



# **Bond Math I Anatomy of Bonds**

**Fall 2011  
Webinar Series  
September 30, 2011  
10:00 AM - 11:15 AM PT**

**CDIAC provides information, education and technical assistance on public debt and investments to local public agencies and other public finance professionals.**



# **Bond Math I**

## **Anatomy of Bonds**

### **Housekeeping**

- **Feedback Button**
- **Questions and Answers**
- **Polling Questions**



# **Bond Math I**

## **Anatomy of Bonds**

### **•Introduction of Speakers**

**Michelle Issa**

**Senior Managing Director, Public Resources Advisory Group**

**Louis Choi**

**Senior Managing Director, Public Resources Advisory Group**



## **Michelle Issa**

**Senior Managing Director, Public Resources Advisory Group**

- Over 24 years of experience in Public Investment Finance*
- Strong general government experience at the state and local government levels in California, Oregon and Florida*
- Senior Managed General Fund financings for such cities as Oakland, Pasadena, San Diego, San Jose and Los Angeles*

## **Louis Choi**

**Senior Managing Director, Public Resources Advisory Group**

- Over 10 years of experience in Municipal finance*
- Provides financial advice to a wide variety of issuers including the States of California, New Mexico and Oregon*
- Over \$50 billion of structured financings during his municipal career*

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# Basics of Bond Math I



**CDIAC**

**CALIFORNIA  
DEBT AND  
INVESTMENT  
ADVISORY  
COMMISSION**

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**September 30, 2011**

**Michelle Issa  
Senior Managing Director  
(310) 477-2786  
missa@pragla.com**



**Louis Choi  
Senior Managing Director  
(310) 477-7098  
lchoi@pragla.com**



## Objective: Quantitative Literacy For Municipal Bonds

By discussing the mathematical aspects of issuing bonds, government issuers can:

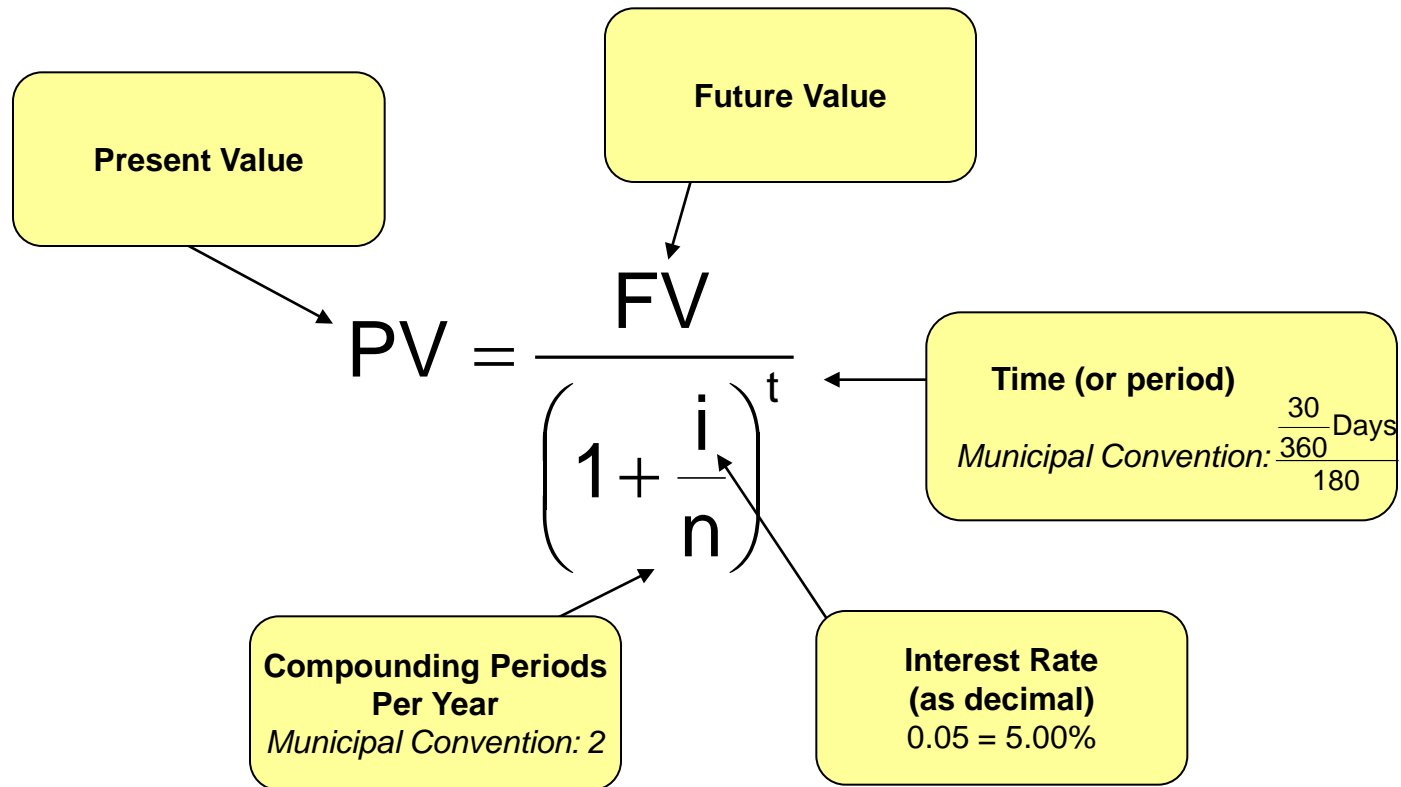
- i. Learn how to “read” the debt service schedules
- ii. Understand their structuring options and be able to compare alternative structures; and
- iii. Develop a more tailored plan of finance

# What are Bonds and Why are they Issued?

- Bonds are:
  - A form of loan where the borrower (the “issuer”) promises to repay the “face value” to the lenders (the “bond holders”) at a specified future date
  - Usually provides interest throughout the life of the bond, either through periodic payments
    - ✓ Semi-annual interest payments are typical
    - ✓ Annual principal payments are from 1-30 years
- Enable an issuer to leverage their annual revenues to get a large upfront sum of money
  - For municipal bonds, proceeds are typically used to finance a capital project

# Fundamental Bond Math Concept: Present Value Formula

- ❑ The basics of bond math is the Time Value of money as calculated with the Present Value and Future Value formulas
- ❑ The practical application of the PV formula is to price a bond.





