially Determined Employer Contribution in the Recession economic scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Commitments to illiquid alternatives are maintained at the steady state level, but recessionary markets combined with lower contributions cause the total portfolio to shrink
  - Total illiquid and quasi-liquid assets are projected to reach as high as 62% of the Plan due to the shrinking market value of the total Plan in this scenario
  - There would not be a concern with the ability to pay benefits
  - PSERS may need to redeem some quasi-liquid assets to stay close to its target allocation (44% illiquid assets)

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Recession Economic Scenario (continued)
Portfolio A: Current Target (5 Years of 80% Actuarial Contributions)

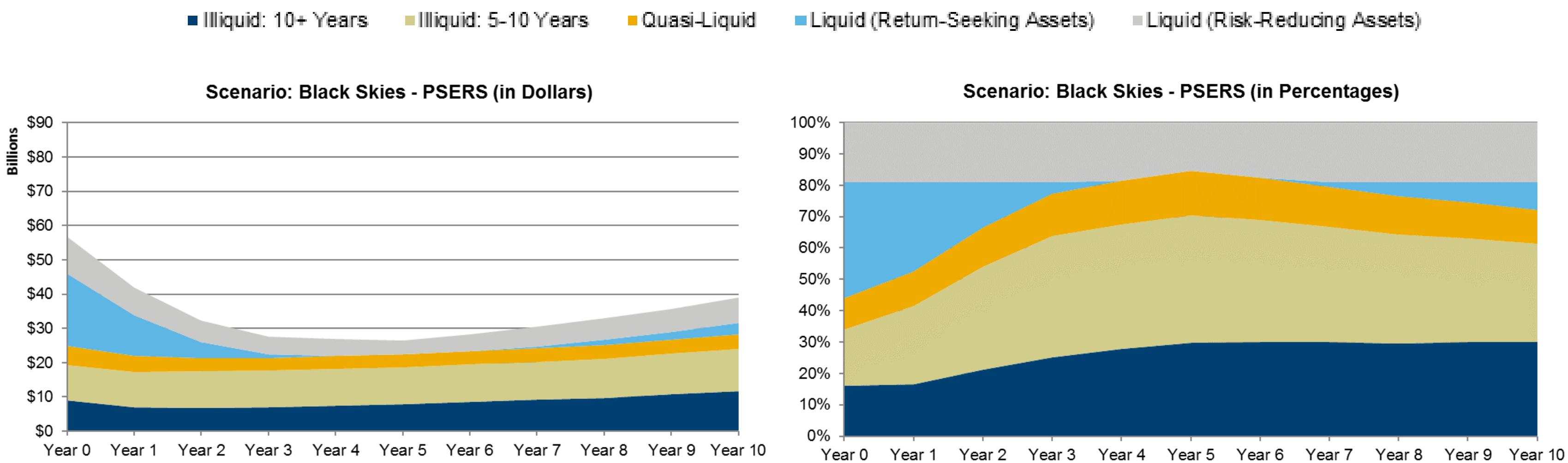
- The exhibit below shows the projected liquidity lock-up of the Current Target allocation and 80% of the Actuarially Determined Employer Contribution in a Recession scenario

Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%
Liquid Return-Seeking	37	30	22	21	21	19	21	23	24	25	26
Total Liquid	**56%**	**49%**	**41%**	**40%**	**40%**	**38%**	**40%**	**42%**	**43%**	**44%**	**45%**
Quasi-Liquid	10%	10%	11%	12%	12%	13%	13%	12%	12%	12%	12%
Illiquid: 5-10 Year Lock-up	18	23	28	27	27	27	26	25	24	23	23
Illiquid: 10+ Year Lock-up	16	18	20	21	21	22	22	21	21	21	21
Total Quasi + Illiquid	**44%**	**51%**	**59%**	**60%**	**60%**	**62%**	**60%**	**58%**	**57%**	**56%**	**55%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Black Skies Economic Scenario
Portfolio A: Current Target (5 Years of 80% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Current Target allocation and 80% of the Actuarially Determined Employer Contribution in a Black Skies scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Commitments to illiquid alternatives are maintained at the steady state level, but subpar markets combined with lower contributions cause the total portfolio to shrink
  - Total illiquid and quasi-liquid assets are projected to reach as high as 85% of the Plan due to the shrinking market value of the total Plan in this scenario
  - In this Black Skies scenario, PSERS may want to redeem some quasi-liquid assets and pare back future commitments to stay closer to the target allocations (44% illiquid assets); however, the allocation would still be significantly different from target

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Black Skies Economic Scenario (continued)

Portfolio A: Current Target (5 Years of 80% Actuarial Contributions)

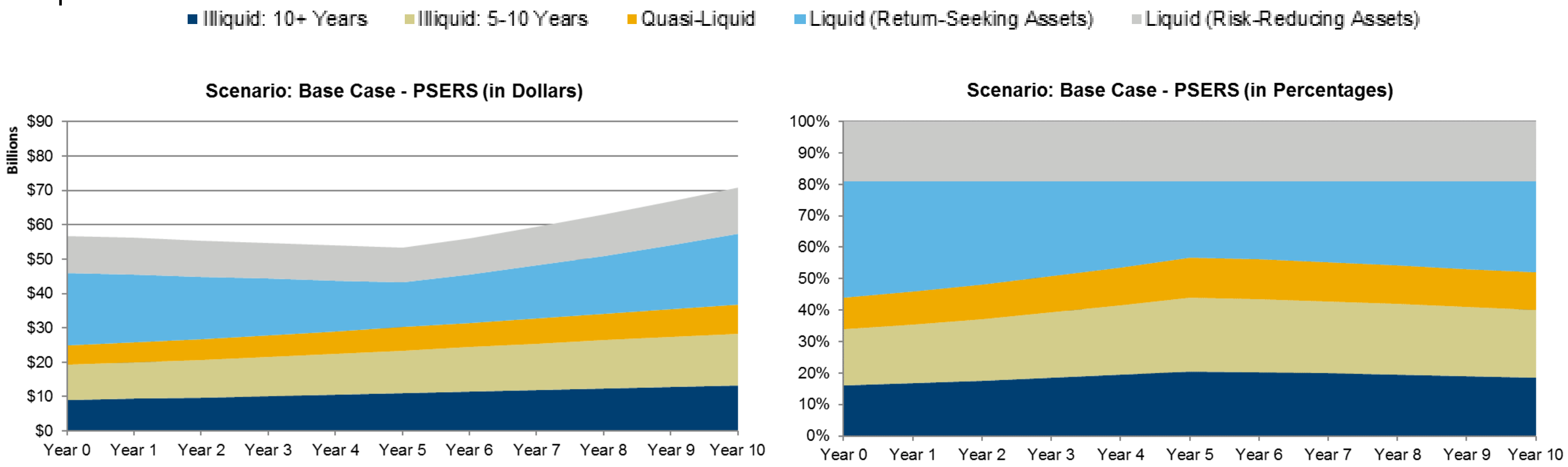
- The exhibit below shows the projected liquidity lock-up of the Current Target allocation and 80% of the Actuarially Determined Employer Contribution in a Black Skies scenario

Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	19%	19%	19%	19%	18%	15%	18%	19%	19%	19%	19%
Liquid Return-Seeking	37	28	14	4	0	0	0	1	5	6	9
Total Liquid	**56%**	**47%**	**33%**	**23%**	**18%**	**15%**	**18%**	**20%**	**24%**	**25%**	**28%**
Quasi-Liquid	10%	11%	12%	14%	14%	14%	14%	13%	12%	11%	11%
Illiquid: 5-10 Year Lock-up	18	25	33	39	40	41	39	37	35	33	31
Illiquid: 10+ Year Lock-up	16	17	21	25	28	30	30	30	29	30	30
Total Quasi + Illiquid	**44%**	**53%**	**67%**	**77%**	**82%**	**85%**	**82%**	**80%**	**76%**	**75%**	**72%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Base Case Economic Scenario
Portfolio A: Current Target (5 Years of 50% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Current Target allocation and 50% of the Actuarially Determined Employer Contribution in the Base Case economic scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Total illiquid and quasi-liquid assets are projected to reach as high as 57% of the Plan in this scenario
  - There would not be a concern with the ability to pay benefits
  - PSERS may need to redeem some quasi-liquid assets to stay close to its target allocation (44% illiquid assets)

Note: Year 0 represents a starting point of June 30, 2020

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Liquidity Analysis: Base Case Economic Scenario (continued)

Portfolio A: Current Target (5 Years of 50% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Current Target allocation and 50% of the Actuarially Determined Employer Contribution in a Base Case scenario

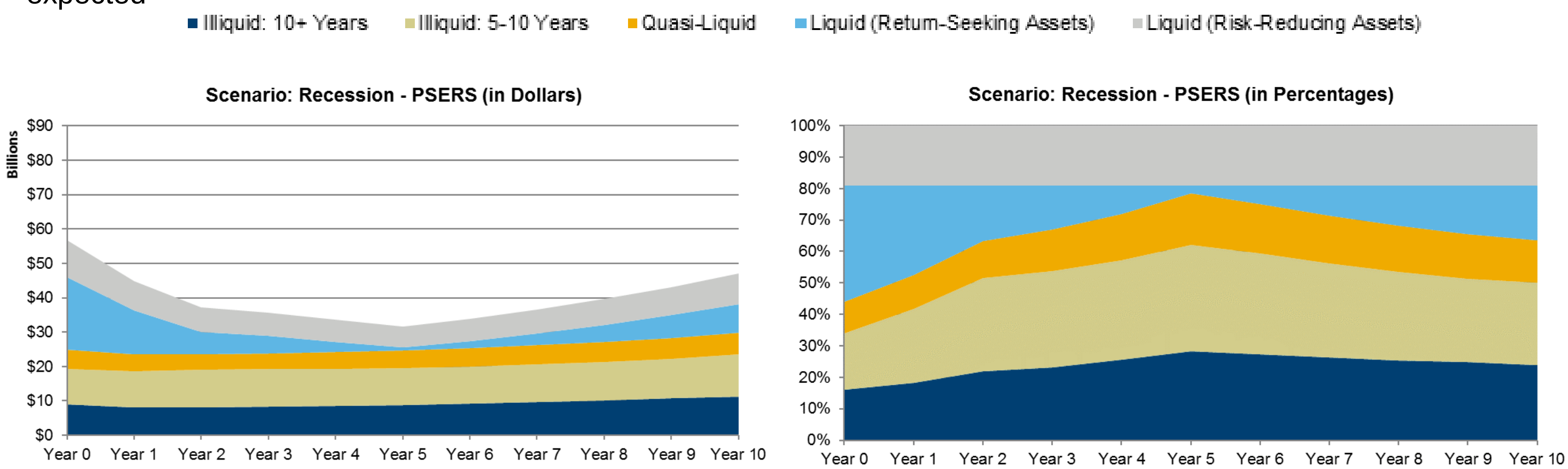
Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%
Liquid Return-Seeking	37	35	33	30	27	24	25	26	27	28	29
Total Liquid	**56%**	**54%**	**52%**	**49%**	**46%**	**43%**	**44%**	**45%**	**46%**	**47%**	**48%**
Quasi-Liquid	10%	10%	11%	11%	12%	13%	13%	12%	12%	12%	12%
Illiquid: 5-10 Year Lock-up	18	19	20	21	22	23	23	23	22	22	21
Illiquid: 10+ Year Lock-up	16	17	17	18	19	20	20	20	19	19	19
Total Quasi + Illiquid	**44%**	**46%**	**48%**	**51%**	**54%**	**57%**	**56%**	**55%**	**54%**	**53%**	**52%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Recession Economic Scenario

Portfolio A: Current Target (5 Years of 50% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Current Target allocation and 50% of the Actuarially Determined Employer Contribution in the Recession economic scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Commitments to illiquid alternatives are maintained at the steady state level, but recessionary markets combined with lower contributions cause the total portfolio to shrink
  - Total illiquid and quasi-liquid assets are projected to reach as high as 78% of the Plan due to the shrinking market value of the total Plan in this scenario
  - In this Recession scenario, PSERS may want to redeem some quasi-liquid assets and pare back future commitments to stay closer to the target allocations (44% illiquid assets); however, the allocation would still be significantly different from target

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Recession Economic Scenario (continued)

Portfolio A: Current Target (5 Years of 50% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Current Target allocation and 50% of the Actuarially Determined Employer Contribution in a Recession scenario

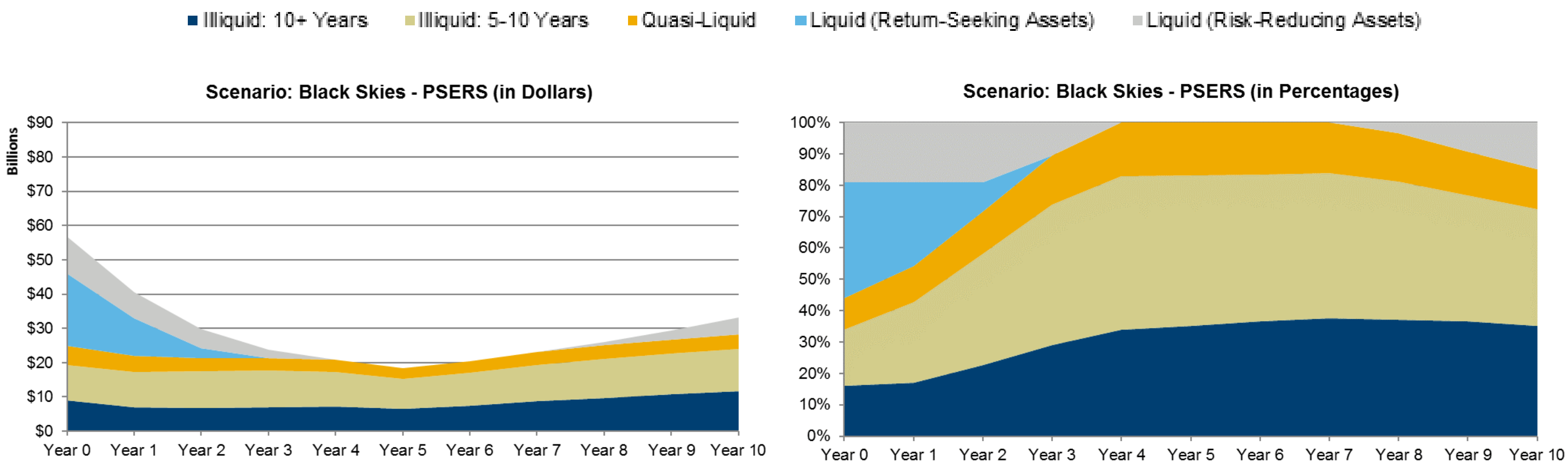
Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%	19%
Liquid Return-Seeking	37	29	18	14	9	3	6	10	13	16	17
Total Liquid	**56%**	**48%**	**37%**	**33%**	**28%**	**22%**	**25%**	**29%**	**32%**	**35%**	**36%**
Quasi-Liquid	10%	11%	12%	13%	15%	16%	16%	15%	15%	14%	13%
Illiquid: 5-10 Year Lock-up	18	23	30	31	32	34	32	30	28	27	26
Illiquid: 10+ Year Lock-up	16	18	22	23	26	28	27	26	25	25	24
Total Quasi + Illiquid	**44%**	**52%**	**63%**	**67%**	**72%**	**78%**	**75%**	**71%**	**68%**	**65%**	**64%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Black Skies Economic Scenario

