

**PENNSYLVANIA  
529 GUARANTEED SAVINGS PLAN**

**Annual Actuarial Report on the Pennsylvania 529  
Guaranteed Savings Plan Fund**

**June 30, 2017**

Prepared by  
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August 8, 2017

The Honorable Joseph M. Torsella  
Treasurer, Commonwealth of Pennsylvania  
State Finance Building, Room 129  
Harrisburg, PA 17120

Dear Treasurer Torsella:

We have completed our actuarial analysis of the Fund ("the Fund") for the Pennsylvania Tuition Account Guaranteed Savings Plan ("the Plan") as of June 30, 2017. This report presents our findings with respect to the Fund's expected cash flows and status of the Fund.

This report also presents our analysis of Plan Credit Rates effective September 1, 2017 through August 31, 2018.

The analysis of the funding of the Plan was prepared for the Pennsylvania Treasury ("Treasury") for the purposes of assessing the status of the Fund in accordance with Section 306(b)(3) of Act 11 of 1992. The analyses have been prepared in accordance with generally accepted actuarial principles and practices commonly applicable to similar types of arrangements.

The rates for Plan Credits for September 1, 2017 through August 31, 2018 are self-supporting. That is, contributions made at these rates are anticipated to generate an additional amount of actuarial reserve.

Currently the expected value of liabilities is \$1,674,615,593 and the value of assets plus projected future fees is \$1,943,760,541, for a difference of \$269,144,948 or 16.07% of liabilities. For comparison purposes, the corresponding amounts from June 30, 2016 were expected value of liabilities of \$1,584,888,481 and value of assets plus projected

future fees of \$1,802,383,651, for a difference of \$217,495,170 and a ratio of 13.72% of liabilities.

In determining the amounts for June 30, 2017, we have updated several assumptions to reflect the most current experience and expectations of the Program. Most notable among these is a change to the investment return assumption. Consultations with the investment advisor led to a decrease in the investment return assumption from 7.00% to 6.00%, net of expenses. This reduced surplus by 5.28% of liabilities. Also, premiums were refunded for academic year 2016/2017.

Subsequent to the date of this analysis, a change will take place involving the account fees paid by contract owners. Fees paid for the 2016 - 2017 academic year will be refunded for those accounts that have agreed to receive plan materials (e.g. statements, confirmations, disclosure documents) by e-mail. Additionally, fees for the third quarter of 2017 will be waived for all accounts. The fee refund will decrease the actuarial reserve by \$3,064,303 to \$266,080,645 which is 15.86% of liabilities. The fee waiver will further decrease the actuarial reserve by \$1,001,443 to \$265,079,202 which is 15.80% of liabilities. These changes are not included in the body of the report as it reflects the Plan as constituted on June 30, 2017.

\* \* \* \* \*

We appreciate the opportunity to serve the Commonwealth of Pennsylvania. Any questions about the report should be directed to me at (770) 752-5656.

Very truly yours,



John T. Condo, FSA, MAAA, Ph.D.  
Vice President

## TABLE OF CONTENTS

<i>REPORT SECTION</i>	<i>PAGE</i>
<i>I. Executive Summary.....</i>	<i>1</i>
<i>II. Reliances &amp; Compliance With Actuarial Standards of Practice .....</i>	<i>4</i>
<i>III. Plan Credit Rates September 1, 2017 Through August 31, 2018.....</i>	<i>5</i>
<i>IV. Description of the Plan .....</i>	<i>6</i>
<i>V. Summary of Contract Data and Current Assets.....</i>	<i>9</i>
<i>VI. Actuarial Methods and Assumptions .....</i>	<i>11</i>
<i>VII. Status of the Fund as of June 30, 2017.....</i>	<i>16</i>
<i>VIII. Sensitivity Testing.....</i>	<i>20</i>
<i>IX. Stochastic Analysis.....</i>	<i>21</i>
<i>X. Changes in Actuarial Assumptions .....</i>	<i>23</i>
<i>XI. Expected Use of Funds.....</i>	<i>24</i>

## I. EXECUTIVE SUMMARY

The following are the key findings of our analysis.

### *New Rates*

Rates for Plan Credits for September 1, 2017 through August 31, 2018 are equal to the cost of academic credits at each of the participating colleges and universities plus premiums of 2.5% at The Pennsylvania State University, University of Pittsburgh and State Related Average; and zero for all other tuition levels. Our analysis shows that these rates produce a positive actuarial reserve equal to 9.90% of deposits.

### *Status of the Fund*

As of June 30, 2017, the Fund's assets exceed its liabilities by \$269,144,948.

<b>Value as of June 30, 2017</b>	<b>Assets and Liabilities</b>
Cash & Invested Assets	\$1,909,913,306
Value of Future Revenues <sup>1</sup>	\$33,847,235
Total Liabilities	\$1,674,615,593
Actuarial Reserve	\$269,144,948
Actuarial Reserve as a Percent of Liabilities	16.07%

### *Methodology*

In making our projections of the actuarial reserve in the table immediately above, we assume that the Plan will not accept any additional contributions. This is a conservative limitation that provides a static "snapshot view" of the Plan as of June 30, 2017.