# Time Value of Money Example

- ❑ All else being equal, more frequent compounding results in greater cash flow
- ❑ Example 1:
  - Investor deposits \$100 in bank
  - Bank pays 5.00% interest compounded *annually*
  - Investor expects to receive \$105 at the end of one year

$$\begin{aligned}FV &= 100 * \left(1 + \frac{.05}{1}\right)^1 \\ &= \$105.00\end{aligned}$$

- ❑ Example 2:
  - Same as Example 1, except that the Bank pays 5.00% interest compounded *semi-annually*
  - Investor expects to receive \$105.06 at the end of one year

$$\begin{aligned}FV &= 100 * \left(1 + \frac{.05}{2}\right)^2 \\ &= \$105.06\end{aligned}$$

# A Fictional Project

- ❑ The State wants to capitalize on the current popularity of magic and wizardry
- ❑ A financing has been approved for a California branch of the Academy of Magic and Wizardry:
  - Undergraduate and graduate studies
  - Semester abroad in England
- ❑ Located on one of the State's university campuses
- ❑ Rather than paying for the project with cash, the Academy will be financed over 25 years
- ❑ The Academy has gotten construction bids and is ready to finance the facility by selling bonds
- ❑ Consultants from England are unfamiliar with municipal bonds and would like to understand the "numbers"

## Herbology



## Potions



## Magical Creatures



## A Mathematical Model Is Used to Develop the Debt Service Structure

*“Working with bonds and financing scholars, we can multiply our limited dollars”*

**Dated/Delivery Date:** October 31, 2011

**Project Cost:** \$40 million

**Annual Debt Service:** < \$4 million

**Project Fund:** 18 even monthly draws

**Capitalized Interest:** 24 months

**Debt Service Reserve Fund:** Lesser of:

10% of Proceeds

125% of Average Annual Debt Service

Maximum Annual Debt Service

**Underwriter’s Discount:** \$4.00/Bond

**Costs of Issuance:** \$150,000

**Final Maturity:** 25 years



# Key Debt Service Concepts

- ❑ **Principal:** Also known par amount, or face value, of the bonds to be paid back on the maturity date
  - Typically municipal bonds are sold in \$5,000 principal denominations
- ❑ **Maturity:** Date on which principal payments are due (November 1)
  - Most bond issues have principal maturing each year until the final maturity date
  - Typically, maturity dates on municipal bonds are within 30 years
- ❑ **Coupon:** Annual interest rate (expressed as a percentage)
  - Different coupon rate for each maturity of a fixed rate bond
  - Bonds can also be variable rate
- ❑ **Interest:** Cost of borrowing money for the issuer
  - Usually paid periodically
    - ✓ Semi-annually for fixed-rate bonds
    - ✓ More frequently for variable rate bonds
  - Interest is calculated by multiplying principal by coupon (adjusted for length of period between interest payments)
- ❑ **Yield:** Percentage rate the investor will earn; different than coupon rate based on the price of the bond
- ❑ **Debt Service:** Sum of all principal and interest due on a bond series

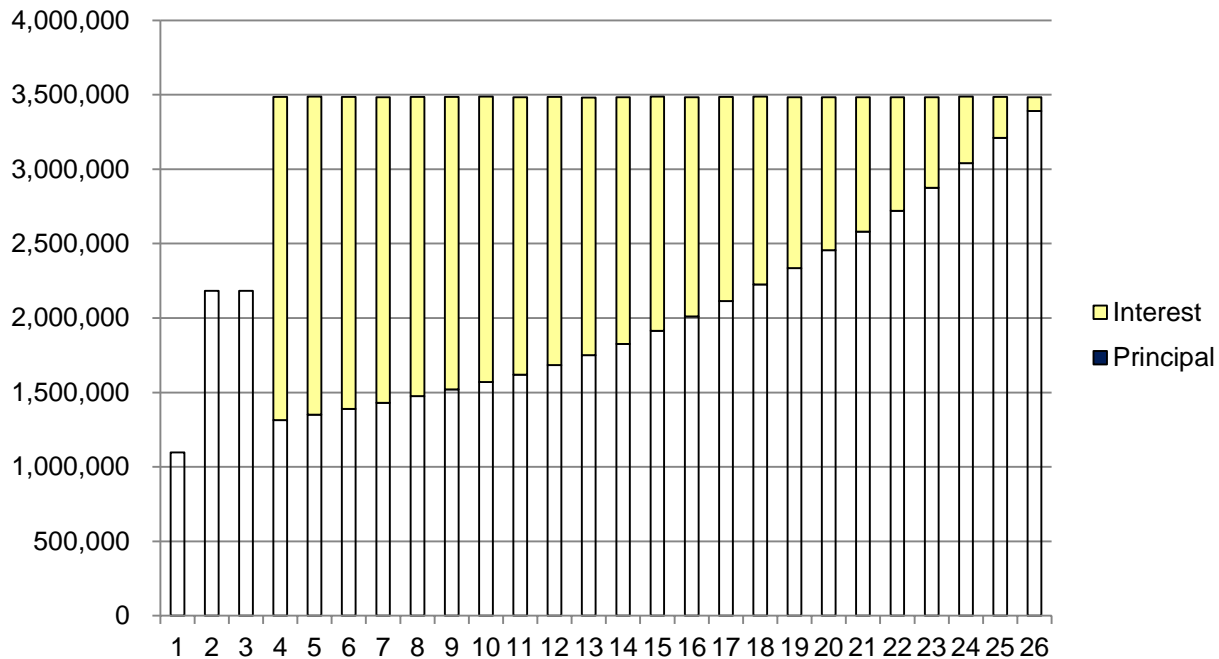
## Current Market Interest Rates and Investor Preferences

- ❑ Utilize market interest rates and investor preferences to “model” the financing
- ❑ Bonds structured to appeal to investors with serial bonds in years 2012 – 2024, and term bonds in 2026, 2031 and 2036

| Maturity Date | Coupon | Yield | Bond Type |
|---------------|--------|-------|-----------|
| 11/1/2014     | 2.00%  | 0.95% | Serial    |
| 11/1/2015     | 3.00%  | 1.30% | Serial    |
| 11/1/2016     | 3.00%  | 1.77% | Serial    |
| 11/1/2017     | 3.00%  | 1.97% | Serial    |
| 11/1/2018     | 3.00%  | 2.30% | Serial    |
| 11/1/2019     | 3.00%  | 2.84% | Serial    |
| 11/1/2020     | 3.25%  | 3.17% | Serial    |
| 11/1/2021     | 3.50%  | 3.54% | Serial    |
| 11/1/2022     | 4.00%  | 3.83% | Serial    |
| 11/1/2023     | 4.00%  | 3.96% | Serial    |
| 11/1/2024     | 4.25%  | 4.15% | Serial    |
| 11/1/2026     | 5.00%  | 4.90% | Term      |
| 11/1/2031     | 5.00%  | 5.11% | Term      |
| 11/1/2036     | 5.00%  | 5.41% | Term      |