Portfolio A: Current Target (5 Years of 50% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Current Target allocation and 50% of the Actuarially Determined Employer Contribution in a Black Skies scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Commitments to illiquid alternatives are maintained at the steady state level, but subpar markets combined with lower contributions cause the total portfolio to shrink
  - Total illiquid and quasi-liquid assets are projected to reach as high as 100% of the Plan due to the shrinking market value of the total Plan in this scenario
  - In this Black Skies scenario, PSERS may want to redeem some quasi-liquid assets and pare back future commitments to stay closer to the target allocations (44% illiquid assets); however, the allocation would still be significantly different from target

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Black Skies Economic Scenario (continued)
Portfolio A: Current Target (5 Years of 50% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Current Target allocation and 50% of the Actuarially Determined Employer Contribution in a Black Skies scenario

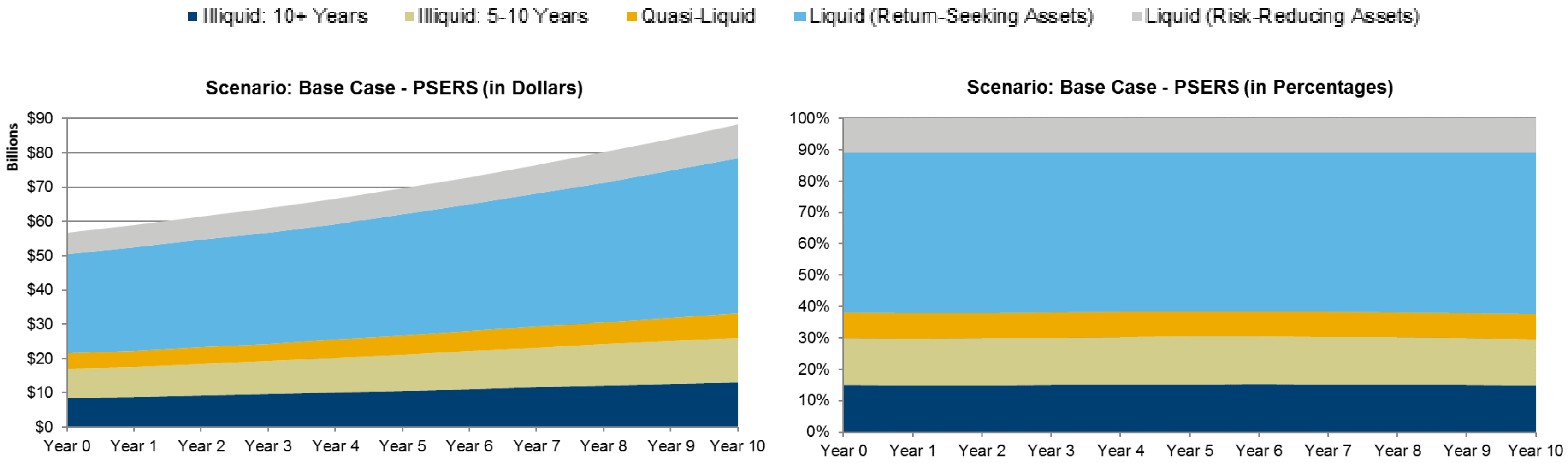
Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	19%	19%	19%	10%	0%	0%	0%	0%	3%	9%	15%
Liquid Return-Seeking	37	27	9	0	0	0	0	0	0	0	0
Total Liquid	**56%**	**46%**	**28%**	**10%**	**0%**	**0%**	**0%**	**0%**	**3%**	**9%**	**15%**
Quasi-Liquid	10%	11%	13%	16%	17%	17%	17%	16%	15%	14%	13%
Illiquid: 5-10 Year Lock-up	18	26	36	45	49	48	47	46	44	40	37
Illiquid: 10+ Year Lock-up	16	17	23	29	34	35	37	38	37	37	35
Total Quasi + Illiquid	**44%**	**54%**	**72%**	**90%**	**100%**	**100%**	**100%**	**100%**	**97%**	**91%**	**85%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Base Case Economic Scenario

Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage (Assuming Full Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Highest Return, Liquidity, Fixed Income & Leverage allocation in the Base Case economic scenario, assuming commitments are continued as expected



- **Key Takeaway:**
  - Total illiquid and quasi-liquid assets are projected to stay near 38% of the Plan and can be maintained near the target with no cash flow problems

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Base Case Economic Scenario (continued)

Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage (Assuming Full Actuarial Contributions)

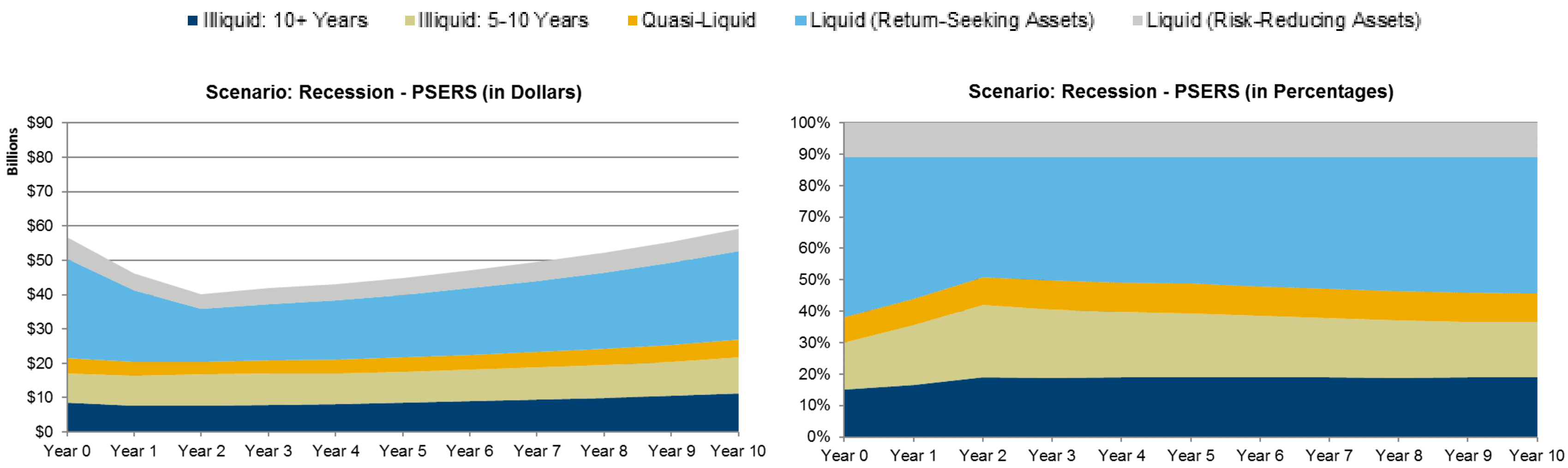
- The exhibit below shows the projected liquidity lock-up of the Highest Return, Liquidity, Fixed Income & Leverage allocation in a Base Case scenario

Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%
Liquid Return-Seeking	51	51	51	51	51	51	51	51	51	51	51
Total Liquid	**62%**	**62%**	**62%**	**62%**	**62%**	**62%**	**62%**	**62%**	**62%**	**62%**	**62%**
Quasi-Liquid	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
Illiquid: 5-10 Year Lock-up	15	15	15	15	15	15	15	15	15	15	15
Illiquid: 10+ Year Lock-up	15	15	15	15	15	15	15	15	15	15	15
Total Quasi + Illiquid	**38%**	**38%**	**38%**	**38%**	**38%**	**38%**	**38%**	**38%**	**38%**	**38%**	**38%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Recession Economic Scenario
Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage (Assuming Full Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Highest Return, Liquidity, Fixed Income & Leverage allocation in the Recession economic scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Commitments to illiquid alternatives are maintained at the steady state level, but recessionary markets cause the total portfolio to shrink
  - Total illiquid and quasi-liquid assets are projected to reach as high as 51% of the Plan due to the shrinking market value of the total Plan in this scenario
  - There would not be a concern with the ability to pay benefits
  - PSERS may need to redeem some quasi-liquid assets to stay close to its target allocation (38% illiquid assets)

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Recession Economic Scenario (continued)
Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage (Assuming Full Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Highest Return, Liquidity, Fixed Income & Leverage allocation in a Recession scenario

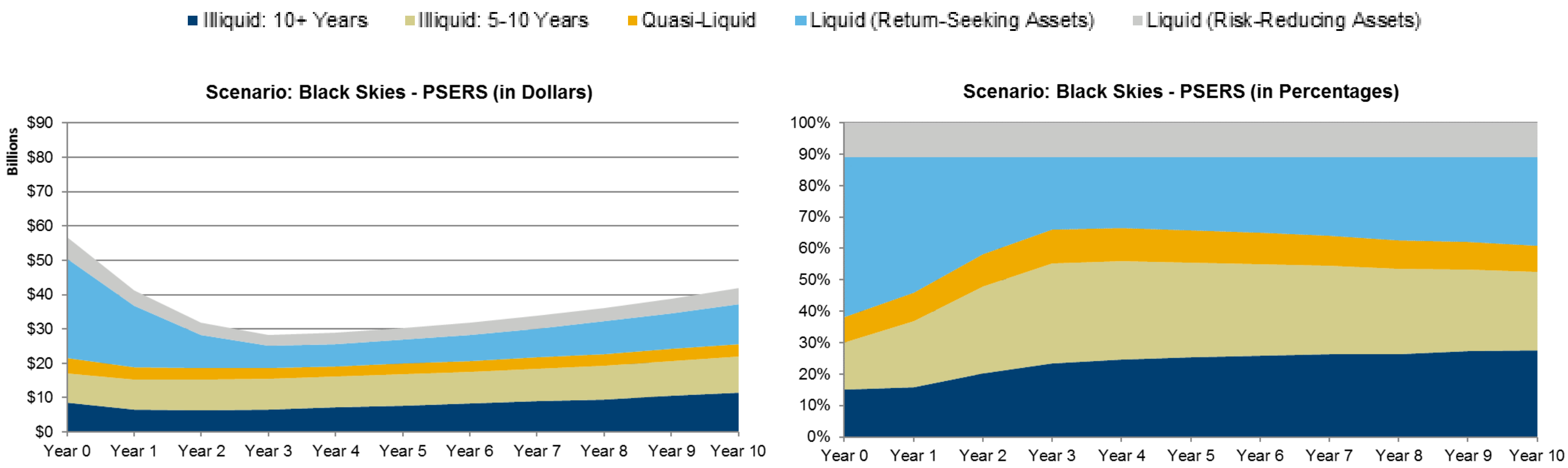
Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%
Liquid Return-Seeking	51	45	38	39	40	40	41	42	43	43	43
Total Liquid	**62%**	**56%**	**49%**	**50%**	**51%**	**51%**	**52%**	**53%**	**54%**	**54%**	**54%**
Quasi-Liquid	8%	8%	9%	9%	9%	9%	9%	9%	9%	9%	9%
Illiquid: 5-10 Year Lock-up	15	19	23	22	21	20	20	19	18	18	18
Illiquid: 10+ Year Lock-up	15	17	19	19	19	19	19	19	19	19	19
Total Quasi + Illiquid	**38%**	**44%**	**51%**	**50%**	**49%**	**49%**	**48%**	**47%**	**46%**	**46%**	**46%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Black Skies Economic Scenario

Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage (Assuming Full Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Highest Return, Liquidity, Fixed Income & Leverage allocation in a Black Skies scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Commitments to illiquid alternatives are maintained at the steady state level, but subpar markets cause the total portfolio to shrink
  - Total illiquid and quasi-liquid assets are projected to reach as high as 66% of the Plan due to the shrinking market value of the total Plan in this scenario
  - In this Black Skies scenario, PSERS may want to redeem some quasi-liquid assets and pare back future commitments to stay closer to the target allocations (38% illiquid assets); however, the allocation would still be significantly different from target

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Black Skies Economic Scenario (continued)

Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage (Assuming Full Actuarial Contributions)

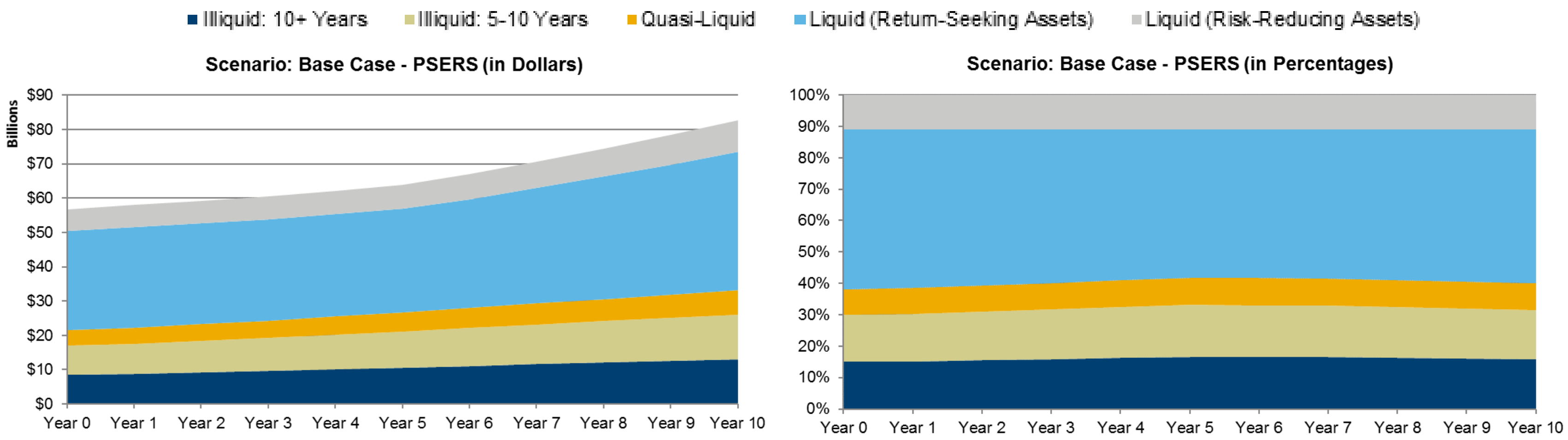
- The exhibit below shows the projected liquidity lock-up of the Highest Return, Liquidity, Fixed Income & Leverage allocation in a Black Skies scenario

Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%
Liquid Return-Seeking	51	43	31	23	23	23	24	25	26	27	28
Total Liquid	**62%**	**54%**	**42%**	**34%**	**34%**	**34%**	**35%**	**36%**	**37%**	**38%**	**39%**
Quasi-Liquid	8%	9%	10%	11%	11%	10%	10%	10%	9%	9%	8%
Illiquid: 5-10 Year Lock-up	15	21	28	32	31	30	29	28	27	26	25
Illiquid: 10+ Year Lock-up	15	16	20	23	25	25	26	26	26	27	28
Total Quasi + Illiquid	**38%**	**46%**	**58%**	**66%**	**66%**	**66%**	**65%**	**64%**	**63%**	**62%**	**61%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Base Case Economic Scenario
Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage (5 Years of 80% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Highest Return, Liquidity, Fixed Income & Leverage allocation and 80% of the Actuarially Determined Employer Contribution in the Base Case economic scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Total illiquid and quasi-liquid assets are projected to reach as high as 42% of the Plan in this scenario
  - There would not be a concern with the ability to pay benefits
  - PSERS may need to redeem some quasi-liquid assets to stay close to its target allocation (38% illiquid assets)

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Base Case Economic Scenario (continued)

Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage (5 Years of 80% Actuarial Contributions)