A dynamic view of the Plan, which would include a reasonable projection of future contributions, provides a more realistic view of the Plan since the Plan is run with the intention of continuing to accept contributions.

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<sup>1</sup> Future revenues are the annual account maintenance fees assessed against GSP accounts. Treasury personnel have informed us that the fees are assessed against the tuition value of each account.

## *Investment Strategy*

The investment strategy of the Fund is designed to enable Treasury to meet the actuarially determined Plan liabilities. The market value composition of the Fund as of June 30, 2017 is 48% fixed income including cash and cash equivalent, 36% equities, and 16% alternative investments. Treasury has selected outside investment managers to invest a portion of the portfolio and manages funds held for liquidity purposes and several select portfolios in house.

By law, Treasury is allowed to direct investments under the "prudent person" rule. This rule allows discretion in determining asset allocation and in choosing particular securities.

The objective of the allocation of 60% - 70% of the portfolio to equity and alternative investments is to provide higher portfolio returns than would be available from a portfolio consisting mainly of fixed income investments. We have not reviewed the strategy nor are we expressing an opinion on the strategy.

## *Assumptions*

Key economic assumptions are listed below.

<b>Key Assumptions</b>	
<b>Net Yield on Investments</b>	
All future years	6.000%
<b>Tuition Inflation</b>	
Community Colleges	4.50%
SSHE	4.25%
The Pennsylvania State University - Main Campus	6.25%
The Pennsylvania State University - Branch Campuses	4.00%
University of Pittsburgh	6.00%
University of Pittsburgh - Branch Campuses	4.00%
Pennsylvania College of Technology	5.25%
Temple University	5.50%
Lincoln University	4.75%
State Related Average	6.00%
Thaddeus Stevens College of Technology	4.50%
Pennsylvania Private Colleges & Universities	5.25%
Ivy League Universities	5.25%

The tuition inflation assumptions are based on a combination of statistical models of tuition increases, actuarial judgment and input from Treasury personnel regarding the likely trajectory of tuition increases.

## II. RELIANCES & COMPLIANCE WITH ACTUARIAL STANDARDS OF PRACTICE

In making the projections on which this report is based, we relied on the following information supplied to me as indicated below.

- Tuition amounts at Pennsylvania colleges and universities, public, private and State-Related, supplied by the staff of the Pennsylvania Treasury Department,
- Tuition amounts at Ivy League universities, supplied by staff of the Pennsylvania Treasury Department,
- Market value of assets of the Plan's fund, supplied by the staff of the Pennsylvania Treasury Department,
- Inventory of Plan credits by institution, year sold and anticipated matriculation year, supplied by staff of the Pennsylvania Treasury Department,
- Assumptions regarding future investment returns on the Plan's fund, supplied by Treasury based on consultation with the Plan's Investment Advisor,
- Assumptions regarding the Plan's anticipated asset allocation, supplied by Treasury based on consultation with the Plan's Investment Advisor, and
- Information on expenses of the Plan, supplied by the staff of the Pennsylvania Treasury Department based on consultation with the Plan's investment advisor.

There are no actuarial standards of practice that apply specifically to prepaid tuition plans or guaranteed college savings programs. However, there are two general standards that we believe apply:

- Actuarial Standard of Practice #23 "Data Quality". This standard sets guidelines on review of data supplied by a third-party. We have performed reasonableness and consistency checks on the data supplied to us by personnel of the Plan and by the records administrator, and are in compliance with this standard. Our review of the data was not an audit of the data.
- Actuarial Standard of Practice #41 "Actuarial Communications". This standard sets general guidelines for actuarial communications. This report is in compliance with this standard.



### III. PLAN CREDIT RATES - SEPTEMBER 1, 2017 THROUGH AUGUST 31, 2018

The Pennsylvania Guaranteed Savings Plan allows account owners to save for future “qualified higher education expenses” with a guarantee that their savings, adjusted by any applicable premiums and fees, will at least keep pace with tuition inflation at one of several tuition levels designated by the account owner. Contributions into an account are divided by the Plan Credit Rate for the designated tuition level for the academic year in which the contribution is made to determine the number of Plan Credits attributable to the contribution. The annual Plan Credit Rates are recommended by us and approved by Treasury. We recommend that prices for 2017/18 be set at current tuition plus a premium as shown in the table below.

<b>Recommended Premiums</b>	
The Pennsylvania State University - Main Campus	2.5%
The Pennsylvania State University - Branch Campuses	2.5%
University of Pittsburgh	2.5%
State Related Average	2.5%
All Other	Nil

#### *Adequacy Analysis*

We have projected financial results for a hypothetical cohort of GSP credits purchased from September 1, 2017 through August 31, 2018. For these credits we included the premiums.