# How the “Bond Issue” is Structured

- ❑ Project cost is \$40 million plus related reserves, capitalized interest and costs of issuance for a total bond financing of \$47.8 million
- ❑ Most bond issues are structured to produce level debt service
  - Interest only until year 4
  - “Amortization” occurs by paying “all interest due and some principal each year beginning in year 4



# Principal Amortization

- ❑ **Serial Bond:** A bond of an issue that matures on a specific date
- ❑ **Term Bond:** A bond of an issue that has multiple due dates; usually in consecutive years
  - Issuer makes periodic payments to partially redeem the sinking funds payments prior to the final maturity

| Maturity Date<br>(November 1) | Principal<br>Amount | Interest<br>Rate | Yield  |
|-------------------------------|---------------------|------------------|--------|
| 2014                          | 1,315,000           | 2.000%           | 0.950% |
| 2015                          | 1,350,000           | 3.000%           | 1.300% |
| 2016                          | 1,390,000           | 3.000%           | 1.770% |
| 2017                          | 1,430,000           | 3.000%           | 1.970% |
| 2018                          | 1,475,000           | 3.000%           | 2.360% |
| 2019                          | 1,520,000           | 3.000%           | 2.840% |
| 2020                          | 1,570,000           | 3.250%           | 3.170% |
| 2021                          | 1,620,000           | 3.500%           | 3.540% |
| 2022                          | 1,685,000           | 4.000%           | 3.830% |
| 2023                          | 1,750,000           | 4.000%           | 3.960% |
| 2024                          | 1,825,000           | 4.250%           | 4.150% |

\$3,925,000 5.00% Term Bond maturing November 1, 2026 – Priced to Yield 4.90%  
 \$11,710,000 5.00% Term Bond maturing November 1, 2031 – Priced to Yield 5.11%  
 \$15,235,000 5.50% Term Bond maturing November 1, 2036 – Priced to Yield 5.41%

*Sinking Fund Redemption.* The Bonds maturing on November 1, 2036 (the “2036 Term Bonds”) are subject to redemption prior to their stated maturity date, in part, by lot, from sinking fund payments made by the Issuer, at a redemption price of 100% of the principal amount thereof plus accrued interest to the sinking fund payment date fixed for redemption, without premium, on November 1 of the years, and in the amounts designated at right:

| Sinking Fund Payment Date<br>(November 1) | Principal Amount Redeemed |
|---|---------------------------|
| 2032                                      | 2,720,000                 |
| 2033                                      | 2,875,000                 |
| 2034                                      | 3,040,000                 |
| 2035                                      | 3,210,000                 |
| 2036                                      | 3,390,000                 |

# Coupon and Interest

- ❑ Coupon – Annual rate of interest payable on a bond based on its principal or par amount
- ❑ Interest – Periodic payments made by issuer based on principal and coupon

| <u>Maturity Date</u><br>(November 1) | <u>Principal</u><br><u>Amount</u> | <u>Interest</u><br><u>Rate</u> | <u>Yield</u> |
|--------------------------------------|-----------------------------------|--------------------------------|--------------|
| 2014                                 | 1,315,000                         | 2.000%                         | 0.950%       |
| 2015                                 | 1,350,000                         | 3.000%                         | 1.300%       |
| 2016                                 | 1,390,000                         | 3.000%                         | 1.770%       |
| 2017                                 | 1,430,000                         | 3.000%                         | 1.970%       |
| 2018                                 | 1,475,000                         | 3.000%                         | 2.360%       |
| 2019                                 | 1,520,000                         | 3.000%                         | 2.840%       |
| 2020                                 | 1,570,000                         | 3.250%                         | 3.170%       |
| 2021                                 | 1,620,000                         | 3.500%                         | 3.540%       |
| 2022                                 | 1,685,000                         | 4.000%                         | 3.830%       |
| 2023                                 | 1,750,000                         | 4.000%                         | 3.960%       |
| 2024                                 | 1,825,000                         | 4.250%                         | 4.150%       |

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$$\text{Interest} = \text{Principal} \times \text{Coupon}$$



## Level Debt Service Structure

- After the initial years of capitalized interest and no principal amortization, annual debt service is level