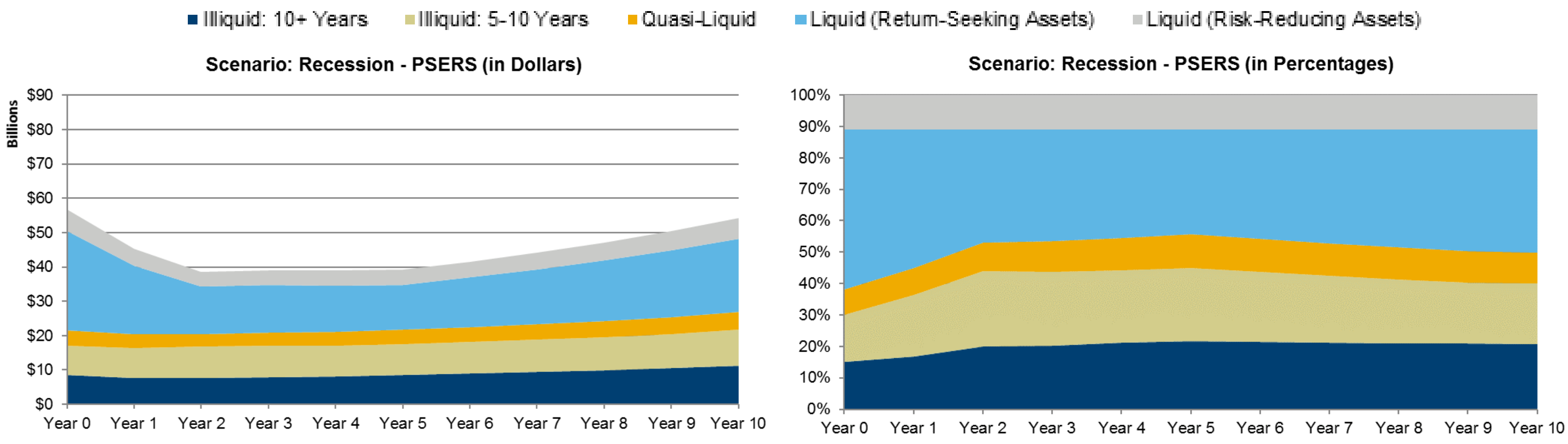
- The exhibit below shows the projected liquidity lock-up of the Highest Return, Liquidity, Fixed Income & Leverage allocation and 80% of the Actuarially Determined Employer Contribution in a Base Case scenario

Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%
Liquid Return-Seeking	51	51	50	49	48	47	47	48	48	48	49
Total Liquid	**62%**	**62%**	**61%**	**60%**	**59%**	**58%**	**58%**	**59%**	**59%**	**59%**	**60%**
Quasi-Liquid	8%	8%	8%	8%	9%	9%	9%	9%	9%	9%	9%
Illiquid: 5-10 Year Lock-up	15	15	15	16	16	17	17	16	16	16	16
Illiquid: 10+ Year Lock-up	15	15	15	16	16	17	17	16	16	16	16
Total Quasi + Illiquid	**38%**	**38%**	**39%**	**40%**	**41%**	**42%**	**42%**	**41%**	**41%**	**41%**	**40%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Recession Economic Scenario
Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage
(5 Years of 80% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Highest Return, Liquidity, Fixed Income & Leverage allocation and 80% of the Actuarially Determined Employer Contribution in the Recession economic scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Commitments to illiquid alternatives are maintained at the steady state level, but recessionary markets combined with lower contributions cause the total portfolio to shrink
  - Total illiquid and quasi-liquid assets are projected to reach as high as 56% of the Plan due to the shrinking market value of the total Plan in this scenario
  - There would not be a concern with the ability to pay benefits
  - PSERS may need to redeem some quasi-liquid assets to stay close to its target allocation (38% illiquid assets)

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Recession Economic Scenario (continued)

Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage (5 Years of 80% Actuarial Contributions)

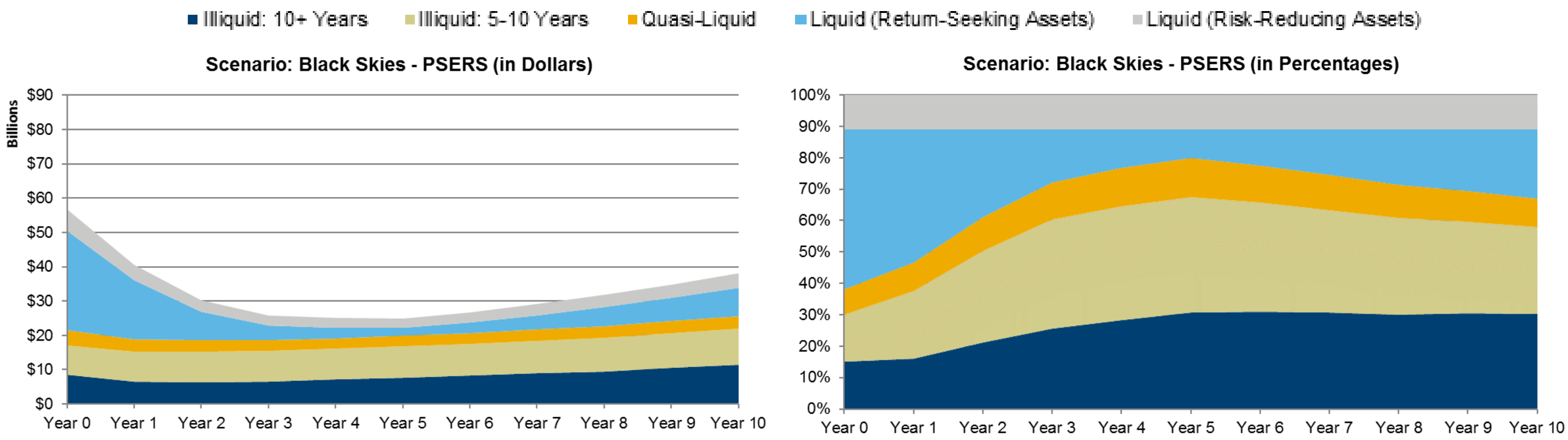
- The exhibit below shows the projected liquidity lock-up of the Highest Return, Liquidity, Fixed Income & Leverage allocation and 80% of the Actuarially Determined Employer Contribution in a Recession scenario

Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%
Liquid Return-Seeking	51	44	36	36	35	33	35	36	38	39	39
Total Liquid	**62%**	**55%**	**47%**	**47%**	**46%**	**44%**	**46%**	**47%**	**49%**	**50%**	**50%**
Quasi-Liquid	8%	9%	9%	10%	10%	11%	11%	10%	10%	10%	10%
Illiquid: 5-10 Year Lock-up	15	19	24	23	23	23	22	21	20	19	19
Illiquid: 10+ Year Lock-up	15	17	20	20	21	22	22	21	21	21	21
Total Quasi + Illiquid	**38%**	**45%**	**53%**	**53%**	**54%**	**56%**	**54%**	**53%**	**51%**	**50%**	**50%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Black Skies Economic Scenario
Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage
(5 Years of 80% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Highest Return, Liquidity, Fixed Income & Leverage allocation and 80% of the Actuarially Determined Employer Contribution in a Black Skies scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  – Commitments to illiquid alternatives are maintained at the steady state level, but subpar markets combined with lower contributions cause the total portfolio to shrink
  – Total illiquid and quasi-liquid assets are projected to reach as high as 80% of the Plan due to the shrinking market value of the total Plan in this scenario
  – In this Black Skies scenario, PSERS may want to redeem some quasi-liquid assets and pare back future commitments to stay closer to the target allocations (38% illiquid assets); however, the allocation would still be significantly different from target

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Black Skies Economic Scenario (continued)

Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage (5 Years of 80% Actuarial Contributions)

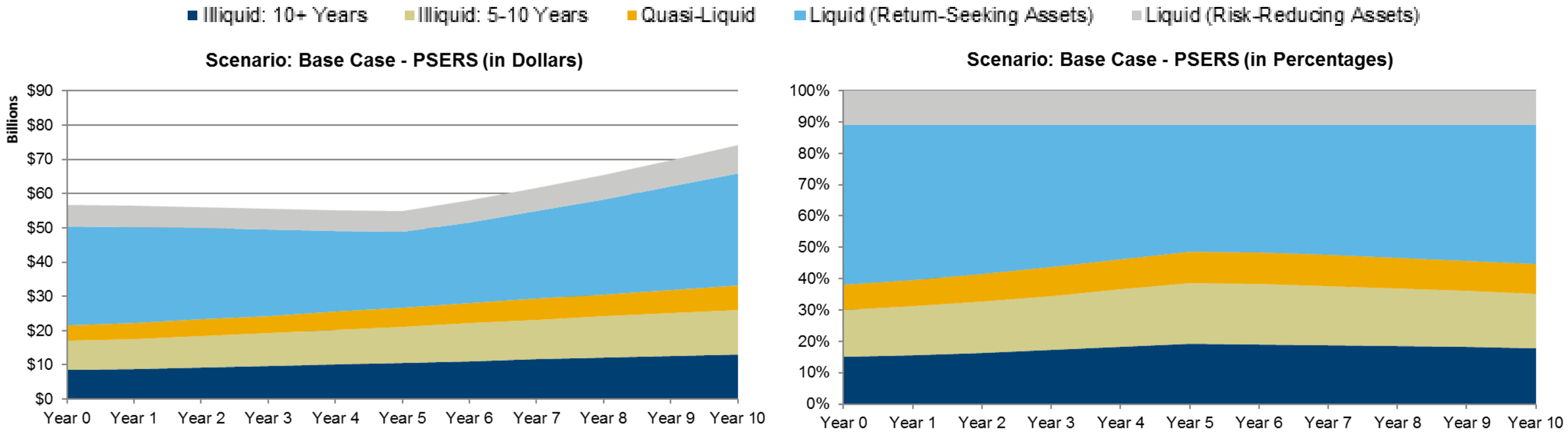
- The exhibit below shows the projected liquidity lock-up of the Highest Return, Liquidity, Fixed Income & Leverage allocation and 80% of the Actuarially Determined Employer Contribution in a Black Skies scenario

Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%
Liquid Return-Seeking	51	42	28	17	12	9	12	15	18	19	22
Total Liquid	**62%**	**53%**	**39%**	**28%**	**23%**	**20%**	**23%**	**26%**	**29%**	**30%**	**33%**
Quasi-Liquid	8%	9%	11%	12%	12%	13%	12%	11%	10%	10%	9%
Illiquid: 5-10 Year Lock-up	15	21	29	35	36	37	35	33	31	29	28
Illiquid: 10+ Year Lock-up	15	16	21	26	28	31	31	31	30	31	30
Total Quasi + Illiquid	**38%**	**47%**	**61%**	**72%**	**77%**	**80%**	**77%**	**75%**	**71%**	**70%**	**67%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Base Case Economic Scenario
Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage (5 Years of 50% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Highest Return, Liquidity, Fixed Income & Leverage allocation and 50% of the Actuarially Determined Employer Contribution in the Base Case economic scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Total illiquid and quasi-liquid assets are projected to reach as high as 49% of the Plan in this scenario
  - There would not be a concern with the ability to pay benefits
  - PSERS may need to redeem some quasi-liquid assets to stay close to its target allocation (38% illiquid assets)

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Base Case Economic Scenario (continued)

Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage
(5 Years of 50% Actuarial Contributions)

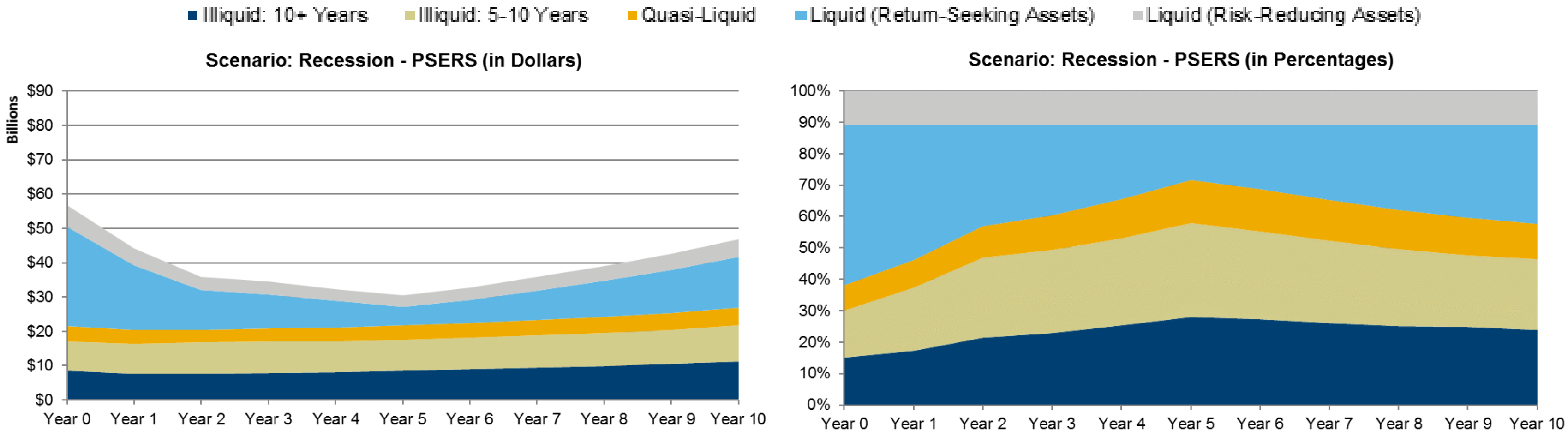
- The exhibit below shows the projected liquidity lock-up of the Highest Return, Liquidity, Fixed Income & Leverage allocation and 50% of the Actuarially Determined Employer Contribution in a Base Case scenario

Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%
Liquid Return-Seeking	51	50	48	45	43	40	41	41	42	43	44
Total Liquid	**62%**	**61%**	**59%**	**56%**	**54%**	**51%**	**52%**	**52%**	**53%**	**54%**	**55%**
Quasi-Liquid	8%	8%	9%	9%	10%	10%	10%	10%	10%	10%	10%
Illiquid: 5-10 Year Lock-up	15	16	16	17	18	19	19	19	18	18	18
Illiquid: 10+ Year Lock-up	15	16	16	17	18	19	19	19	18	18	18
Total Quasi + Illiquid	**38%**	**39%**	**41%**	**44%**	**46%**	**49%**	**48%**	**48%**	**47%**	**46%**	**45%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Recession Economic Scenario
Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage (5 Years of 50% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Highest Return, Liquidity, Fixed Income & Leverage allocation and 50% of the Actuarially Determined Employer Contribution in the Recession economic scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Commitments to illiquid alternatives are maintained at the steady state level, but recessionary markets combined with lower contributions cause the total portfolio to shrink
  - Total illiquid and quasi-liquid assets are projected to reach as high as 72% of the Plan due to the shrinking market value of the total Plan in this scenario
  - In this Recession scenario, PSERS may want to redeem some quasi-liquid assets and pare back future commitments to stay closer to the target allocations (38% illiquid assets); however, the allocation would still be significantly different from target

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Recession Economic Scenario (continued)

Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage (5 Years of 50% Actuarial Contributions)