Our projection shows that these credits are anticipated to generate a positive actuarial reserve of 9.90% of deposits.

#### IV. DESCRIPTION OF THE PLAN

The Plan was created in 1992 by the Pennsylvania Legislature to provide for the advance purchase of tuition as both a means and an incentive to provide for future higher education expenses. By Act 2000-58, effective August 21, 2000, it was amended, making the Plan a guaranteed college savings Plan with growth indexed to tuition inflation. The Plan is administered by the Tuition Account Programs Bureau ("the Bureau"), within the Pennsylvania State Treasury. The Plan is summarized below. This summary is provided for explanation purposes only, and the Plan will be governed by the provisions of the enabling legislation and Bureau procedures.

##### *Contributions*

To join the Plan, an account owner must pay an enrollment fee. The fee is currently \$50. Contributions may be made in any amount of \$15 or more. At the time of joining the Plan, the account owner must designate a beneficiary and the anticipated date of matriculation into postsecondary education.

All contributions for a specific beneficiary are accumulated in an account ("the Account"). The Investment Performance Value of the Account is the sum of all contributions times the actual annual net earnings rate of the fund compounded annually. The Tuition Credit Value of the Account is based on tuition inflation.

##### *Categories of Credits Available*

An account owner can save at any one of the following five "average" tuition levels:

- Community Colleges,
- Universities in the State System of Higher Education,
- State Related Universities, defined as the following schools:

Pennsylvania State University, including the Pennsylvania College of  
Technology

University of Pittsburgh

Temple University

Lincoln University

Any other postsecondary school which is later designated "state-related" by the  
Commonwealth.

- Ivy League Colleges or
- Private Four-Year Colleges.

Additionally, an account owner can save at the tuition level for any one of the “public institutions.” An account owner may, however, change the designated tuition level at any time and the change is made retroactive for each contribution made to the account.

Additionally, for specific “public institutions” and public institutions average tuition levels, there are separate Plan Credit Rates for state residents/out-of-state residents and, in the case of community colleges, for district and out-of-district residents.

### *Residency Requirements*

There is also a residency requirement associated with joining the Plan. Either the account owner or the beneficiary must be a resident of the Commonwealth of Pennsylvania at the time the account is opened.

### *Using the Account*

Contributions must be in the Plan account for approximately one year before any growth related to the contribution may be used for higher education expenses. If the beneficiary is attending a public institution, the tuition level is converted, if necessary, to that of the specific public institution branch campus and/or major of the beneficiary; and payouts from the account will be made at the actual tuition rates charged. If the beneficiary is attending a private or out-of-state institution, pay-outs from the account will be based on the designated tuition level; specifically, if the tuition level is a specific public institution, payment will be made at the actual tuition of that institution; if the tuition level is one of the average levels, payment will be made at the average actual tuition of the schools used to determine the Plan Credit Rate for that Tuition Level.

### *Refunds*

If the beneficiary dies or becomes disabled, the Investment Performance Value of the account, but not less than the amount contributed less fees, will be returned to the account owner.

If the beneficiary is awarded a scholarship, the account owner may obtain a refund equal to the amount that could have been paid from the account had the scholarship not been awarded. Provided, however, that the refund for any one year may not exceed the amount of the scholarship. Requested transfers from the Guaranteed Savings Plan to the Pennsylvania 529 Investment Plan, as well as rollovers to other Section 529 plans, are calculated in the same manner as at-will terminations as discussed below.

If the beneficiary decides at the time of matriculation not to attend school, or if the beneficiary does not gain admission to an eligible institution, or if the contract is terminated for any other reason, it is considered an “at-will” termination. These at-will

terminations receive refunds that are the lesser of the Investment Performance Value of the Account and the Tuition Credit Value of the Account, but in no event less than the sum of the contributions.

*Change of Beneficiary*

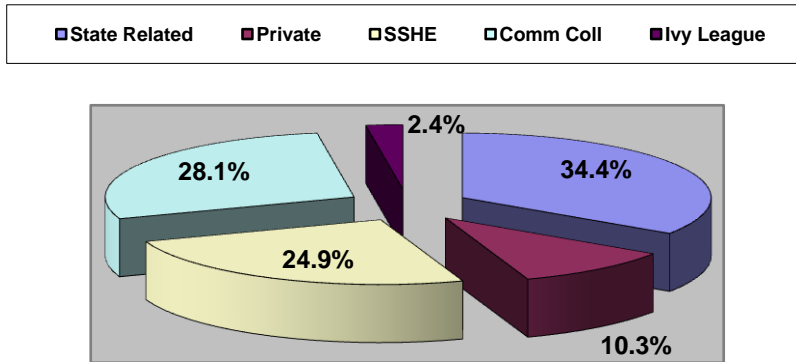
An account owner may request a change of beneficiary to a substitute who is a family member of the immediately-preceding beneficiary.