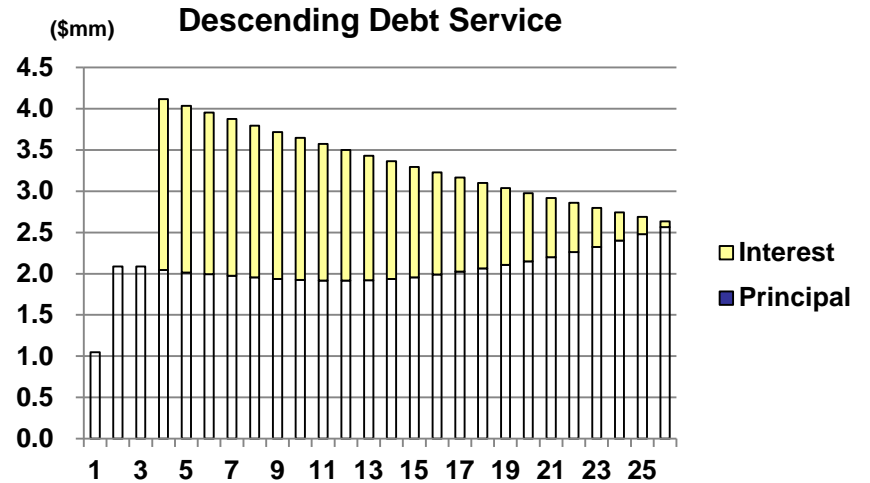
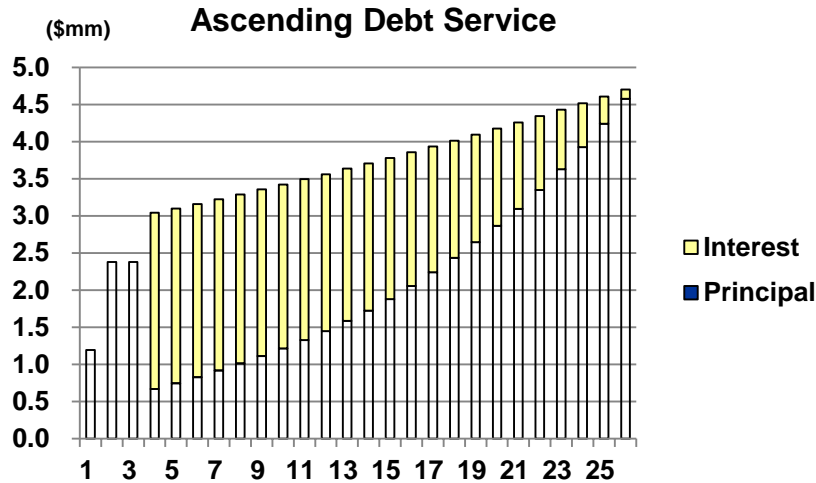
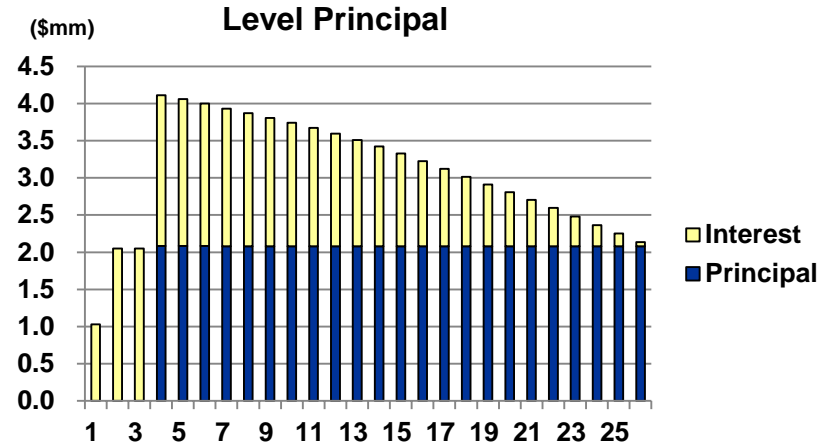
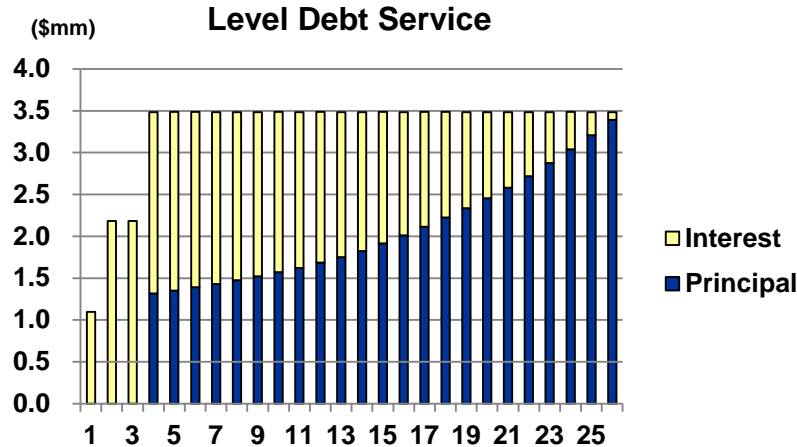
| Fiscal Year |              |              |              | Fiscal Year  |                     |                     |                      |
|-------------|--------------|--------------|--------------|--------------|---------------------|---------------------|----------------------|
| 6/30        | Principal    | Interest     | Debt Service | 6/30         | Principal           | Interest            | Debt Service         |
| 2012        | \$ -         | \$ 1,097,872 | \$ 1,097,872 | 2025         | \$ 1,825,000        | \$ 1,658,456        | \$ 3,483,456         |
| 2013        | \$ -         | \$ 2,183,613 | \$ 2,183,613 | 2026         | \$ 1,915,000        | \$ 1,571,800        | \$ 3,486,800         |
| 2014        | \$ -         | \$ 2,183,613 | \$ 2,183,613 | 2027         | \$ 2,010,000        | \$ 1,473,675        | \$ 3,483,675         |
| 2015        | \$ 1,315,000 | \$ 2,170,463 | \$ 3,485,463 | 2028         | \$ 2,115,000        | \$ 1,370,550        | \$ 3,485,550         |
| 2016        | \$ 1,350,000 | \$ 2,137,063 | \$ 3,487,063 | 2029         | \$ 2,225,000        | \$ 1,262,050        | \$ 3,487,050         |
| 2017        | \$ 1,390,000 | \$ 2,095,963 | \$ 3,485,963 | 2030         | \$ 2,335,000        | \$ 1,148,050        | \$ 3,483,050         |
| 2018        | \$ 1,430,000 | \$ 2,053,663 | \$ 3,483,663 | 2031         | \$ 2,455,000        | \$ 1,028,300        | \$ 3,483,300         |
| 2019        | \$ 1,475,000 | \$ 2,010,088 | \$ 3,485,088 | 2032         | \$ 2,580,000        | \$ 902,425          | \$ 3,482,425         |
| 2020        | \$ 1,520,000 | \$ 1,965,163 | \$ 3,485,163 | 2033         | \$ 2,720,000        | \$ 763,125          | \$ 3,483,125         |
| 2021        | \$ 1,570,000 | \$ 1,916,850 | \$ 3,486,850 | 2034         | \$ 2,875,000        | \$ 609,263          | \$ 3,484,263         |
| 2022        | \$ 1,620,000 | \$ 1,862,988 | \$ 3,482,988 | 2035         | \$ 3,040,000        | \$ 446,600          | \$ 3,486,600         |
| 2023        | \$ 1,685,000 | \$ 1,800,938 | \$ 3,485,938 | 2036         | \$ 3,210,000        | \$ 274,725          | \$ 3,484,725         |
| 2024        | \$ 1,750,000 | \$ 1,732,238 | \$ 3,482,238 | 2037         | \$ 3,390,000        | \$ 93,225           | \$ 3,483,225         |
|             |              |              |              | <b>Total</b> | <b>\$47,800,000</b> | <b>\$37,812,753</b> | <b>\$ 85,612,753</b> |