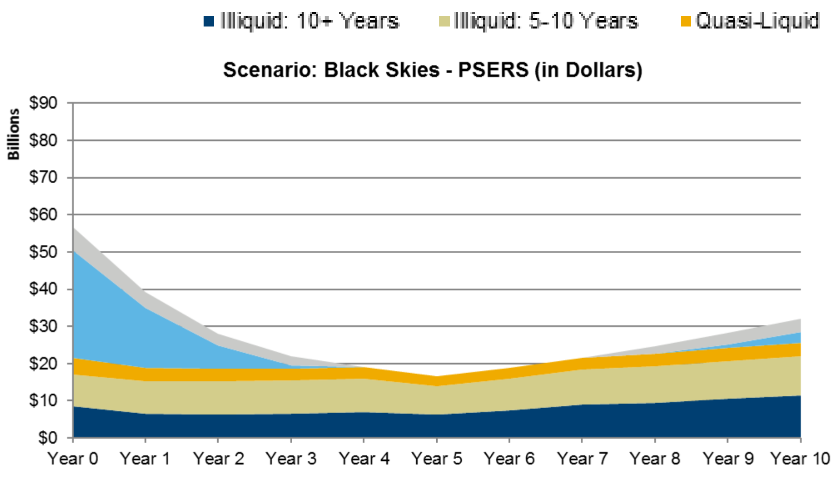
- The exhibit below shows the projected liquidity lock-up of the Highest Return, Liquidity, Fixed Income & Leverage allocation and 50% of the Actuarially Determined Employer Contribution in a Recession scenario

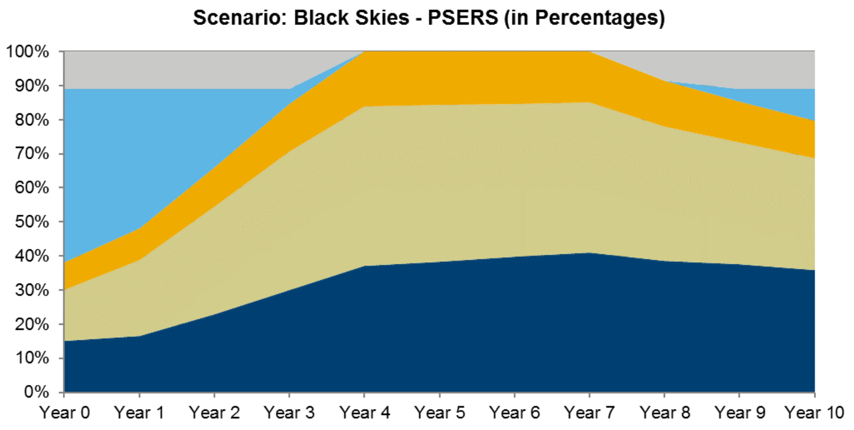
Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%	11%
Liquid Return-Seeking	51	43	32	29	24	17	20	24	27	29	31
Total Liquid	**62%**	**54%**	**43%**	**40%**	**35%**	**28%**	**31%**	**35%**	**38%**	**40%**	**42%**
Quasi-Liquid	8%	9%	10%	11%	12%	14%	13%	13%	12%	12%	11%
Illiquid: 5-10 Year Lock-up	15	20	26	26	28	30	28	26	24	23	22
Illiquid: 10+ Year Lock-up	15	17	21	23	25	28	27	26	25	25	24
Total Quasi + Illiquid	**38%**	**46%**	**57%**	**60%**	**65%**	**72%**	**69%**	**65%**	**62%**	**60%**	**58%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Black Skies Economic Scenario
Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage
(5 Years of 50% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Highest Return, Liquidity, Fixed Income & Leverage allocation and 50% of the Actuarially Determined Employer Contribution in a Black Skies scenario, assuming commitments are continued as expected





- **Key Takeaways:**
  - Commitments to illiquid alternatives are maintained at the steady state level, but subpar markets combined with lower contributions cause the total portfolio to shrink
  - Total illiquid and quasi-liquid assets are projected to reach as high as 100% of the Plan due to the shrinking market value of the total Plan in this scenario
  - In this Black Skies scenario, PSERS may want to redeem some quasi-liquid assets and pare back future commitments to stay closer to the target allocations (38% illiquid assets); however, the allocation would still be significantly different from target

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Black Skies Economic Scenario (continued)

Portfolio B: Highest Return, Liquidity, Fixed Income & Leverage (5 Years of 50% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Highest Return, Liquidity, Fixed Income & Leverage allocation and 50% of the Actuarially Determined Employer Contribution in a Black Skies scenario

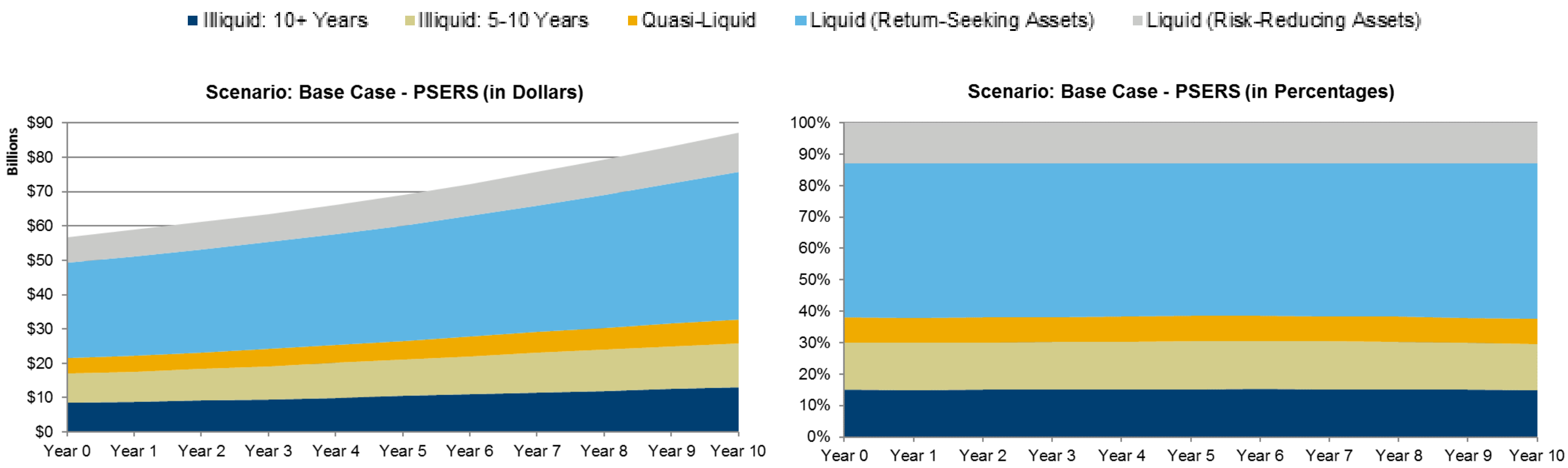
Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	11%	11%	11%	11%	0%	0%	0%	0%	9%	11%	11%
Liquid Return-Seeking	51	41	23	4	0	0	0	0	0	4	9
Total Liquid	**62%**	**52%**	**34%**	**15%**	**0%**	**0%**	**0%**	**0%**	**9%**	**15%**	**20%**
Quasi-Liquid	8%	9%	12%	14%	16%	16%	15%	15%	13%	12%	11%
Illiquid: 5-10 Year Lock-up	15	22	32	41	47	46	45	44	40	36	33
Illiquid: 10+ Year Lock-up	15	17	23	30	37	38	40	41	39	37	36
Total Quasi + Illiquid	**38%**	**48%**	**66%**	**85%**	**100%**	**100%**	**100%**	**100%**	**91%**	**85%**	**80%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Base Case Economic Scenario

Portfolio C: Higher Return, Liquidity & Leverage (Assuming Full Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Higher Return, Liquidity & Leverage allocation in the Base Case economic scenario, assuming commitments are continued as expected



- **Key Takeaway:**
  - Total illiquid and quasi-liquid assets are projected to stay near 38% of the Plan and can be maintained near the target with no cash flow problems

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Base Case Economic Scenario (continued)

Portfolio C: Higher Return, Liquidity & Leverage (Assuming Full Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Higher Return, Liquidity & Leverage allocation in a Base Case scenario

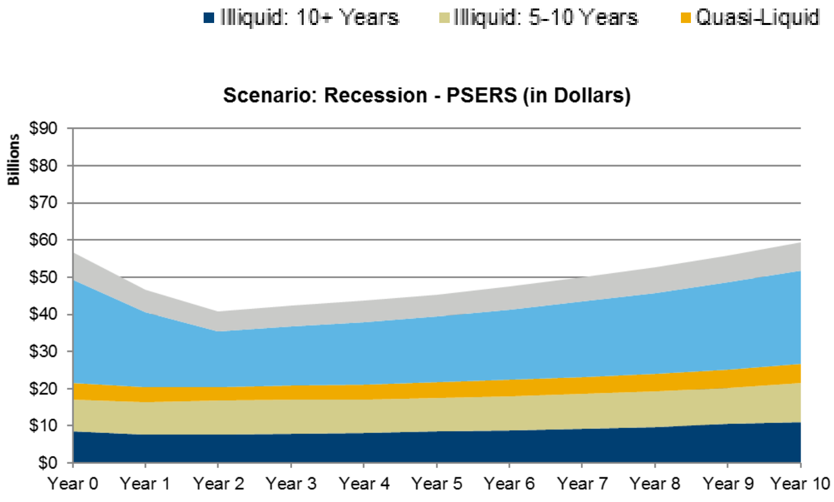
Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%
Liquid Return-Seeking	49	49	49	49	49	49	49	49	49	49	49
Total Liquid	**62%**	**62%**	**62%**	**62%**	**62%**	**62%**	**62%**	**62%**	**62%**	**62%**	**62%**
Quasi-Liquid	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
Illiquid: 5-10 Year Lock-up	15	15	15	15	15	15	15	15	15	15	15
Illiquid: 10+ Year Lock-up	15	15	15	15	15	15	15	15	15	15	15
Total Quasi + Illiquid	**38%**	**38%**	**38%**	**38%**	**38%**	**38%**	**38%**	**38%**	**38%**	**38%**	**38%**

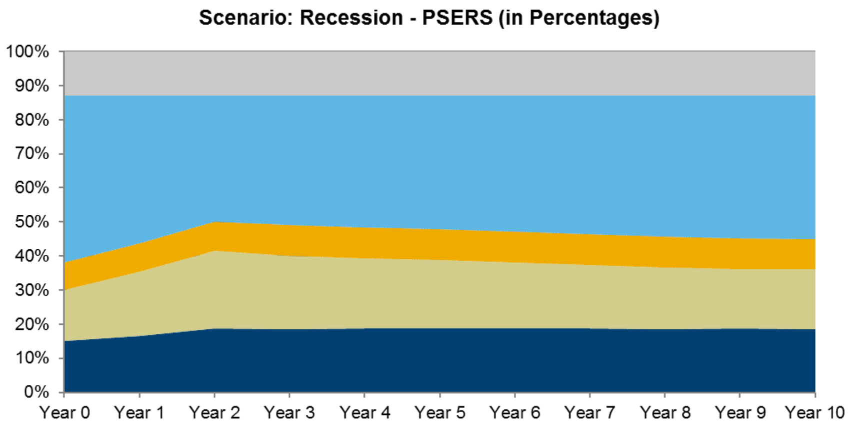
Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Recession Economic Scenario

Portfolio C: Higher Return, Liquidity & Leverage (Assuming Full Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Higher Return, Liquidity & Leverage allocation in the Recession economic scenario, assuming commitments are continued as expected





- **Key Takeaways:**
  - Commitments to illiquid alternatives are maintained at the steady state level, but recessionary markets cause the total portfolio to shrink
  - Total illiquid and quasi-liquid assets are projected to reach as high as 50% of the Plan due to the shrinking market value of the total Plan in this scenario
  - There would not be a concern with the ability to pay benefits
  - PSERS may need to redeem some quasi-liquid assets to stay close to its target allocation (38% illiquid assets)

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Recession Economic Scenario (continued)

Portfolio C: Higher Return, Liquidity & Leverage (Assuming Full Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Higher Return, Liquidity & Leverage allocation in a Recession scenario

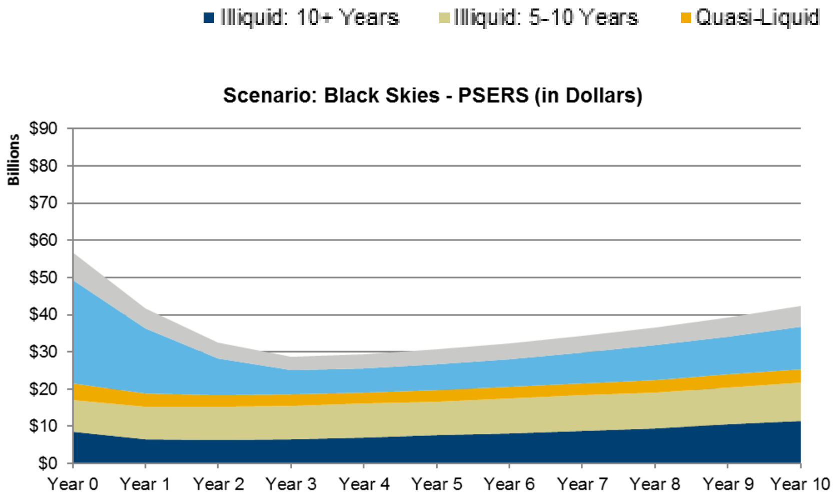
Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%
Liquid Return-Seeking	49	43	37	38	39	39	40	41	41	42	42
Total Liquid	**62%**	**56%**	**50%**	**51%**	**52%**	**52%**	**53%**	**54%**	**54%**	**55%**	**55%**
Quasi-Liquid	8%	8%	9%	9%	9%	9%	9%	9%	9%	9%	9%
Illiquid: 5-10 Year Lock-up	15	19	23	22	21	20	19	19	18	17	17
Illiquid: 10+ Year Lock-up	15	16	19	19	19	19	19	19	19	19	19
Total Quasi + Illiquid	**38%**	**44%**	**50%**	**49%**	**48%**	**48%**	**47%**	**46%**	**46%**	**45%**	**45%**

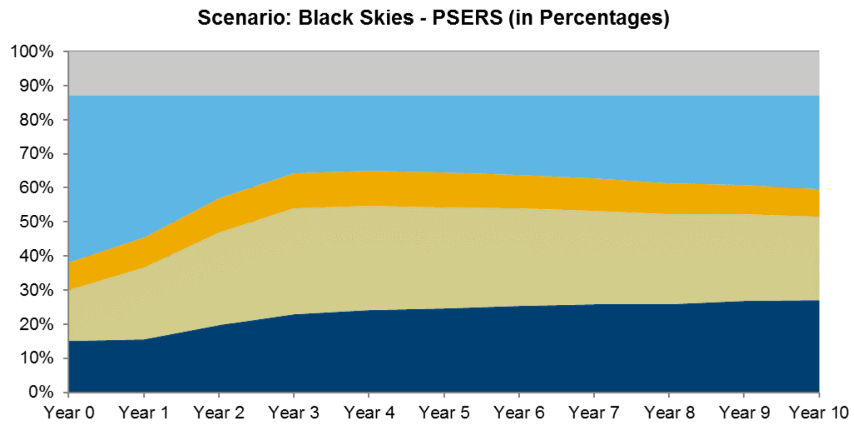
Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Black Skies Economic Scenario

Portfolio C: Higher Return, Liquidity & Leverage (Assuming Full Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Higher Return, Liquidity & Leverage allocation in a Black Skies scenario, assuming commitments are continued as expected





- **Key Takeaways:**
  - Commitments to illiquid alternatives are maintained at the steady state level, but subpar markets cause the total portfolio to shrink
  - Total illiquid and quasi-liquid assets are projected to reach as high as 65% of the Plan due to the shrinking market value of the total Plan in this scenario
  - In this Black Skies scenario, PSERS may want to redeem some quasi-liquid assets and pare back future commitments to stay closer to the target allocations (38% illiquid assets); however, the allocation would still be significantly different from target