## V. SUMMARY OF CONTRACT DATA AND CURRENT ASSETS

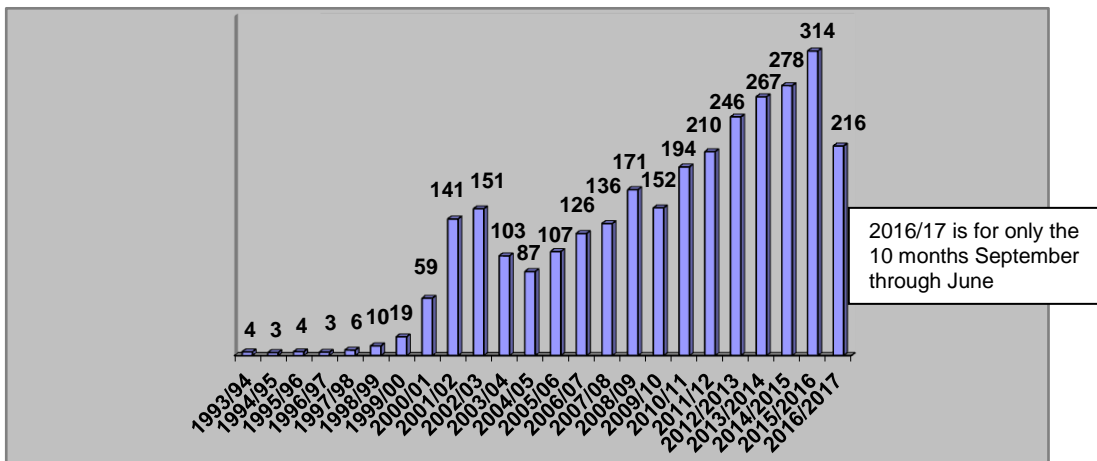
### *Contract Data*

Data on the number of outstanding contracts, contributions, Plan Credit equivalents and beneficiary account values was provided by the Bureau. The data provided was divided by residency status, tuition level, and year of matriculation. The graphs below summarize the data provided concerning these Plan Credits.

**Distribution of Credits by Institution Type**



**Distribution of Credits by Year of Contribution (000's)**



### *Current Assets*

The assets currently held by the Fund are an important part of the determination of the actuarial status of the Plan. The investment strategy for those assets is also critical to the yield and to the vulnerability of the Plan's actuarial status to changes in the return earned on investments.

## Fund Investments

Treasury administers assets of the Fund and has outside investment managers invest a large portion of the Fund, except for liquidity funds and several select portfolios that are invested by Treasury. The total market value of assets held as of June 30, 2017 is \$1,909,913,306. The allocation between asset classes is shown in the table below.

<b>Market value of assets held as of June 30, 2017</b>		
	<u>Amount (000's)</u>	<u>% Of Total</u>
Equities	909,082	48%
Alternative Investments	314,458	16%
Fixed Income (Including cash & cash equivalents)	686,373	36%
TOTAL	1,909,913	100.0%

## Investment Strategy

The investment strategy is designed to achieve a rate of return in excess of anticipated increases in tuition rates at each tuition level. The Fund's asset allocation anticipates that the amount invested in equities and alternative investments will remain in the range of 60% - 70% of total assets. The Plan's investment authority is governed by the "prudent person" rule rather than by statutory limitations on various classes of investments.

## VI. ACTUARIAL METHODS AND ASSUMPTIONS

### *Methods*

The actuarial method for the determination of the status of the Fund consists of projecting future tuition rates, future expenses based on the average anticipated number of Plan Credits and future utilization of Plan Credits. Future benefits and expenses are discounted using the assumed investment yield as the interest discount rate. The assumed discount rate is based on the current and anticipated mix of assets of the Fund.

For the projection of future benefits, the analysis proceeds as follows:

- Project future tuition rates for all years under consideration. Future tuition is based on the assumptions for tuition inflation. These assumptions vary by postsecondary school.
- Determine the nominal cost of future use of accounts based on the assumptions regarding utilization of accounts and the length of time the average beneficiary will take to complete his college education.
- Determine the nominal value of administrative expenses pertinent only to the ongoing administration of existing contracts.
- Determine the present value of future account usage and future expenses based on the investment yield assumptions.
- Perform projections for all of the Plan's beneficiaries to determine if the Fund is adequate in the aggregate, and make sufficient provision for overhead expenses.
- In making our projections of the actuarial reserve, we assume that the Plan will not accept any additional contributions. This is a conservative limitation that provides a static "snapshot view" of the Plan as of June 30, 2017.

## *Assumptions*

Actuarial assumptions used to determine financial soundness of programs are of two general types: economic and demographic. Demographic assumptions determine the expected exposure to financial claims and generally answer the question "How and when will people use their account?" Economic assumptions are concerned with the expected level of account usage and answer the question "What is the expected value of account usage?" The assumptions that we used were those that were approved by the Pennsylvania Treasury, after consultation with us.