Term Bond \$3.92 mm

Term Bond \$11.71 mm

Term Bond \$11.23 mm

# Alternative Amortization Structures



# Example: New Money Issue for the Academy of Magic and Wizardry

## ☐ Bond Financing Reports

- Sources and Uses
- Bond Summary Statistics
- Bond Pricing
- Debt Service
- Net Debt Service
- Project Fund
- Reserve Funds
  - ✓ Capitalized Interest
  - ✓ Debt Service Reserve Fund
- Costs of Issuance



# Sources and Uses

| SOURCES                              |                         |
|--------------------------------------|-------------------------|
| <b><u>Bond Proceeds</u></b>          |                         |
| Par Amount                           | \$ 47,800,000.00        |
| Net Premium                          | <u>\$ 402,190.70</u>    |
| <b>Total</b>                         | <b>\$ 48,202,190.70</b> |
| USES                                 |                         |
| <b><u>Project Fund Deposits</u></b>  |                         |
| Project Fund                         | \$ 40,000,000.00        |
| <b><u>Other Fund Deposits</u></b>    |                         |
| Capitalized Interest Fund            | \$ 4,373,290.59         |
| Debt Service Reserve Fund (MADS)     | \$ 3,487,062.50         |
| <b><u>Delivery Date Expenses</u></b> |                         |
| Cost of Issuance                     | \$ 150,000.00           |
| Underwriter's Discount               | \$ 191,200.00           |
| Additional Proceeds                  | <u>\$ 637.61</u>        |
| <b>Total</b>                         | <b>\$ 48,202,190.70</b> |

## Sources and Uses

### ☐ Uses

- Project Fund – Gross funded for 18 even monthly construction draws

### ☐ Other Fund Deposits

- Capitalized Interest Fund – Calculated to pay interest on bonds for two years while project is being built and prior to the Academy’s ability to pay debt service
- Debt Service Reserve Fund – Based on tax law, calculated as the lesser of of:
  - (i) 10% of Par Amount; (ii) 125% of Average Annual Debt Service; or (iii) Maximum Annual Debt Service

In our example:

|  |                 |
|--|-----------------|
| 10% of Proceeds (\$48,202,190.70) =                    | \$ 4,820,219.00 |
| 125% of Average Annual Debt Service (\$3,292,798.20) = | \$ 4,115,997.74 |
| Maximum Annual Debt Service =                          | \$ 3,487,062.50 |
| Debt Service Reserve Fund (lesser of above) =          | \$ 3,487,062.50 |

### ☐ Cost of Issuance

## Bond Summary Statistics

|                          |            |
|--------------------------|------------|
| Dated Date               | 10/31/2011 |
| Delivery Date            | 10/31/2011 |
| Last Maturity            | 11/1/2036  |
| Arbitrage Yield          | 4.798%     |
| True Interest Cost (TIC) | 4.835%     |
| All-In TIC               | 4.865%     |
| Average Coupon           | 4.962%     |
| Average Life (years)     | 15.943000  |

- Yield = Rate at which Present Value of debt service equals the Target Value on the Target Date

|                                   | TIC           | All-In TIC    | Arbitrage Yield |
|-----------------------------------|---------------|---------------|-----------------|
| <b>Par Value</b>                  | \$ 47,800,000 | \$ 47,800,000 | \$ 47,800,000   |
| <b>+ Premium (Discount)</b>       | 402,191       | 402,191       | 402,191         |
| <b>- Underwriter's Discount</b>   | (191,200)     | (191,200)     |                 |
| <b>- Cost of Issuance Expense</b> |               | (150,000)     |                 |
| <b>- Other Amounts</b>            | -             | -             | -               |
| <b>Target Value</b>               | \$ 48,010,991 | \$ 47,860,991 | \$ 48,202,191   |
| <b>Target Date</b>                | 10/31/2011    | 10/31/2011    | 10/31/2011      |
| <b>Yield</b>                      | 4.835%        | 4.865%        | 4.798%          |

# Bond Summary Statistics

|                                 |                  |
|---------------------------------|------------------|
| Par Amount                      | \$ 47,800,000.00 |
| Bond Proceeds                   | \$ 48,202,190.70 |
| Total Interest                  | \$ 37,812,753.09 |
| Net Interest                    | \$ 37,601,762.39 |
| Total Debt Service              | \$ 85,612,753.09 |
| Maximum Annual Debt Service     | \$ 3,487,062.50  |
| Average Annual Debt Service     | \$ 3,424,129.66  |
| Underwriter's Fees (per \$1000) |                  |
| Management Fee                  | \$ -             |
| Average Takedown                | \$ 3.75          |
| Other Fee                       | \$ 0.25          |
|                                 | -----            |
| Total Underwriter's Discount    | \$ 4.00          |
| Bid Price                       | \$ 100.44        |

| Bond Component             | Par Value               | Price          | Average Coupon | Average Life  |
|----------------------------|-------------------------|----------------|----------------|---------------|
| Serial Maturities          | \$ 16,930,000.00        | 102.521        | 3.545%         | 8.328         |
| Term Bond Maturing in 2026 | \$ 3,925,000.00         | 100.783        | 5.000%         | 14.515        |
| Term Bond Maturing in 2031 | \$ 11,710,000.00        | 98.632         | 5.000%         | 18.102        |
| Term Bond Maturing in 2036 | \$ 15,235,000.00        | 100.688        | 5.500%         | 23.113        |
|                            | <u>\$ 47,800,000.00</u> | <u>100.441</u> | <u>4.962%</u>  | <u>15.943</u> |