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Black Skies Economic Scenario (continued)

Portfolio C: Higher Return, Liquidity & Leverage (Assuming Full Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Higher Return, Liquidity & Leverage allocation in a Black Skies scenario

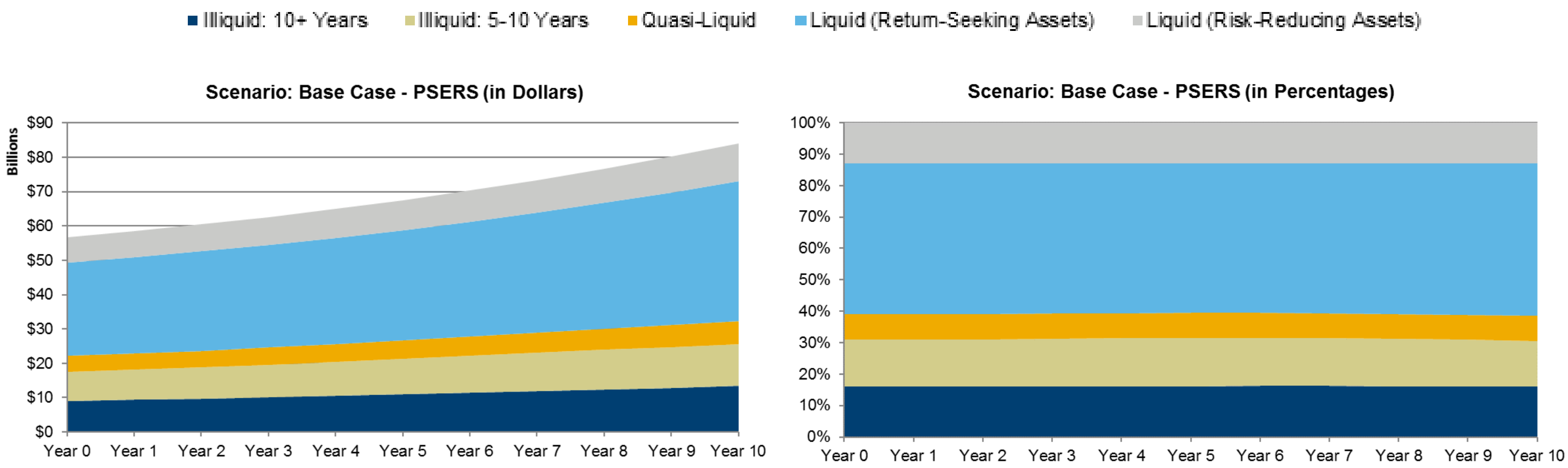
Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%
Liquid Return-Seeking	49	42	30	23	22	23	23	24	26	26	27
Total Liquid	**62%**	**55%**	**43%**	**36%**	**35%**	**36%**	**36%**	**37%**	**39%**	**39%**	**40%**
Quasi-Liquid	8%	9%	10%	10%	10%	10%	10%	9%	9%	9%	8%
Illiquid: 5-10 Year Lock-up	15	21	27	31	31	30	29	28	27	26	25
Illiquid: 10+ Year Lock-up	15	16	20	23	24	25	25	26	26	27	27
Total Quasi + Illiquid	**38%**	**45%**	**57%**	**64%**	**65%**	**64%**	**64%**	**63%**	**61%**	**61%**	**60%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Base Case Economic Scenario

Portfolio H: Higher Return & Liquidity / Lower Leverage (Assuming Full Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Higher Return & Liquidity / Lower Leverage allocation in the Base Case economic scenario, assuming commitments are continued as expected



- **Key Takeaway:**
  - Total illiquid and quasi-liquid assets are projected to stay near 39% of the Plan and can be maintained near the target with no cash flow problems

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Base Case Economic Scenario (continued)

Portfolio H: Higher Return & Liquidity / Lower Leverage
(Assuming Full Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Higher Return & Liquidity / Lower Leverage allocation in a Base Case scenario

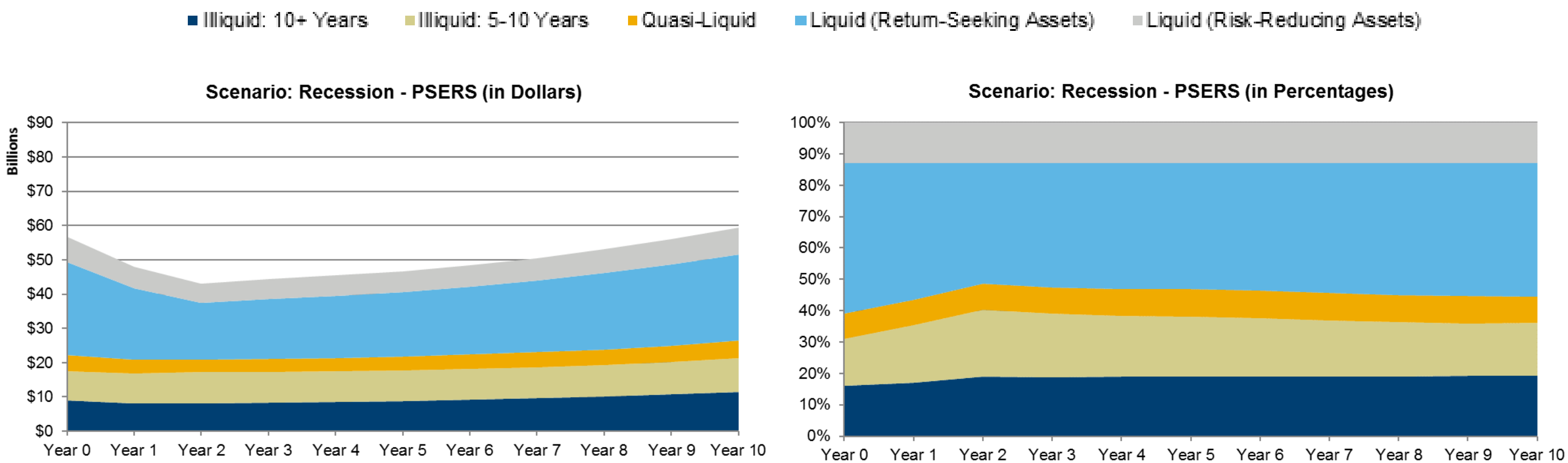
Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%
Liquid Return-Seeking	48	48	48	48	48	48	48	48	48	48	48
Total Liquid	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**	**61%**
Quasi-Liquid	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
Illiquid: 5-10 Year Lock-up	15	15	15	15	15	15	15	15	15	15	15
Illiquid: 10+ Year Lock-up	16	16	16	16	16	16	16	16	16	16	16
Total Quasi + Illiquid	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**	**39%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Recession Economic Scenario

Portfolio H: Higher Return & Liquidity / Lower Leverage (Assuming Full Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Higher Return & Liquidity / Lower Leverage allocation in the Recession economic scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Commitments to illiquid alternatives are maintained at the steady state level, but recessionary markets cause the total portfolio to shrink
  - Total illiquid and quasi-liquid assets are projected to reach as high as 48% of the Plan due to the shrinking market value of the total Plan in this scenario
  - There would not be a concern with the ability to pay benefits
  - PSERS may need to redeem some quasi-liquid assets to stay close to its target allocation (39% illiquid assets)

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Recession Economic Scenario (continued)

Portfolio H: Higher Return & Liquidity / Lower Leverage (Assuming Full Actuarial Contributions)

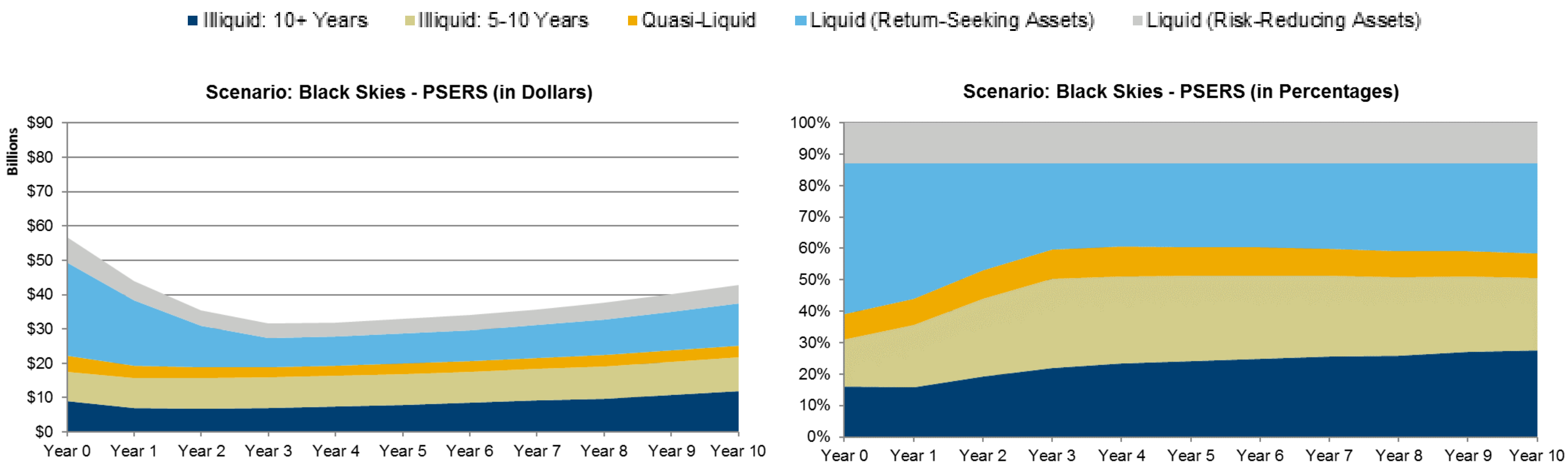
- The exhibit below shows the projected liquidity lock-up of the Higher Return & Liquidity / Lower Leverage allocation in a Recession scenario

Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%
Liquid Return-Seeking	48	44	39	40	40	40	41	41	42	42	42
Total Liquid	**61%**	**57%**	**52%**	**53%**	**53%**	**53%**	**54%**	**54%**	**55%**	**55%**	**55%**
Quasi-Liquid	8%	8%	8%	8%	9%	9%	9%	9%	9%	9%	9%
Illiquid: 5-10 Year Lock-up	15	18	21	20	19	19	18	18	17	17	17
Illiquid: 10+ Year Lock-up	16	17	19	19	19	19	19	19	19	19	19
Total Quasi + Illiquid	**39%**	**43%**	**48%**	**47%**	**47%**	**47%**	**46%**	**46%**	**45%**	**45%**	**45%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Black Skies Economic Scenario
Portfolio H: Higher Return & Liquidity / Lower Leverage (Assuming Full Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Higher Return & Liquidity / Lower Leverage allocation in a Black Skies scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Commitments to illiquid alternatives are maintained at the steady state level, but subpar markets cause the total portfolio to shrink
  - Total illiquid and quasi-liquid assets are projected to reach as high as 61% of the Plan due to the shrinking market value of the total Plan in this scenario
  - In this Black Skies scenario, PSERS may want to redeem some quasi-liquid assets and pare back future commitments to stay closer to the target allocations (39% illiquid assets); however, the allocation would still be significantly different from target

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Black Skies Economic Scenario (continued)

Portfolio H: Higher Return & Liquidity / Lower Leverage (Assuming Full Actuarial Contributions)

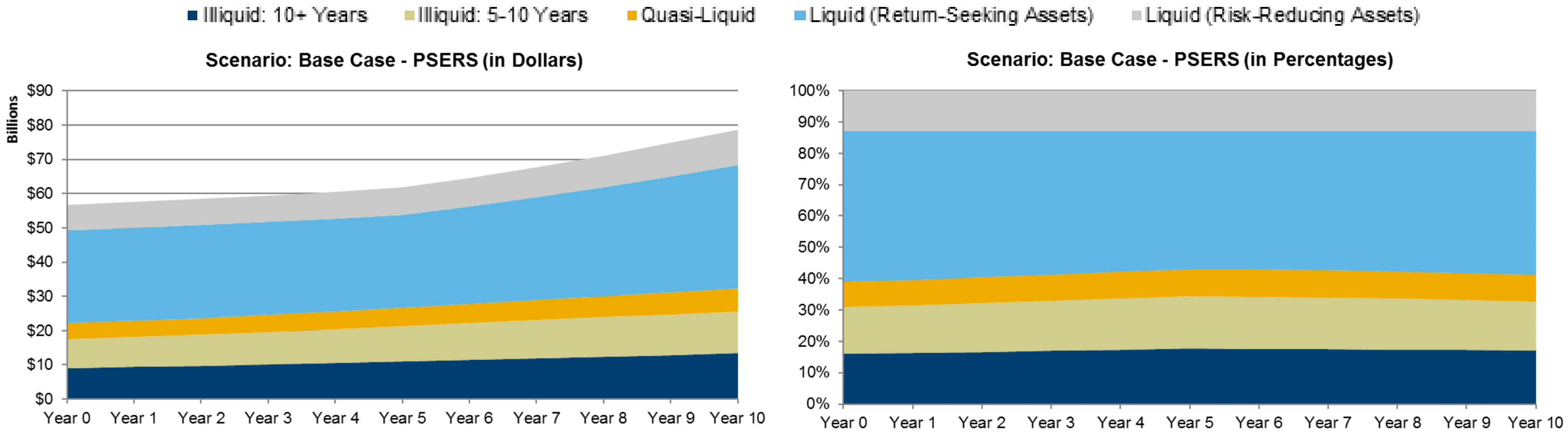
- The exhibit below shows the projected liquidity lock-up of the Higher Return & Liquidity / Lower Leverage allocation in a Black Skies scenario

Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%
Liquid Return-Seeking	48	43	34	27	26	27	27	27	28	28	28
Total Liquid	**61%**	**56%**	**47%**	**40%**	**39%**	**40%**	**40%**	**40%**	**41%**	**41%**	**41%**
Quasi-Liquid	8%	8%	9%	9%	9%	9%	9%	9%	8%	8%	8%
Illiquid: 5-10 Year Lock-up	15	20	25	28	28	27	26	26	25	24	23
Illiquid: 10+ Year Lock-up	16	16	19	22	23	24	25	26	26	27	27
Total Quasi + Illiquid	**39%**	**44%**	**53%**	**60%**	**61%**	**60%**	**60%**	**60%**	**59%**	**59%**	**59%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Base Case Economic Scenario
Portfolio H: Higher Return & Liquidity / Lower Leverage
(5 Years of 80% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Higher Return & Liquidity / Lower Leverage allocation and 80% of the Actuarially Determined Employer Contribution in the Base Case economic scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Total illiquid and quasi-liquid assets are projected to reach as high as 43% of the Plan in this scenario
  - There would not be a concern with the ability to pay benefits
  - PSERS may need to redeem some quasi-liquid assets to stay close to its target allocation (39% illiquid assets)

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Base Case Economic Scenario (continued)

Portfolio H: Higher Return & Liquidity / Lower Leverage (5 Years of 80% Actuarial Contributions)