### Economic Assumptions

Economic assumptions are used to estimate the annual tuition rates at two and four year colleges, increases in Fund expenses, and Fund earnings on assets invested. Because inflation is a major component of the rate of increase in tuition rates and of investment returns, we considered these rates together. We believe that the difference in these rates is more important than the absolute level of the rates. The following paragraphs describe the economic assumptions used in this study.

#### *Federal Income Tax*

We assumed that Fund earnings are exempt from Federal Income Tax.

#### *Annual Tuition Rates*

Tuition increases vary at the different participating institutions. Accordingly, our assumptions vary by institution. Our assumptions were guided by our observations of historic tuition increases, trends in postsecondary enrollment in Pennsylvania and the level of legislative appropriations for postsecondary schools in Pennsylvania.

The assumptions for the different categories of institutions are shown in the table below.



Tuition Inflation	
Community Colleges	4.50%
SSHE	4.25%
The Pennsylvania State University - Main Campus	6.25%
The Pennsylvania State University - Branch Campuses	4.00%
University of Pittsburgh	6.00%
University of Pittsburgh - Branch Campuses	4.00%
Pennsylvania College of Technology	5.25%
Temple University	5.50%
Lincoln University	4.75%
State Related Average <sup>2</sup>	6.00%
Thaddeus Stevens College of Technology	4.50%
Pennsylvania Private Colleges & Universities	5.25%
Ivy League Universities	5.25%

These rates are based on statistical models built with 30 years of historical tuition increases, combined with our professional judgment regarding future increases, as well as input from Treasury staff regarding likely trajectories of tuition increases.

#### *Fund Earnings Rate*

Our investment yield assumption, net of fees, is as follows:

6.000% for all future years.

This assumption was agreed to by Treasury based upon the recommendation of the Fund's Investment Advisor. Although we do not expect the Fund to realize this exact return in any year, we believe it represents a reasonable earnings rate over the time horizon of this report. In some years the Fund will have yields in excess of the assumed rate, while in other years the Fund will earn less than this rate.

#### *Annual Expenses*

Appropriations for expenses in fiscal year 2017/18 are \$3,200,000. This includes expenses for non-GSP and marketing activities in the amount of \$1,825,000. As our projections do not include provisions for non-GSP work or new business, these expenses can be excluded leaving \$1,375,000 to be included in our analysis. For projection purposes, we have assumed that \$300,000 of this annual total is fixed, while

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<sup>2</sup> The State Related Average is calculated from the results of all other State Related campuses rather than projected directly from assumptions.

the balance is variable in proportion to the number of outstanding Plan Credits. That is, we project that the variable portion attributable to the existing Plan Credits will decline in the future proportionately with the projected decline in the number of Plan credits.

The Plan also incurs expenses to pay its administrative services provider. The administrative services provider charges fees according to the following schedule.

- A specified dollar amount per year inflating at 3.5% per year,
- A specified number of basis points annually of the Plan Fund and
- A specified dollar amount annually per contract.

We have included these expenses in our projections.

As the investment earned rate assumption is now reported net of expenses, investment expenses are no longer part of this analysis.

### Demographic Assumptions

The demographic assumptions used in this report are based on our experience with similar types of liabilities. Our choice of assumptions is based on recent experience and our best estimates as to future events. These assumptions are as follows:

#### *Mortality and Disability*

We assumed that there would be no contract cancellations due to mortality or disability.

#### *At-Will Termination of Contract*

Because individual accounts are under no obligation to make additional contributions, we anticipate low termination rates. We have assumed that at-will terminations are 1.0% each year. This assumption is supported by at-will termination experience.

#### *Matriculation Percent*

All beneficiaries are assumed to matriculate at the matriculation date specified in the application, except for those who are projected to terminate.

#### *Utilization of Benefits*

Because account owners have flexibility in how much they contribute to their accounts over time, the utilization of accounts once the beneficiaries enroll in college will vary. Even if all account owners contributed the same amount, the utilization of the Plan would vary since students progress through college at different rates, depending on

their course load, attendance during the Summer semester, and whether any sabbaticals are taken during postsecondary education.

Our assumptions for utilization of accounts are based on judgmental factors and on review of actual benefit payouts.

Account usage for those saving at Community College tuition levels are assumed to be 70% in the first year and 30% in the second year. Usage at all other tuition levels are assumed to be 30% first year, 25% second year, 20% third year, 15% fourth year and 10% fifth year.

Within an academic year, account usage is assumed to be 50% for the Fall semester, 40% for the Spring semester and 10% for the Summer semester.

#### *Dropout Rate*

All beneficiaries are assumed to use 100% of their account once they have enrolled in college.

#### *Frequency of Beneficiary Replacement*

Since all surviving beneficiaries are expected to matriculate and are expected to use their accounts until completion, the assumption is made that no replacement of beneficiaries will occur.