# Bond Pricing

| Bond Component | Maturity Date | Principal           | Coupon | Yield | Price   | Yield to Maturity | Call Date | Call Price | Premium (Discount) |
|----------------|---------------|---------------------|--------|-------|---------|-------------------|-----------|------------|--------------------|
| Serial Bond    | 11/1/2014     | \$1,315,000         | 2.00%  | 0.95% | 103.098 |                   |           |            | \$40,739           |
|                | 11/1/2015     | \$1,350,000         | 3.00%  | 1.30% | 106.605 |                   |           |            | \$89,168           |
|                | 11/1/2016     | \$1,390,000         | 3.00%  | 1.77% | 105.860 |                   |           |            | \$81,454           |
|                | 11/1/2017     | \$1,430,000         | 3.00%  | 1.97% | 105.801 |                   |           |            | \$82,954           |
|                | 11/1/2018     | \$1,475,000         | 3.00%  | 2.30% | 104.107 |                   |           |            | \$60,578           |
|                | 11/1/2019     | \$1,520,000         | 3.00%  | 2.84% | 101.137 |                   |           |            | \$17,282           |
|                | 11/1/2020     | \$1,570,000         | 3.25%  | 3.17% | 100.622 |                   |           |            | \$9,765            |
|                | 11/1/2021     | \$1,620,000         | 3.50%  | 3.54% | 99.665  |                   |           |            | (\$5,427)          |
|                | 11/1/2022     | \$1,685,000         | 4.00%  | 3.83% | 101.514 |                   |           |            | \$25,511           |
|                | 11/1/2023     | \$1,750,000         | 4.00%  | 3.96% | 100.379 |                   |           |            | \$6,633            |
|                | 11/1/2024     | \$1,825,000         | 4.25%  | 4.15% | 100.996 |                   |           |            | \$18,177           |
|                |               | <u>\$16,930,000</u> |        |       |         |                   |           |            | <u>\$426,834</u>   |
| 2026 Term Bond | 11/1/2025     | \$1,915,000         | 5.00%  | 4.90% | 100.783 | 4.93%             | 11/1/2021 | 100.00     | \$14,994           |
|                | 11/1/2026     | \$2,010,000         | 5.00%  | 4.90% | 100.783 | 4.93%             | 11/1/2021 | 100.00     | \$15,738           |
|                |               | <u>\$3,925,000</u>  |        |       |         |                   |           |            | <u>\$30,733</u>    |
| 2031 Term Bond | 11/1/2027     | \$2,115,000         | 5.00%  | 5.11% | 98.632  |                   |           |            | (\$28,933)         |
|                | 11/1/2028     | \$2,225,000         | 5.00%  | 5.11% | 98.632  |                   |           |            | (\$30,438)         |
|                | 11/1/2029     | \$2,335,000         | 5.00%  | 5.11% | 98.632  |                   |           |            | (\$31,943)         |
|                | 11/1/2030     | \$2,455,000         | 5.00%  | 5.11% | 98.632  |                   |           |            | (\$33,584)         |
|                | 11/1/2031     | \$2,580,000         | 5.00%  | 5.11% | 98.632  |                   |           |            | (\$35,294)         |
|                |               | <u>\$11,710,000</u> |        |       |         |                   |           |            | <u>(\$160,193)</u> |
| 2036 Term Bond | 11/1/2032     | \$2,720,000         | 5.50%  | 5.41% | 100.688 | 5.45%             | 11/1/2021 | 100.00     | \$18,714           |
|                | 11/1/2033     | \$2,875,000         | 5.50%  | 5.41% | 100.688 | 5.45%             | 11/1/2021 | 100.00     | \$19,780           |
|                | 11/1/2034     | \$3,040,000         | 5.50%  | 5.41% | 100.688 | 5.45%             | 11/1/2021 | 100.00     | \$20,915           |
|                | 11/1/2035     | \$3,210,000         | 5.50%  | 5.41% | 100.688 | 5.45%             | 11/1/2021 | 100.00     | \$22,085           |
|                | 11/1/2036     | \$3,390,000         | 5.50%  | 5.41% | 100.688 | 5.45%             | 11/1/2021 | 100.00     | \$23,323           |
|                |               | <u>\$15,235,000</u> |        |       |         |                   |           |            | <u>\$104,817</u>   |
| <b>Total</b>   |               | <b>\$47,800,000</b> |        |       |         |                   |           |            | <b>\$402,191</b>   |



# Purchase Price

|                        |                   |             |  |
|------------------------|-------------------|-------------|--|
| Dated Date             | 10/31/11          |             |  |
| Delivery Date          | 10/31/11          |             |  |
| First Coupon           | 05/01/12          |             |  |
| Par Amount             | 47,800,000        |             |  |
| Premium                | 402,191           |             |  |
| Production             | <u>48,202,191</u> | 100.841403% |  |
| Underwriter's Discount | (191,200)         | (0.400000)% |  |
| Purchase Price         | <u>48,010,991</u> | 100.441403% |  |
| Accrued Interest       | -                 |             |  |

# Annual Debt Service Requirements

| Period Ending | Principal        | Interest         | Debt Service     | Fiscal Year      |
|---------------|------------------|------------------|------------------|------------------|
| 5/1/2012      | \$ -             | \$ 1,097,871.84  | \$ 1,097,871.84  | \$ 1,097,871.84  |
| 11/1/2012     | \$ -             | \$ 1,091,806.25  | \$ 1,091,806.25  | \$ -             |
| 5/1/2013      | \$ -             | \$ 1,091,806.25  | \$ 1,091,806.25  | \$ 2,183,612.50  |
| 11/1/2013     | \$ -             | \$ 1,091,806.25  | \$ 1,091,806.25  | \$ -             |
| 5/1/2014      | \$ -             | \$ 1,091,806.25  | \$ 1,091,806.25  | \$ 2,183,612.50  |
| 11/1/2014     | \$ 1,315,000.00  | \$ 1,091,806.25  | \$ 2,406,806.25  | \$ -             |
| 5/1/2015      | \$ -             | \$ 1,078,656.25  | \$ 1,078,656.25  | \$ 3,485,462.50  |
| 11/1/2015     | \$ 1,350,000.00  | \$ 1,078,656.25  | \$ 2,428,656.25  | \$ -             |
| 5/1/2016      | \$ -             | \$ 1,058,406.25  | \$ 1,058,406.25  | \$ 3,487,062.50  |
| 11/1/2016     | \$ 1,390,000.00  | \$ 1,058,406.25  | \$ 2,448,406.25  | \$ -             |
| 5/1/2017      | \$ -             | \$ 1,037,556.25  | \$ 1,037,556.25  | \$ 3,485,962.50  |
| 11/1/2017     | \$ 1,430,000.00  | \$ 1,037,556.25  | \$ 2,467,556.25  | \$ -             |
| 5/1/2018      | \$ -             | \$ 1,016,106.25  | \$ 1,016,106.25  | \$ 3,483,662.50  |
| .             | .                | .                | .                | .                |
| .             | .                | .                | .                | .                |
| 11/1/2026     | \$ 2,010,000.00  | \$ 761,962.50    | \$ 2,771,962.50  | \$ -             |
| 5/1/2027      | \$ -             | \$ 711,712.50    | \$ 711,712.50    | \$ 3,483,675.00  |
| .             | .                | .                | .                | .                |
| 11/1/2031     | \$ 2,580,000.00  | \$ 483,462.50    | \$ 3,063,462.50  | \$ -             |
| 5/1/2032      | \$ -             | \$ 418,962.50    | \$ 418,962.50    | \$ 3,482,425.00  |
| .             | .                | .                | .                | .                |
| 11/1/2036     | \$ 3,390,000.00  | \$ 93,225.00     | \$ 3,483,225.00  | \$ -             |
| 5/1/2037      | \$ -             | \$ -             | \$ -             | \$ 3,483,225.00  |
|               | \$ 47,800,000.00 | \$ 37,812,753.09 | \$ 85,612,753.09 | \$ 85,612,753.09 |