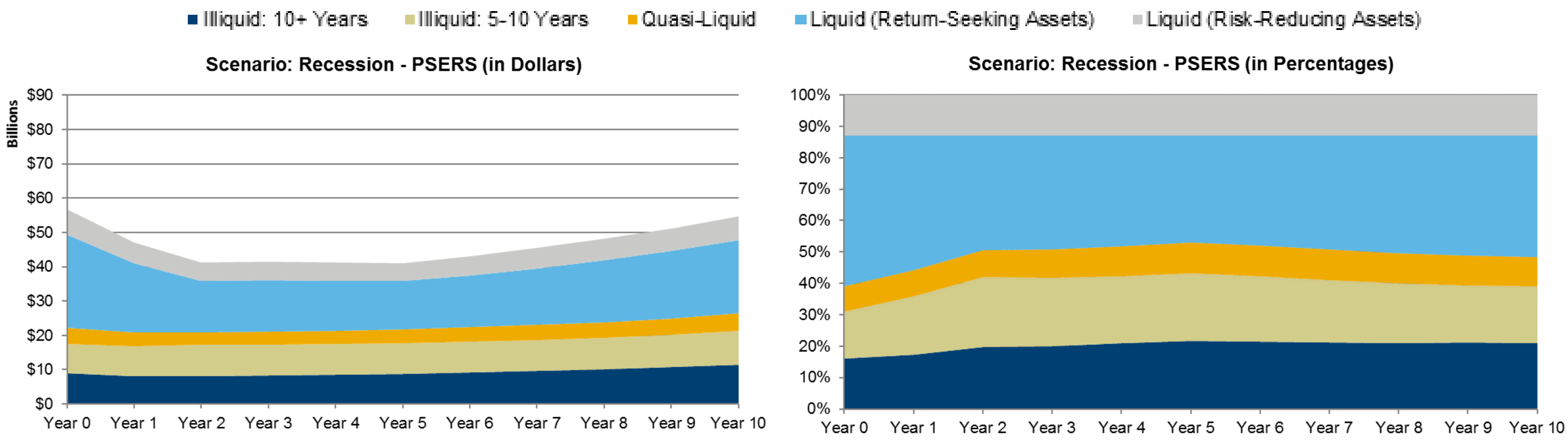
- The exhibit below shows the projected liquidity lock-up of the Higher Return & Liquidity / Lower Leverage allocation and 80% of the Actuarially Determined Employer Contribution in a Base Case scenario

Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%
Liquid Return-Seeking	48	47	47	46	45	44	44	44	45	45	46
Total Liquid	**61%**	**60%**	**60%**	**59%**	**58%**	**57%**	**57%**	**57%**	**58%**	**58%**	**59%**
Quasi-Liquid	8%	8%	8%	8%	9%	9%	9%	9%	9%	9%	9%
Illiquid: 5-10 Year Lock-up	15	15	16	16	16	17	17	16	16	16	16
Illiquid: 10+ Year Lock-up	16	16	17	17	17	18	18	18	17	17	17
Total Quasi + Illiquid	**39%**	**40%**	**40%**	**41%**	**42%**	**43%**	**43%**	**43%**	**42%**	**42%**	**41%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Recession Economic Scenario
Portfolio H: Higher Return & Liquidity / Lower Leverage (5 Years of 80% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Higher Return & Liquidity / Lower Leverage allocation and 80% of the Actuarially Determined Employer Contribution in the Recession economic scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Commitments to illiquid alternatives are maintained at the steady state level, but recessionary markets combined with lower contributions cause the total portfolio to shrink
  - Total illiquid and quasi-liquid assets are projected to reach as high as 53% of the Plan due to the shrinking market value of the total Plan in this scenario
  - There would not be a concern with the ability to pay benefits
  - PSERS may need to redeem some quasi-liquid assets to stay close to its target allocation (39% illiquid assets)

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Recession Economic Scenario (continued)

Portfolio H: Higher Return & Liquidity / Lower Leverage
(5 Years of 80% Actuarial Contributions)

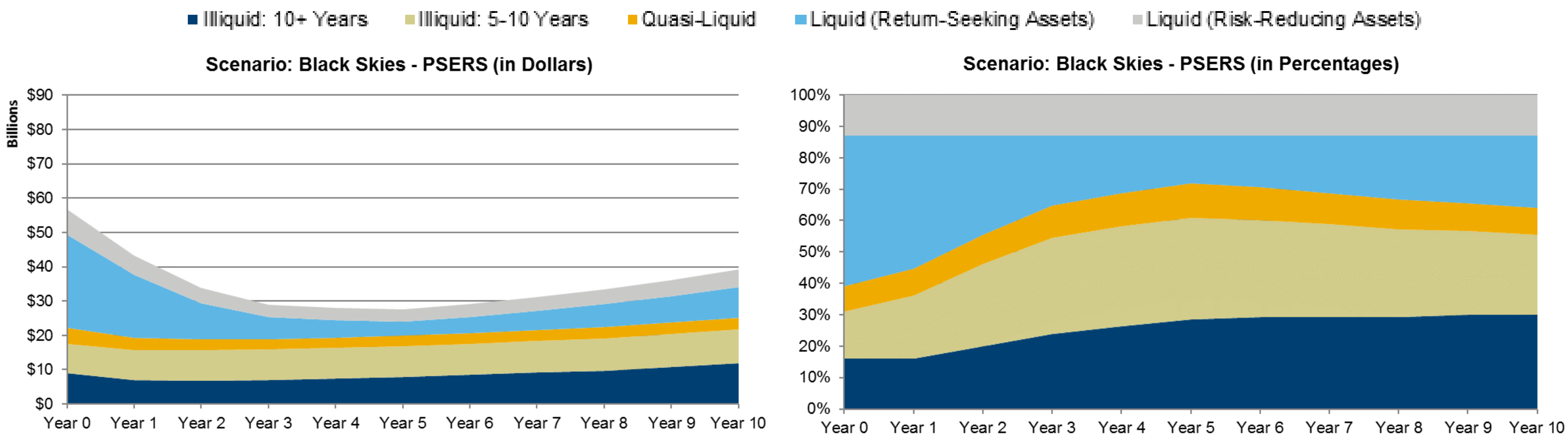
- The exhibit below shows the projected liquidity lock-up of the Higher Return & Liquidity / Lower Leverage allocation and 80% of the Actuarially Determined Employer Contribution in a Recession scenario

Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%
Liquid Return-Seeking	48	43	36	36	35	34	35	36	37	38	39
Total Liquid	**61%**	**56%**	**49%**	**49%**	**48%**	**47%**	**48%**	**49%**	**50%**	**51%**	**52%**
Quasi-Liquid	8%	8%	9%	9%	10%	10%	10%	10%	10%	9%	9%
Illiquid: 5-10 Year Lock-up	15	19	22	22	21	22	21	20	19	18	18
Illiquid: 10+ Year Lock-up	16	17	20	20	21	22	21	21	21	21	21
Total Quasi + Illiquid	**39%**	**44%**	**51%**	**51%**	**52%**	**53%**	**52%**	**51%**	**50%**	**49%**	**48%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Black Skies Economic Scenario
Portfolio H: Higher Return & Liquidity / Lower Leverage (5 Years of 80% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Higher Return & Liquidity / Lower Leverage allocation and 80% of the Actuarially Determined Employer Contribution in a Black Skies scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Commitments to illiquid alternatives are maintained at the steady state level, but subpar markets combined with lower contributions cause the total portfolio to shrink
  - Total illiquid and quasi-liquid assets are projected to reach as high as 72% of the Plan due to the shrinking market value of the total Plan in this scenario
  - In this Black Skies scenario, PSERS may want to redeem some quasi-liquid assets and pare back future commitments to stay closer to the target allocations (39% illiquid assets); however, the allocation would still be significantly different from target

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Black Skies Economic Scenario (continued)

Portfolio H: Higher Return & Liquidity / Lower Leverage
(5 Years of 80% Actuarial Contributions)

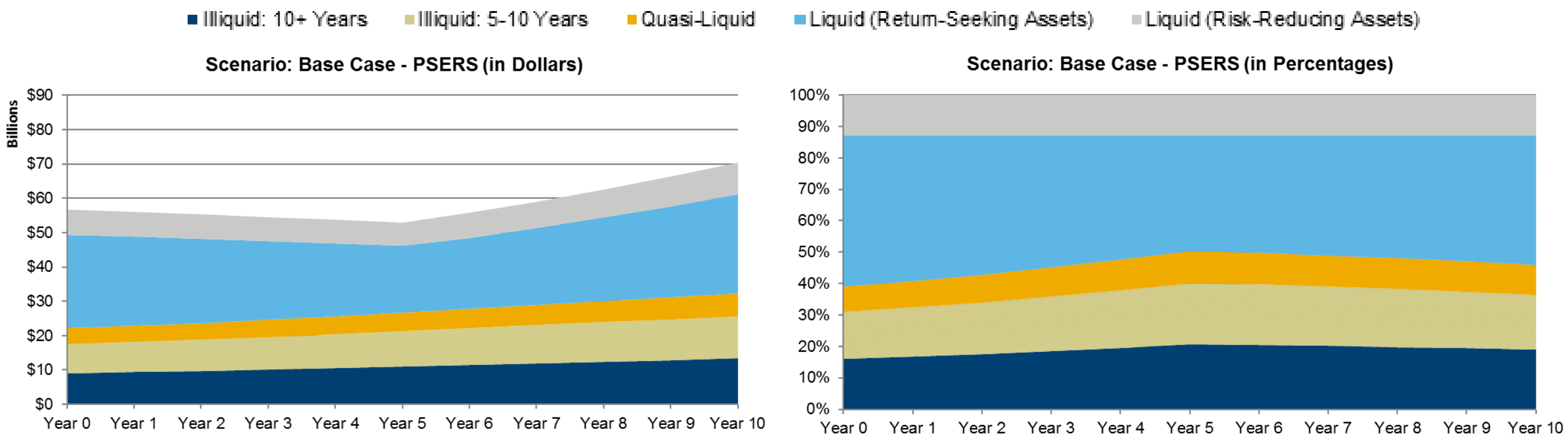
- The exhibit below shows the projected liquidity lock-up of the Higher Return & Liquidity / Lower Leverage allocation and 80% of the Actuarially Determined Employer Contribution in a Black Skies scenario

Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%
Liquid Return-Seeking	48	42	31	22	18	15	16	18	20	21	23
Total Liquid	**61%**	**55%**	**44%**	**35%**	**31%**	**28%**	**29%**	**31%**	**33%**	**34%**	**36%**
Quasi-Liquid	8%	9%	9%	10%	11%	11%	10%	10%	10%	9%	9%
Illiquid: 5-10 Year Lock-up	15	20	26	31	32	32	31	29	28	27	25
Illiquid: 10+ Year Lock-up	16	16	20	24	26	29	29	29	29	30	30
Total Quasi + Illiquid	**39%**	**45%**	**56%**	**65%**	**69%**	**72%**	**71%**	**69%**	**67%**	**66%**	**64%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Base Case Economic Scenario
Portfolio H: Higher Return & Liquidity / Lower Leverage
(5 Years of 50% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Higher Return & Liquidity / Lower Leverage allocation and 50% of the Actuarially Determined Employer Contribution in the Base Case economic scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Total illiquid and quasi-liquid assets are projected to reach as high as 50% of the Plan in this scenario
  - There would not be a concern with the ability to pay benefits
  - PSERS may need to redeem some quasi-liquid assets to stay close to its target allocation (39% illiquid assets)

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Base Case Economic Scenario (continued)

Portfolio H: Higher Return & Liquidity / Lower Leverage (5 Years of 50% Actuarial Contributions)

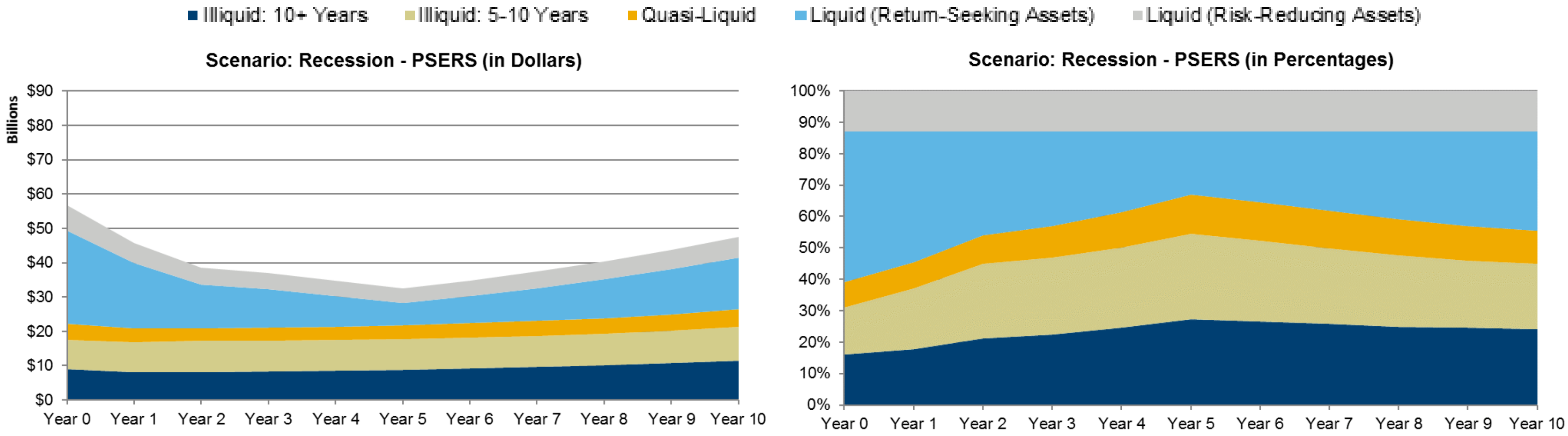
- The exhibit below shows the projected liquidity lock-up of the Higher Return & Liquidity / Lower Leverage allocation and 50% of the Actuarially Determined Employer Contribution in a Base Case scenario

Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%
Liquid Return-Seeking	48	46	44	42	39	37	37	38	39	40	41
Total Liquid	**61%**	**59%**	**57%**	**55%**	**52%**	**50%**	**50%**	**51%**	**52%**	**53%**	**54%**
Quasi-Liquid	8%	8%	9%	9%	10%	10%	10%	10%	10%	10%	10%
Illiquid: 5-10 Year Lock-up	15	16	16	17	18	19	19	19	18	18	17
Illiquid: 10+ Year Lock-up	16	17	18	18	19	21	20	20	20	19	19
Total Quasi + Illiquid	**39%**	**41%**	**43%**	**45%**	**48%**	**50%**	**50%**	**49%**	**48%**	**47%**	**46%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Recession Economic Scenario
Portfolio H: Higher Return & Liquidity / Lower Leverage
(5 Years of 50% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Higher Return & Liquidity / Lower Leverage allocation and 50% of the Actuarially Determined Employer Contribution in the Recession economic scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Commitments to illiquid alternatives are maintained at the steady state level, but recessionary markets combined with lower contributions cause the total portfolio to shrink
  - Total illiquid and quasi-liquid assets are projected to reach as high as 67% of the Plan due to the shrinking market value of the total Plan in this scenario
  - In this Recession scenario, PSERS may want to redeem some quasi-liquid assets and pare back future commitments to stay closer to the target allocations (39% illiquid assets); however, the allocation would still be significantly different from target

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Recession Economic Scenario (continued)

Portfolio H: Higher Return & Liquidity / Lower Leverage
(5 Years of 50% Actuarial Contributions)