## VII. STATUS OF THE FUND AS OF JUNE 30, 2017

In determining the status of the Fund, we estimated the future disbursements for higher education expenses of beneficiaries, expenses and refunds for terminated contracts. We also projected the future assets based on current assets and expected earnings on assets. We believe these estimates are reasonable based on the information available and our past experience and judgment.

The estimates of the prospective assets and liabilities of the Fund are summarized in the table on the following page and demonstrate the financial position of the Fund. The value of all assets is \$1,943,760,541 while the expected value of all liabilities is \$1,674,615,593. The expected present value of the excess of liabilities over assets is \$269,144,948.

The Plan's actuarial reserve is the amount of funds over and above that amount which is necessary to meet account usage and expenses on our baseline assumptions.

The actuarial reserve will change from year to year due to positive and negative cash flows and due to the change in the present value of future account usage and expense payments because of the passage of time. The actuarial reserve will also change due to the variance of experience from the assumptions. These variances include tuition increases, investment income and expenses.

The actuarial reserve will also change due to the growth of the Plan and due to the updating of the assumptions to reflect the Plan's emerging experience. The changes for the year ending June 30, 2017 are summarized in the table below.

<b>Progression of Actuarial Reserve</b>	
Actuarial Reserve at June 30, 2016	\$217,495,170
Projected Increase to June 30, 2017	15,224,662
Gain from Favorable Tuition Inflation	41,850,671
Gain due to Favorable Investment Experience	50,355,522
Gain due to Additional Contributions	18,361,447
Changes Due to Change In Assumptions	(74,142,524)
Actuarial Reserve at June 30, 2017	\$269,144,948

Our determination of the status of the Fund is based on the asset and contract information provided by Treasury and on the stated assumptions. Because of the uncertainty of the future, actual events are almost certain to vary from our assumptions. These differences may be material.

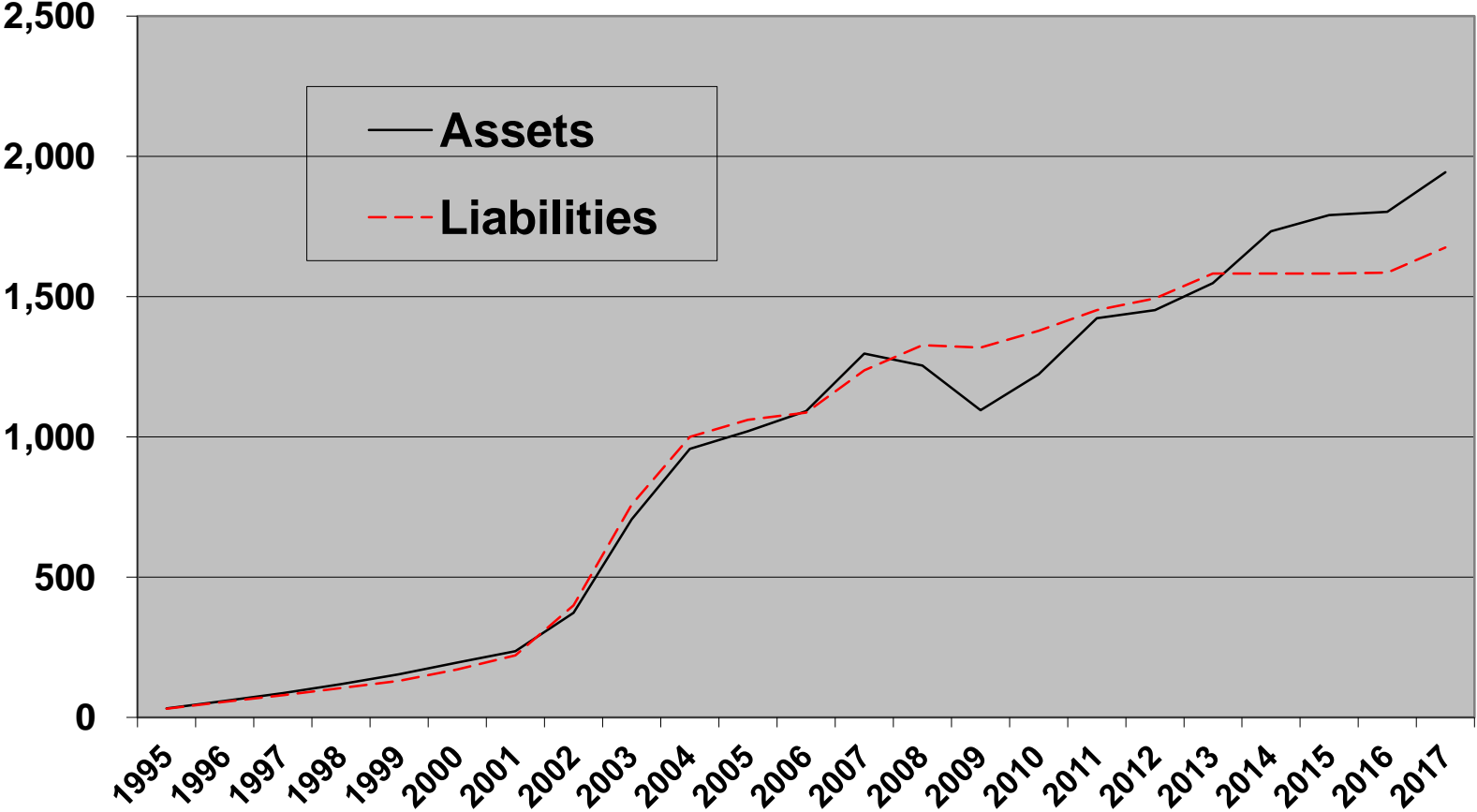
In the chart immediately below, we show the value of expected future account usage, expected future payments, current assets and expected actuarial reserve as of the end of each future year for contributions made through June 30, 2017.