Revised numbers as of  
10/07/2011

# Net Debt Service: Gross Debt Service minus Capitalized Interest, DSRF and Earnings

| Period Ending | Gross Debt Service | DSRF / Cap I Funds and Earnings | Net Debt Service  | Fiscal Year       |
|---------------|--------------------|---------------------------------|-------------------|-------------------|
| 5/1/2012      | 1,097,872          | (1,097,872)                     | 0                 | 0                 |
| 11/1/2012     | 1,091,806          | (1,091,806)                     | 0                 | 0                 |
| 5/1/2013      | 1,091,806          | (1,091,806)                     | 0                 | 0                 |
| 11/1/2013     | 1,091,806          | (1,091,806)                     | 0                 | 0                 |
| 5/1/2014      | 1,091,806          | (44,183)                        | 1,047,624         | 1,047,624         |
| 11/1/2014     | 2,406,806          | (8,718)                         | 2,398,089         | 0                 |
| 5/1/2015      | 1,078,656          | (8,718)                         | 1,069,939         | 3,468,027         |
| 11/1/2015     | 2,428,656          | (8,718)                         | 2,419,939         | 0                 |
| 5/1/2016      | 1,058,406          | (8,718)                         | 1,049,689         | 3,469,627         |
| 11/1/2016     | 2,448,406          | (8,718)                         | 2,439,689         | 0                 |
| 5/1/2017      | 1,037,556          | (8,718)                         | 1,028,839         | 3,468,527         |
| 11/1/2017     | 2,467,556          | (8,718)                         | 2,458,839         | 0                 |
| .             | .                  | .                               | .                 | .                 |
| .             | .                  | .                               | .                 | .                 |
| .             | .                  | .                               | .                 | .                 |
| 5/1/2025      | 809,838            | (8,718)                         | 801,120           | 801,120           |
| 11/1/2025     | 2,724,838          | (8,718)                         | 2,716,120         | 0                 |
| 5/1/2026      | 761,963            | (8,718)                         | 753,245           | 3,469,365         |
| 11/1/2026     | 2,771,963          | (8,718)                         | 2,763,245         | 0                 |
| .             | .                  | .                               | .                 | .                 |
| 5/1/2030      | 544,838            | (8,718)                         | 536,120           | 536,120           |
| 11/1/2030     | 2,999,838          | (8,718)                         | 2,991,120         | 0                 |
| 5/1/2031      | 483,463            | (8,718)                         | 474,745           | 3,465,865         |
| 11/1/2031     | 3,063,463          | (8,718)                         | 3,054,745         | 0                 |
| .             | .                  | .                               | .                 | .                 |
| 5/1/2035      | 181,500            | (8,718)                         | 172,782           | 172,782           |
| 11/1/2035     | 3,391,500          | (8,718)                         | 3,382,782         | 0                 |
| 5/1/2036      | 93,225             | (8,718)                         | 84,507            | 3,467,290         |
| 11/1/2036     | 3,483,225          | (3,495,780)                     | (12,555)          | 0                 |
|               | <u>27,914,584</u>  | <u>(4,548,238)</u>              | <u>23,366,346</u> | <u>23,366,346</u> |

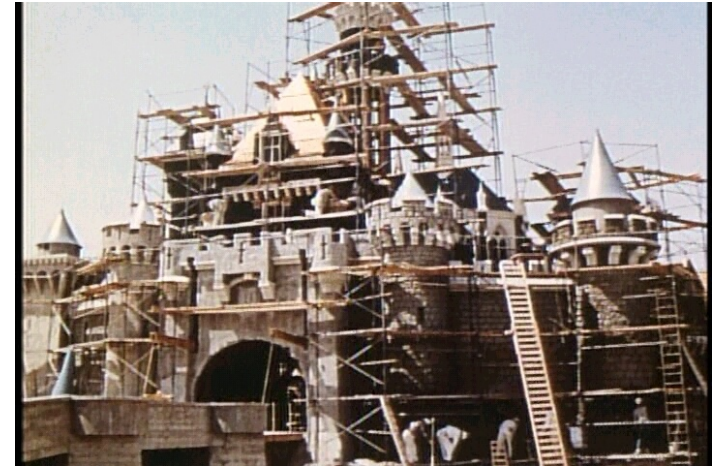
Assumptions:

- ✓ 2 years Cap I
- ✓ Use DSRF in last year
- ✓ Earnings: 0.1% on Cap I  
0.5% on DSRF