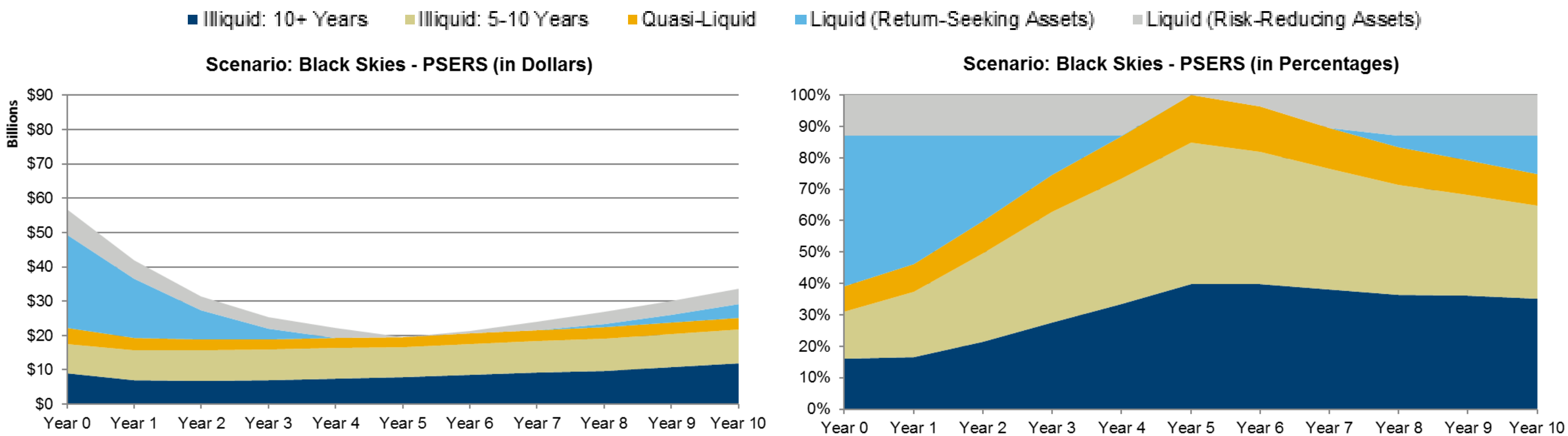
- The exhibit below shows the projected liquidity lock-up of the Higher Return & Liquidity / Lower Leverage allocation and 50% of the Actuarially Determined Employer Contribution in a Recession scenario

Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%
Liquid Return-Seeking	48	42	33	30	26	20	22	25	28	30	31
Total Liquid	**61%**	**55%**	**46%**	**43%**	**39%**	**33%**	**35%**	**38%**	**41%**	**43%**	**44%**
Quasi-Liquid	8%	8%	9%	10%	11%	13%	12%	12%	11%	11%	11%
Illiquid: 5-10 Year Lock-up	15	19	24	24	25	27	26	24	23	21	21
Illiquid: 10+ Year Lock-up	16	18	21	22	25	27	27	26	25	25	24
Total Quasi + Illiquid	**39%**	**45%**	**54%**	**57%**	**61%**	**67%**	**65%**	**62%**	**59%**	**57%**	**56%**

Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

Liquidity Analysis: Black Skies Economic Scenario
Portfolio H: Higher Return & Liquidity / Lower Leverage
(5 Years of 50% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Higher Return & Liquidity / Lower Leverage allocation and 50% of the Actuarially Determined Employer Contribution in a Black Skies scenario, assuming commitments are continued as expected



- **Key Takeaways:**
  - Commitments to illiquid alternatives are maintained at the steady state level, but subpar markets combined with lower contributions cause the total portfolio to shrink
  - Total illiquid and quasi-liquid assets are projected to reach as high as 100% of the Plan due to the shrinking market value of the total Plan in this scenario
  - In this Black Skies scenario, PSERS may want to redeem some quasi-liquid assets and pare back future commitments to stay closer to the target allocations (39% illiquid assets); however, the allocation would still be significantly different from target

Note: Year 0 represents a starting point of June 30, 2020

Liquidity Analysis: Black Skies Economic Scenario (continued)

Portfolio H: Higher Return & Liquidity / Lower Leverage (5 Years of 50% Actuarial Contributions)

- The exhibit below shows the projected liquidity lock-up of the Higher Return & Liquidity / Lower Leverage allocation and 50% of the Actuarially Determined Employer Contribution in a Black Skies scenario

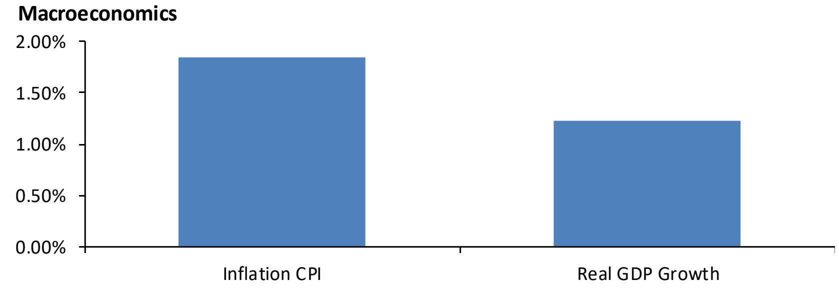
Asset Allocation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Risk-Reducing Assets	13%	13%	13%	13%	13%	0%	4%	10%	13%	13%	13%
Liquid Return-Seeking	48	41	27	12	0	0	0	0	4	8	12
Total Liquid	**61%**	**54%**	**40%**	**25%**	**13%**	**0%**	**4%**	**10%**	**17%**	**21%**	**25%**
Quasi-Liquid	8%	9%	10%	12%	13%	15%	14%	13%	12%	11%	10%
Illiquid: 5-10 Year Lock-up	15	21	28	35	40	45	42	38	35	32	30
Illiquid: 10+ Year Lock-up	16	17	22	27	33	40	40	38	36	36	35
Total Quasi + Illiquid	**39%**	**46%**	**60%**	**75%**	**87%**	**100%**	**96%**	**90%**	**83%**	**79%**	**75%**

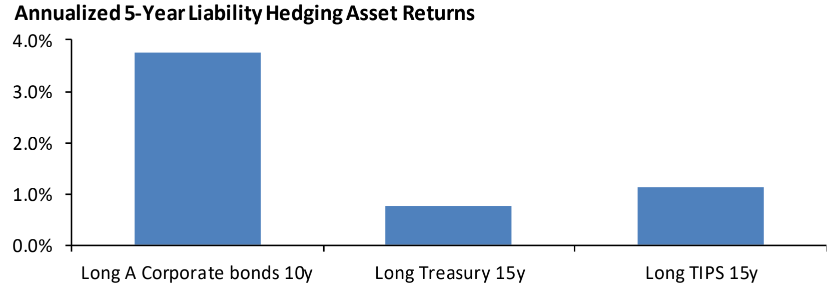
Note: Year 0 represents a starting point of June 30, 2020; Percentages may not sum to 100% due to rounding

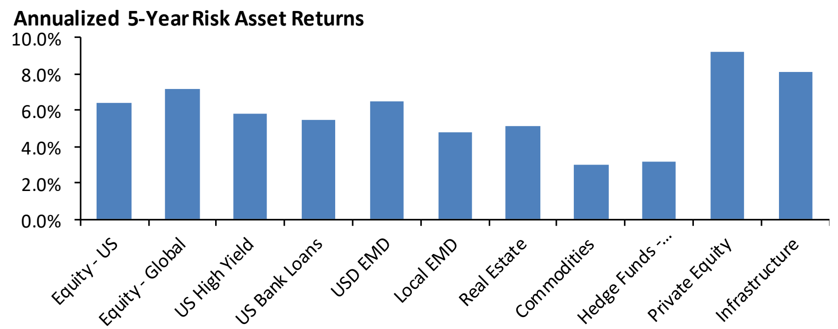
Base Case Scenario
Description

World events unfold in a fashion consistent with our Capital Market Assumptions and yields are based on median ESGs

- Yield and bond return series reflect our average estimates. These estimates represent our benchmark view.
- The pace of US economic growth moderates over the first few years, growing below its long-term trend growth rate. The moderation reflects the fading of previous fiscal stimulus and increased bilateral tariffs between the US and China.
- In later years, the US economy strengthens, eventually growing in line with the long-term trend growth rate, supported by accommodative monetary policy.
- Consumer price inflation, measured by the Consumer Price Index, remains modestly above 2% over the next five years, supported by global growth prospects.
- Government and corporate bond yields gradually rise. Robust profit margins sustain stable corporate spreads.
- Risk asset returns are in line with our long term assumptions.







Returns from 31 March 2020
Source: Aon
The opinions referenced are as of the date of publication and are subject to change due to changes in the market or economic conditions and may not necessarily come to pass. Information contained herein is for informational purposes only and should not be considered investment advice.

Base Case Scenario
Data Table

BASE CASE SCENARIO

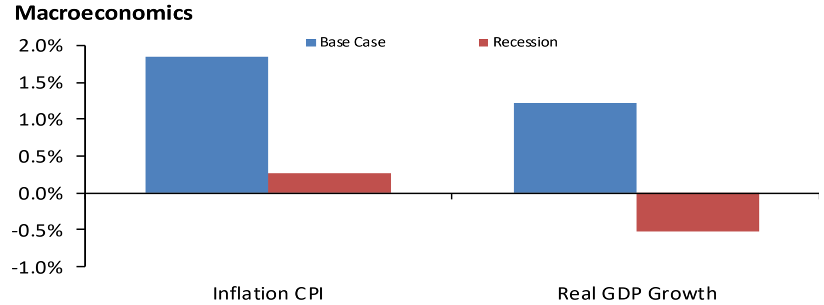
	Year 0	1	2	3	4	5	6	7	8	9	10
Yields (BOY)											
Treasury yield 5y	0.5%	0.6%	0.6%	0.7%	0.7%	0.8%	0.8%	0.9%	0.9%	0.8%	0.7%
Long Treasury yield 15y	1.1%	1.1%	1.2%	1.2%	1.3%	1.3%	1.4%	1.5%	1.5%	1.5%	1.5%
TIPS yield 5y	0.1%	-0.3%	-0.4%	-0.3%	-0.3%	-0.3%	-0.3%	-0.2%	-0.1%	0.2%	0.5%
Long TIPS yield 15y	0.0%	0.0%	0.0%	0.1%	0.2%	0.3%	0.3%	0.4%	0.5%	0.5%	0.6%
Breakeven price inflation 15y	1.0%	1.2%	1.2%	1.1%	1.0%	1.0%	1.1%	1.0%	1.0%	1.0%	0.9%
A Corporate bond yield 5y	2.8%	2.6%	2.6%	2.5%	2.5%	2.5%	2.5%	2.5%	2.4%	2.3%	2.2%
Long A Corporate bond yield 10y	3.2%	3.2%	3.2%	3.2%	3.1%	3.1%	3.1%	3.0%	3.0%	3.0%	3.1%
A Corporate spread 5y	2.3%	2.1%	1.9%	1.8%	1.8%	1.8%	1.7%	1.6%	1.6%	1.5%	1.5%
Long A Corporate spread 10y	2.3%	2.2%	2.2%	2.1%	2.1%	2.1%	2.0%	1.9%	1.9%	1.8%	1.8%
Expected nominal return on assets											
Equity - US		6.4%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%
Equity - Global		7.2%	7.2%	7.2%	7.2%	7.2%	7.2%	7.2%	7.2%	7.2%	7.2%
A Corporate bonds 5y		4.4%	4.0%	4.0%	3.7%	3.4%	2.8%	3.0%	2.7%	3.1%	2.9%
Long A Corporate bonds 10y		3.6%	3.6%	4.0%	4.0%	3.7%	3.7%	3.7%	3.4%	3.9%	3.6%
Treasury 5y		1.0%	1.0%	1.1%	1.2%	1.2%	0.7%	0.7%	1.0%	1.2%	1.2%
Long Treasury 15y		0.7%	0.7%	0.7%	1.0%	0.7%	1.0%	1.4%	1.8%	1.8%	1.5%
TIPS 5y		3.1%	1.9%	1.5%	2.2%	2.5%	1.9%	1.9%	1.7%	1.5%	1.5%
Long TIPS 15y		2.5%	1.2%	0.4%	0.7%	0.9%	1.7%	1.6%	1.5%	1.3%	1.2%
US High Yield		6.5%	5.8%	5.8%	5.6%	5.3%	5.0%	4.7%	5.1%	4.9%	4.6%
Bank Loans		5.4%	5.6%	5.5%	5.5%	5.5%	5.6%	5.6%	5.5%	5.6%	5.6%
USD Emerging Market Debt		7.4%	6.6%	6.4%	6.3%	5.8%	5.5%	5.3%	5.4%	5.6%	5.6%
Local Emerging Market Debt		5.0%	4.9%	5.0%	4.8%	4.5%	4.4%	3.9%	4.4%	3.9%	4.6%
Real Estate		5.2%	5.2%	5.2%	5.2%	5.2%	5.2%	5.2%	5.2%	5.2%	5.2%
Commodities		3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%
Hedge Funds - FoHF - Universe		3.2%	3.2%	3.2%	3.2%	3.2%	3.2%	3.2%	3.2%	3.2%	3.2%
Private Equity		9.2%	9.2%	9.2%	9.2%	9.2%	9.2%	9.2%	9.2%	9.2%	9.2%
Infrastructure - US		8.1%	8.1%	8.1%	8.1%	8.1%	8.1%	8.1%	8.1%	8.1%	8.1%
Cash		0.2%	0.1%	0.3%	0.6%	0.4%	0.3%	0.3%	0.6%	0.7%	0.7%
CPI		1.3%	1.9%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%

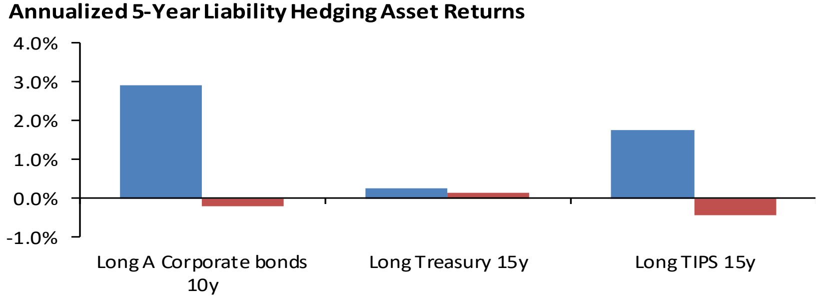
Scenario information as of March 31, 2020

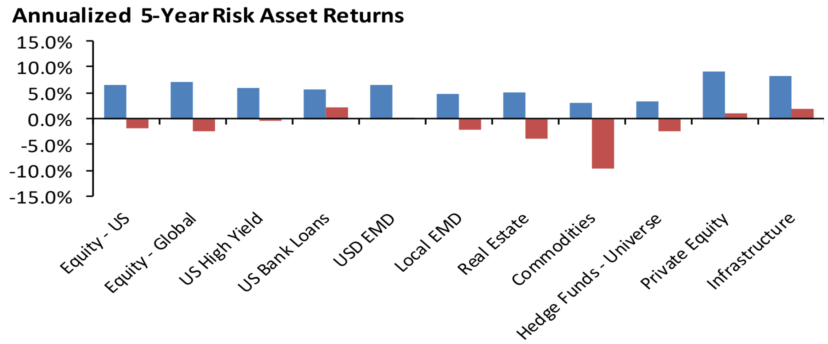
Recession Scenario
Description

The US economy slips back into recession in 2020

- Global growth is much slower than under the base case scenario.
- The US experiences a deep recession in 2020, due to subdued global growth.
- Inflation turns slightly negative in 2020. However, the period of deflation is short lived and inflation starts to rise in later years as an economic recovery begins to establish itself.
- Treasury yields fall while TIPS yields remain at low levels as the US enters recession. Yields rise in later years as a recovery gets underway.
- Corporate spreads rise significantly due to the poor economic situation and increased risks of downgrades or defaults.
- Most risk assets make losses in the first two years but rebound in later years as the economy recovers.