**PRESENT VALUE OF ASSETS AND LIABILITIES**

Fiscal Year Ending	Value of Assets	Present Value of Future Account Usage And Expenses	Actuarial Reserve
2017	1,943,760,541	1,674,615,593	269,144,948
2018	1,785,104,506	1,499,562,218	285,542,288
2019	1,653,034,167	1,350,359,342	302,674,825
2020	1,528,815,485	1,207,980,170	320,835,315
2021	1,404,359,242	1,064,273,808	340,085,434
2022	1,287,086,513	926,595,953	360,490,560
2023	1,179,966,003	797,846,009	382,119,993
2024	1,092,305,285	687,258,092	405,047,193
2025	1,024,036,932	594,686,908	429,350,024
2026	970,565,863	515,454,837	455,111,026
2027	927,164,140	444,746,453	482,417,688
2028	891,248,129	379,885,381	511,362,749
2029	861,598,394	319,553,880	542,044,514
2030	838,320,669	263,753,485	574,567,185
2031	820,493,379	211,452,164	609,041,216
2032	809,552,730	163,969,041	645,583,689
2033	806,540,392	122,221,682	684,318,710
2034	811,805,842	86,428,010	725,377,832
2035	826,382,126	57,481,623	768,900,502
2036	851,080,964	36,046,431	815,034,533
2037	885,237,355	21,300,750	863,936,604
2038	927,691,234	11,918,433	915,772,801
2039	977,074,339	6,355,171	970,719,169
2040	1,032,246,754	3,284,435	1,028,962,319
2041	1,092,533,586	1,833,528	1,090,700,058
2042	1,157,008,969	866,908	1,156,142,062
2043	1,225,460,830	226,726	1,225,234,104

# Historical TAP Assets and Liabilities

Millions



## VIII. SENSITIVITY TESTING

We believe that when there is a significant amount of uncertainty about conditions prevailing in the future it is important to test for status under other possible assumptions.

We investigated the effect of variances in both university inflation and investment yield assumptions from those anticipated by the status test assumptions. For these projections, we assumed no future contributions. These scenarios are described below.

- 1) Tuition inflation lower than status test assumptions by 0.25% every year.
- 2) Tuition inflation higher than status test assumptions by 0.25% every year.
- 3) Investment yields higher than status test assumptions by 0.25% every year.
- 4) Investment yields lower than status test assumptions by 0.25% every year.
- 5) Tuition inflation lower and investment yields higher than status test assumptions by 0.25% every year.
- 6) Tuition inflation higher and investment yields lower than status test assumptions by 0.25% every year.

The actuarial reserve for each of these scenarios is shown below.

<b>Sensitivity Testing Results</b>	
<u>Scenario</u>	<u>Actuarial Reserve</u>
1	\$286,710,715
2	\$251,251,199
3	\$287,891,974
4	\$249,957,583
5	\$305,089,358
6	\$231,674,958



## IX. STOCHASTIC ANALYSIS

We have retained the same model for stochastic projections as we used last year. We have updated the beginning values to reflect 2017 actual results, but otherwise have left the same structure and parameters in place.