# Project Fund

- 18 month construction period with equal monthly draws; net funded

| Date       | Deposit       | Interest @<br>0.10% | Principal     | Scheduled<br>Draws | Balance       |
|------------|---------------|---------------------|---------------|--------------------|---------------|
| 10/31/2011 | \$ 40,000,000 | \$ -                | \$ -          | \$ -               | \$ 40,000,000 |
| 11/1/2011  | \$ -          | \$ 111              | \$ (12)       | \$ -               | \$ 40,000,012 |
| 12/1/2011  | \$ -          | \$ -                | \$ 2,222,222  | \$ 2,222,222       | \$ 37,777,790 |
| 1/1/2012   | \$ -          | \$ -                | \$ 2,222,222  | \$ 2,222,222       | \$ 35,555,568 |
| 2/1/2012   | \$ -          | \$ -                | \$ 2,222,222  | \$ 2,222,222       | \$ 33,333,345 |
| 3/1/2012   | \$ -          | \$ -                | \$ 2,222,222  | \$ 2,222,222       | \$ 31,111,123 |
| 4/1/2012   | \$ -          | \$ -                | \$ 2,222,222  | \$ 2,222,222       | \$ 28,888,901 |
| 5/1/2012   | \$ -          | \$ 17,222           | \$ 2,220,036  | \$ 2,222,222       | \$ 26,668,865 |
| 6/1/2012   | \$ -          | \$ -                | \$ 2,222,222  | \$ 2,222,222       | \$ 24,446,643 |
| 7/1/2012   | \$ -          | \$ -                | \$ 2,222,222  | \$ 2,222,222       | \$ 22,224,421 |
| 8/1/2012   | \$ -          | \$ -                | \$ 2,222,222  | \$ 2,222,222       | \$ 20,002,199 |
| 9/1/2012   | \$ -          | \$ -                | \$ 2,222,222  | \$ 2,222,222       | \$ 17,779,977 |
| 10/1/2012  | \$ -          | \$ -                | \$ 2,222,222  | \$ 2,222,222       | \$ 15,557,754 |
| 11/1/2012  | \$ -          | \$ 10,557           | \$ 2,220,585  | \$ 2,222,222       | \$ 13,337,170 |
| 12/1/2012  | \$ -          | \$ -                | \$ 2,222,222  | \$ 2,222,222       | \$ 11,114,948 |
| 1/1/2013   | \$ -          | \$ -                | \$ 2,222,222  | \$ 2,222,222       | \$ 8,892,725  |
| 2/1/2013   | \$ -          | \$ -                | \$ 2,222,222  | \$ 2,222,222       | \$ 6,670,503  |
| 3/1/2013   | \$ -          | \$ -                | \$ 2,222,222  | \$ 2,222,222       | \$ 4,448,281  |
| 4/1/2013   | \$ -          | \$ -                | \$ 2,222,222  | \$ 2,222,222       | \$ 2,226,059  |
| 5/1/2013   | \$ -          | \$ 3,891            | \$ 2,221,130  | \$ 2,222,222       | \$ 4,928      |
|            | \$ 40,000,000 | \$ 31,781           | \$ 39,995,072 | \$ 40,000,000      |               |



## Capitalized Interest Fund

- 24 months: 18 month construction period plus six months cushion; gross funded with earnings flowing to pay debt service after capitalized interest period

| Date       | Deposit                | Interest @ 0.1%    | Scheduled Draws        | Balance         |
|------------|------------------------|--------------------|------------------------|-----------------|
| 10/31/2011 | \$ 4,373,290.59        | \$ -               | \$ -                   | \$ 4,373,290.59 |
| 11/1/2011  | \$ -                   | \$ 12.15           | \$ -                   | \$ 4,373,290.59 |
| 5/1/2012   | \$ -                   | \$ 2,186.65        | \$ 1,097,871.84        | \$ 3,275,418.75 |
| 11/1/2012  | \$ -                   | \$ 1,637.71        | \$ 1,091,806.25        | \$ 2,183,612.50 |
| 5/1/2013   | \$ -                   | \$ 1,091.81        | \$ 1,091,806.25        | \$ 1,091,806.25 |
| 11/1/2013  | \$ -                   | \$ 545.90          | \$ 1,091,806.25        |                 |
|            | <u>\$ 4,373,290.59</u> | <u>\$ 5,474.22</u> | <u>\$ 4,373,290.59</u> |                 |

# Debt Service Reserve Fund

- Earnings flow to capitalized interest fund during capitalized interest period and then used to offset debt service

| Interest @ |              |          |           |              |              | Interest @ |              |            |              |                |              |
|------------|--------------|----------|-----------|--------------|--------------|------------|--------------|------------|--------------|----------------|--------------|
| Date       | Deposit      | 0.50%    | Principal | Debt Service | Balance      | Date       | Deposit      | 0.50%      | Principal    | Debt Service   | Balance      |
| 10/31/2011 | \$ 3,487,063 | \$ -     | \$ -      | \$ -         | \$ 3,487,063 | 5/1/2024   | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 11/1/2011  | \$ -         | \$ 48    | \$ -      | \$ (48)      | \$ 3,487,063 | 11/1/2024  | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 5/1/2012   | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 5/1/2025   | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 11/1/2012  | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 11/1/2025  | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 5/1/2013   | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 5/1/2026   | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 11/1/2013  | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 11/1/2026  | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 5/1/2014   | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 5/1/2027   | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 11/1/2014  | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 11/1/2027  | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 5/1/2015   | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 5/1/2028   | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 11/1/2015  | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 11/1/2028  | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 5/1/2016   | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 5/1/2029   | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 11/1/2016  | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 11/1/2029  | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 5/1/2017   | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 5/1/2030   | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 11/1/2017  | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 11/1/2030  | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 5/1/2018   | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 5/1/2031   | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 11/1/2018  | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 11/1/2031  | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 5/1/2019   | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 5/1/2032   | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 11/1/2019  | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 11/1/2032  | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 5/1/2020   | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 5/1/2033   | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 11/1/2020  | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 11/1/2033  | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 5/1/2021   | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 5/1/2034   | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 11/1/2021  | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 11/1/2034  | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 5/1/2022   | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 5/1/2035   | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 11/1/2022  | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 11/1/2035  | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 5/1/2023   | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 5/1/2036   | \$ -         | \$ 8,718   | \$ -         | \$ (8,718)     | \$ 3,487,063 |
| 11/1/2023  | \$ -         | \$ 8,718 | \$ -      | \$ (8,718)   | \$ 3,487,063 | 11/1/2036  | \$ -         | \$ 8,718   | \$ 3,487,063 | \$ (3,495,780) | \$ 3,487,063 |
|            |              |          |           |              |              |            | \$ 3,487,063 | \$ 435,931 | \$ 3,487,063 | \$ (3,922,994) |              |

# Typical Issuance Expenses

## Issuer's Cost of Issuance

Rating Agency Fees

Issuer Fee

Bond Counsel /Disclosure Counsel Fee

Trustee Fees

Financial Advisor Fee

Printing and Mailing Costs

Miscellaneous and Contingency

## Components of Underwriter's Discount

Takedown: \$/\$1,000

Management Fee: Infrequently seen

Underwriter's Counsel: Investment Bank Requirement

DTC: Industry formula

CUSIP: Industry formula

Dalcomp: Industry formula

Electronic Order Entry/Order Monitoring

CDIAC: Industry formula

Day Loan: Investment bank formula

Miscellaneous: Travel and other

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Class of 2017







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**October 7, 2011, 10am- 11:15am PT**

## **Not Concerned About Arbitrage Rebate? Not So Fast**

**November 8, 2011, 10am- 11:15am PT**

## **Swaps Math: What Are Your Swaps Worth?**

**November 30, 2011, 10am- 11:15am PT**



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