Returns from 31 March 2020
Source: Aon
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Recession Scenario
Data Table

RECESSION SCENARIO

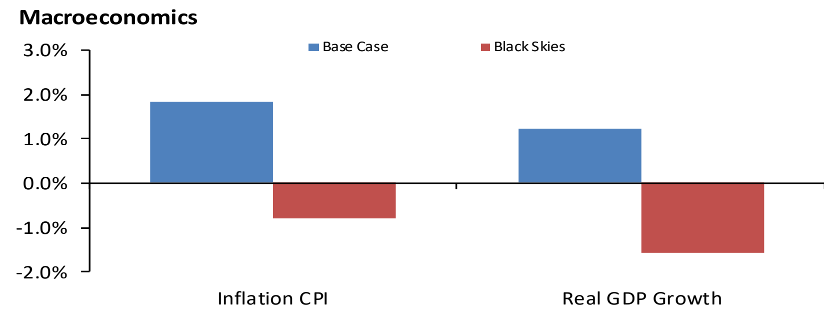
	Year 0	1	2	3	4	5	6	7	8	9	10
Yields (BOY)											
Treasury yield 5y	0.5%	-0.3%	-0.4%	0.0%	0.4%	0.9%	1.2%	1.3%	1.4%	1.5%	1.5%
Long Treasury yield 15y	1.1%	0.6%	0.4%	0.6%	0.9%	1.4%	1.6%	1.8%	1.9%	2.0%	2.1%
TIPS yield 5y	0.1%	-1.0%	-1.1%	-1.0%	-0.6%	-0.3%	-0.4%	-0.3%	-0.1%	0.2%	0.4%
Long TIPS yield 15y	0.0%	-0.4%	-0.5%	-0.4%	-0.1%	0.2%	0.3%	0.3%	0.4%	0.5%	0.5%
Breakeven price inflation 15y	1.0%	1.0%	0.9%	1.0%	1.0%	1.2%	1.3%	1.4%	1.5%	1.5%	1.5%
A Corporate bond yield 5y	2.8%	3.9%	4.3%	4.3%	4.3%	4.3%	4.3%	4.2%	4.1%	3.9%	3.8%
Long A Corporate bond yield 10y	3.2%	4.0%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.5%	4.4%	4.4%
A Corporate spread 5y	2.3%	4.2%	4.7%	4.3%	3.9%	3.3%	3.1%	2.9%	2.7%	2.4%	2.2%
Long A Corporate spread 10y	2.3%	3.9%	4.4%	4.2%	3.9%	3.4%	3.1%	2.9%	2.8%	2.6%	2.4%
Expected nominal return on assets											
Equity - US		-18.0%	-10.0%	10.7%	5.8%	5.8%	5.8%	5.9%	5.9%	6.0%	6.1%
Equity - Global		-20.7%	-11.5%	11.6%	6.1%	6.1%	6.2%	6.3%	6.4%	6.5%	6.7%
A Corporate bonds 5y		-1.4%	1.3%	3.4%	3.8%	4.0%	3.8%	3.9%	4.0%	4.2%	4.2%
Long A Corporate bonds 10y		-5.5%	-1.7%	1.9%	2.1%	2.3%	3.3%	3.5%	3.8%	4.2%	4.1%
Treasury 5y		4.7%	0.6%	-1.3%	-1.1%	-0.9%	0.5%	0.8%	1.1%	1.4%	1.5%
Long Treasury 15y		9.2%	2.8%	-1.5%	-3.3%	-5.9%	-1.1%	-0.7%	-0.3%	0.3%	0.3%
TIPS 5y		3.5%	0.1%	-0.6%	-1.0%	-0.1%	1.7%	1.7%	1.5%	1.4%	1.4%
Long TIPS 15y		5.3%	1.1%	-1.0%	-4.0%	-3.3%	0.3%	0.3%	0.3%	0.3%	0.5%
US High Yield		-11.2%	-5.9%	8.2%	4.8%	4.6%	4.3%	4.1%	4.5%	4.4%	4.3%
Bank Loans		-4.7%	-1.1%	6.7%	5.0%	5.0%	5.2%	5.2%	5.1%	5.3%	5.3%
USD Emerging Market Debt		-12.7%	-6.0%	9.8%	6.2%	6.0%	5.6%	5.4%	5.6%	5.7%	5.7%
Local Emerging Market Debt		-17.4%	-9.2%	8.7%	4.8%	4.7%	4.6%	4.0%	4.6%	4.1%	4.7%
Real Estate		-13.0%	-7.9%	-2.8%	0.7%	4.6%	4.6%	4.7%	4.7%	4.8%	4.9%
Commodities		-29.2%	-23.3%	5.7%	2.3%	2.3%	2.3%	2.4%	2.5%	2.6%	2.7%
Hedge Funds - FoHF - Universe		-14.8%	-9.5%	6.0%	4.9%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%
Private Equity		-18.0%	-5.5%	14.0%	9.2%	9.4%	9.4%	9.4%	9.4%	9.4%	9.3%
Infrastructure - US		-4.6%	-0.2%	3.3%	4.1%	7.7%	7.7%	7.8%	7.8%	7.8%	7.9%
Cash		0.2%	0.0%	0.0%	0.5%	0.6%	0.6%	0.7%	1.1%	1.4%	1.6%
CPI		-1.2%	0.1%	0.5%	0.8%	1.1%	1.2%	1.3%	1.4%	1.5%	1.6%

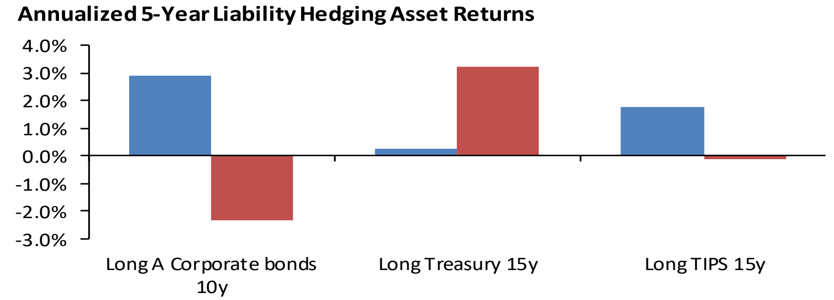
Scenario information as of March 31, 2020

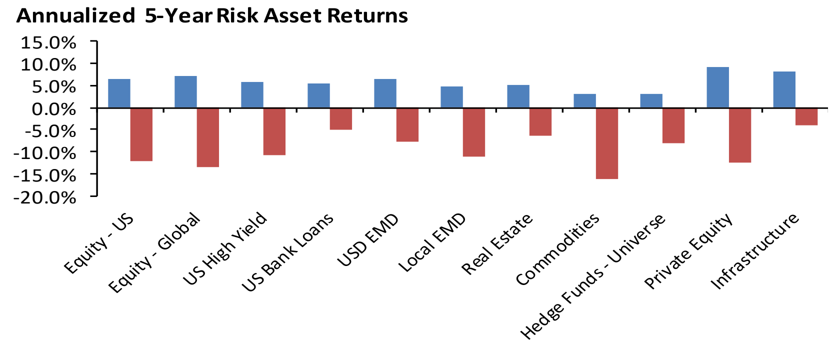
Black Skies Scenario
Description

A deep recession followed by a longer period of stagnant growth

- A confluence of factors, including falling oil prices, economic weakness in developed and emerging market economies and severe levels of financial distress (due to high debt levels and political crisis) lead to a global recession followed by stagnation.
- The US experiences a protracted deep recession.
- Inflation is pushed into negative territory in 2020 and remains there in 2021, while continued sluggish growth over the following years means that inflation stays close to zero.
- Treasury yields fall and remain at low levels as the US enters recession.
- Corporate spreads rise significantly due to the poor economic situation and increased risks of downgrades or defaults.
- Risk assets make losses in the first few years. There is no pronounced bounce in growth and the economic situation remains poor for a long time, which weighs on returns in later years.







Returns from 31 March 2020
Source: Aon
The opinions referenced are as of the date of publication and are subject to change due to changes in the market or economic conditions and may not necessarily come to pass. Information contained herein is for informational purposes only and should not be considered investment advice.

Black Skies Scenario
Data Table

BLACK SKIES SCENARIO

	Year 0	1	2	3	4	5	6	7	8	9	10
Yields (BOY)											
Treasury yield 5y	0.5%	-0.7%	-0.7%	-0.6%	-0.6%	-0.4%	0.0%	0.3%	0.5%	0.7%	0.9%
Long Treasury yield 15y	1.1%	0.1%	-0.1%	-0.1%	0.0%	0.2%	0.5%	0.8%	1.0%	1.2%	1.5%
TIPS yield 5y	0.1%	-1.1%	-1.2%	-1.2%	-1.2%	-1.1%	-1.1%	-0.9%	-0.7%	-0.3%	0.0%
Long TIPS yield 15y	0.0%	-0.6%	-0.7%	-0.6%	-0.5%	-0.3%	-0.2%	-0.1%	0.0%	0.2%	0.3%
Breakeven price inflation 15y	1.0%	0.7%	0.7%	0.6%	0.5%	0.6%	0.7%	0.9%	1.0%	1.1%	1.2%
A Corporate bond yield 5y	2.8%	4.4%	5.2%	5.0%	4.7%	4.3%	4.3%	4.3%	4.1%	4.0%	3.8%
Long A Corporate bond yield 10y	3.2%	4.4%	5.0%	4.9%	4.7%	4.4%	4.4%	4.4%	4.4%	4.3%	4.3%
A Corporate spread 5y	2.3%	5.2%	5.9%	5.7%	5.3%	4.8%	4.4%	4.0%	3.6%	3.3%	2.9%
Long A Corporate spread 10y	2.3%	4.7%	5.4%	5.3%	5.0%	4.5%	4.2%	3.9%	3.6%	3.3%	3.0%
Expected nominal return on assets											
Equity - US		-28.8%	-20.8%	-11.5%	2.6%	2.6%	3.0%	3.4%	3.8%	4.1%	4.5%
Equity - Global		-31.6%	-22.9%	-12.5%	2.7%	2.7%	3.2%	3.6%	4.1%	4.5%	5.0%
A Corporate bonds 5y		-4.4%	-1.9%	2.0%	3.0%	3.2%	1.5%	1.8%	2.1%	2.5%	2.6%
Long A Corporate bonds 10y		-9.8%	-5.8%	0.4%	1.5%	2.6%	0.5%	0.9%	1.4%	2.0%	2.1%
Treasury 5y		6.4%	-0.6%	-0.7%	-0.4%	-0.8%	-1.5%	-1.1%	-0.6%	-0.2%	0.1%
Long Treasury 15y		16.4%	3.2%	0.9%	-1.0%	-2.4%	-3.6%	-3.1%	-2.6%	-2.0%	-1.9%
TIPS 5y		2.6%	-2.0%	-1.0%	-0.6%	-0.2%	0.1%	0.2%	0.1%	0.1%	0.3%
Long TIPS 15y		6.7%	0.0%	-1.8%	-2.9%	-2.2%	-1.6%	-1.4%	-1.3%	-1.2%	-0.9%
US High Yield		-25.6%	-19.0%	-10.1%	2.2%	2.0%	2.1%	2.1%	2.7%	2.9%	3.0%
Bank Loans		-15.1%	-10.3%	-4.9%	3.1%	3.2%	3.5%	3.7%	3.8%	4.2%	4.4%
USD Emerging Market Debt		-20.9%	-14.9%	-7.1%	3.5%	3.1%	3.1%	3.1%	3.6%	4.0%	4.3%
Local Emerging Market Debt		-26.5%	-19.1%	-10.1%	1.7%	1.5%	1.7%	1.5%	2.3%	2.2%	3.1%
Real Estate		-15.7%	-11.1%	-5.2%	-0.7%	1.5%	1.9%	2.3%	2.6%	3.0%	3.4%
Commodities		-38.3%	-29.9%	-5.2%	0.7%	0.7%	1.0%	1.2%	1.4%	1.7%	1.9%
Hedge Funds - FoHF - Universe		-18.7%	-13.2%	-7.3%	0.0%	0.0%	0.3%	0.6%	1.0%	1.3%	1.6%
Private Equity		-31.8%	-22.9%	-11.7%	5.0%	5.0%	5.4%	5.8%	6.3%	6.7%	7.1%
Infrastructure - US		-12.4%	-7.9%	-4.0%	1.3%	4.0%	4.4%	4.8%	5.3%	5.7%	6.1%
Cash		0.2%	-0.1%	0.0%	0.0%	0.0%	0.0%	0.2%	0.6%	1.0%	1.3%
CPI		-2.7%	-1.6%	-0.1%	0.1%	0.3%	0.5%	0.6%	0.8%	1.0%	1.2%

Scenario information as of March 31, 2020

About This Material

This material includes a summary of calculations and consulting related to the finances of Pennsylvania Public School Employees' Retirement System (PSERS). The following variables have been addressed:

- Contributions
- Funded Ratio
- Net Outflow

This analysis is intended to assist the Investment Committee with a review of the associated issues and options, and its use may not be appropriate for other purposes. This analysis has been prepared solely for the benefit of the Investment Committee. Any further dissemination of this report is not allowed without the written consent of Aon Investments USA Inc.

Our calculations were generally based on the methodologies identified in the actuary's valuation report for PSERS. We believe the methodology used in these calculations conforms to the applicable standards identified in the report.

Models are used to develop alternative scenarios based on the underlying valuation model and project financial results under those scenarios. The models were developed by experts outside and within Aon. Where outside models were used, the models were reviewed by experts within Aon. The models were selected as appropriate for these projections by the undersigned.

Experience different than anticipated could have a material impact on the ultimate costs of the benefits. In addition, changes in plan provisions or applicable laws could have a significant impact on cost. Actual experience may differ from our modeling assumptions.

Our calculations were based on data provided by the plan actuary. The actuarial assumptions and methods and plan provisions reflected in these projections are the same as those used for the 2019 actuarial valuation for PSERS as noted in the actuarial reports, except where noted in this report. Unless specifically noted, our calculations do not reflect any other changes or events after June 30, 2019. Reflecting events after June 30, 2019 would impact the results of the projection.

In conducting these projections, we have relied on plan design, demographic and financial information provided by other parties, including the plan's actuary and plan sponsor. While we cannot verify the accuracy of all of the information, the supplied information was reviewed for consistency and reasonableness. As a result of this review, we have no reason to doubt the substantial accuracy or completeness of the information and believe that it has produced appropriate results.

These projections have been conducted in accordance with generally accepted actuarial principles and practices, including applicable Actuarial Standards of Practice as issued by the Actuarial Standards Board. The undersigned actuary is familiar with the near-term and long-term aspects of pension valuations and meet the Qualification Standards of the American Academy of Actuaries necessary to render the actuarial opinions contained herein. All sections of this report are considered an integral part of the actuarial opinions.

To our knowledge, no colleague of Aon Investments USA Inc. providing services to PSERS has any direct financial interest or indirect material interest in PSERS. Thus, we believe there is no relationship existing that might affect our capacity to prepare and certify this report for PSERS.

Aon Investments USA Inc.

Phil Kivarkis FSA, CFA

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