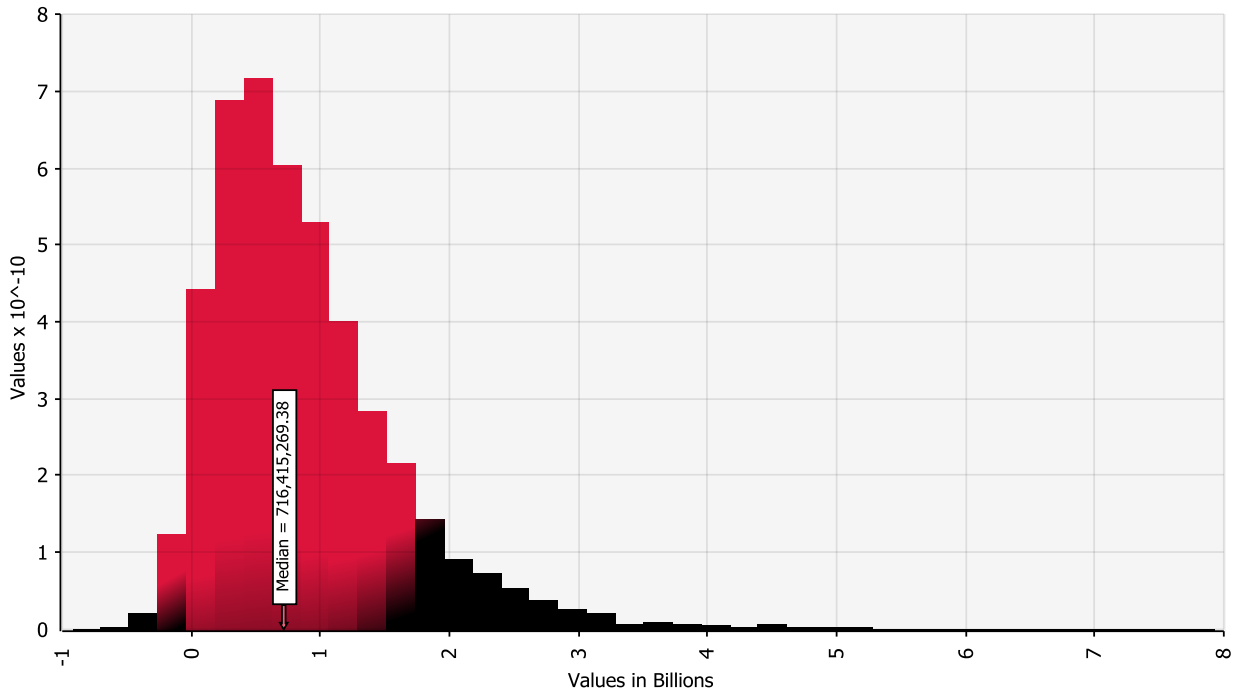
As in prior years, we ran 10,000 scenarios with varying tuition inflation and investment returns. The results are summarized in the table below and shown graphically in the chart at the end of this section

Proportion with positive Actuarial Reserve	95.9%
25% of results are better than:	1,213,874,580
50% of results are better than:	716,415,269
75% of results are better than:	362,047,650
Largest Actuarial Reserve	7,933,301,974
Smallest Actuarial Reserve	(922,052,775)
Mean Actuarial Reserve	874,285,778

The most important measures from the table immediately above are the Proportion with positive Actuarial Reserve and the 50% Results. The Proportion with positive Actuarial Reserve probability of 95.9% indicates that there is a better than 9/10 likelihood that the Program will have a surplus.

The 50% Results measure is a “best-estimate” measure of results. If our assumptions are neither conservative (that is they understate results) nor aggressive (that is they overstate results) then the 50% Results measure should be close to our projected result of \$716,415,269. The table above indicates that our assumptions are more conservative in aggregate than the historical values on which the stochastic analysis was based.

The Smallest Actuarial Reserve indicates what happens if economic events continue adversely for the lifetime of the current GSP Credits -high tuition increases, coupled with negative returns in the equity market until the end of the projection horizon. On the other hand, the Largest Actuarial Reserve indicates what happens if economic conditions are favorable for the remaining lifetime of the current GSP credits.



## X. CHANGES IN ACTUARIAL ASSUMPTIONS

We made three assumption changes for our projections this year. These are updating projected tuition inflation to better reflect recent experience, changing from a gross investment return to a net return, and incrementally changing appropriated expenses. Also, premiums from the last academic year were refunded.

### **Change in Investment Return**

Last year, the gross investment return was assumed to be 7.00% net of any investment fees. This year, the investment return is assumed to be 6.00% net of any investment fees.

### **Appropriated Expenses**

Last year, appropriated expenses were \$3,220,000. This year, there has been a slight decrease to \$3,200,000. Part of this expense is for non-GSP and marketing activities and is excluded from our analysis. (See page 13 for details.)

### **Premium Refund**

Premiums for academic year 2016/2017 were refunded.

### **Effect of Changes in Assumptions**

If assumptions had been the same as last year, the Plan's actuarial reserve and funded status would have been:

\$343,287,473 Reserve

21.47% Funded Status

These changes decreased the actuarial reserve by \$74,142,524 and the funded status by 5.40%.

The components of the change are:

- Change in Investment Return                   \$ 72,478,683 worsening of results
- Change in Allocated Expense               \$ 479,165 worsening of results
- Premium Refund                               \$ 1,184,676 worsening of results

## XI. EXPECTED USE OF FUNDS

The Fund, which is comprised of contributions, fees, all interest and earnings, and any other money appropriated or made available to Treasury, is expected to pay benefits and expenses in the following proportions:

- Tuition payments - 95.0%
- Expenses - 1.6%
- Payments of refunds to account owners - 3.4%

These results are shown graphically below.

