

# Bond Concepts and Overview

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CDIAC

CALIFORNIA  
DEBT AND  
INVESTMENT  
ADVISORY  
COMMISSION

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# Acquiring Quantitative Literacy for Municipal Bonds

- By learning the mathematical rules and conventions of issuing bonds, government issuers can:
  - Understand their structuring options and be able to compare alternative structures; and
  - Learn how to “read” the debt service schedules
- Topics to be covered
  - Sizing a bond issue
  - Structuring a bond issue: turning an “issue” into bonds
  - Yield curves and pricing
  - The specialized vocabulary

# Some Introductory Vocabulary

- Principal: also known as par amount or face value. The amount of bonds to be paid back on the maturity date
- Interest: cost of borrowing money
- Yield: percentage rate the investor will earn, based on the nominal rate on the bond ("the coupon rate") and the price of the bond ("par," "discount," or "premium")
- Debt Service: sum of all principal and interest due on a bond series
- Maturity: date on which principal payments are due
  - Most bond issues have principal maturing each year until the final maturity date
  - Typically, maturity dates on municipal bonds are within 30 years

# Sources and Uses

SOURCES	
<b>Bond Proceeds</b>	
Par Amount	\$47,800,000.00
Net Amount of Premium	<u>402,190.70</u>
<b>Total</b>	<b>\$48,202,190.70</b>

USES	
<b>Project Fund Deposits</b>	
Project Fund	\$40,000,000.00
<b>Other Fund Deposits</b>	
Capitalized Interest Fund	4,373,290.59
Debt Service Reserve Fund	3,487,062.50
<b>Delivery Date Expenses</b>	
Costs 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>

# The Project Fund

- Project Fund holds the main use of proceeds
- Most commonly “net funded,”
  - Downsized-based on projected interest earnings during expenditure period
  - Required by federal tax rules to prevent “over-issuance”
- For refunding bonds, “project” becomes the “escrow” fund

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### Project Fund Deposits

**Project Fund** **\$40,000,000.00**

### Other Fund Deposits

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**Total** **\$48,202,190.70**

# Capitalized Interest

- Sometimes additional bonds are sold to pay interest during project construction
  - Most common for lease revenue bonds and certificates of participation
  - During capitalized interest period, no principal is usually repaid

Date	Deposit	Interest @ 0.1%	Scheduled Draws	Balance
10/31/11	\$4,373,290.59	\$ -	\$ -	\$4,373,290.59
11/01/11	-	12.15	-	4,373,290.59
5/01/12	-	2,186.65	1,097,871.84	3,275,418.75
11/01/12	-	1,637.71	1,091,806.25	2,183,612.50
5/01/13	-	1,091.81	1,091,806.25	1,091,806.25
11/01/13	-	545.90	1,091,806.25	
	<u>\$4,373,290.59</u>	<u>\$5,474.22</u>	<u>\$4,373,290.59</u>	

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# The Reserve Fund

- A common security feature, designed to insure that investors are paid in the event of a problem with the borrower's ability or willingness to make timely debt service payments
- Most common for revenue bonds, including lease revenue bonds
- Federal tax law limits the size of the Debt Service Reserve Fund to the lesser of:
  - 10% of Par Amount
  - 125% of Average Annual Debt Service
  - Maximum Annual Debt Service ("MADS")
- When Reserve Fund could be invested above bond yield, relatively free to issuer
- "Negative arbitrage" (earnings at a lower rate than the cost of funds) has resulted in more issuers trying for smaller or no reserve

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# Costs of Issuance

- Fees
  - Rating agency fees
  - Bond counsel
  - Disclosure counsel
  - Financial advisor
  - Bond insurance
  - Trustee fee
  - Title or property insurance
  - Official statement distribution
- Underwriter's Discount
  - Takedown (quoted in \$ per \$1,000)
  - Management fee (less common)
  - Expenses
    - Underwriter's counsel
    - Miscellaneous expenses
- Rounded to nearest \$5,000 in par

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# The Making of a Bond Issue

- A bond issue is a single loan, broken up into smaller loans, each maturing at a different time
  - Each maturity is an investment product that can be sold to different types of investors with different investment horizons
  - Maturities are further tailored to fit the needs of different types of investors: such as individuals and mutual funds
- Each maturity of a bond has a “coupon” rate, the nominal interest rate
  - Before 1982, investors clipped physical coupons off their bonds, and sent them in to the paying agent to receive interest
  - Now, all bonds are registered and paid automatically; the “coupon” is metaphoric
- Interest is paid periodically until bond matures
  - Fixed-rate bonds usually pay interest every six months, principal annually
  - Variable-rate bonds might change rates weekly, pay interest monthly
  - In current market, most bonds are issued with fixed interest rates

# Types of Bonds—Serials and Terms

- Principal is amortized by paying off individual maturities of the bond issue
- Serially bonds mature annually
- Term bonds mature over a number of years

Maturity Date	Principal	Coupon	Interest	Debt Service
6/30/11	-	-	\$ 2,400,275	\$ 2,400,275
6/30/12	\$10,245,000	1.50%	2,400,275	12,645,275
6/30/13	10,395,000	2.00	2,246,600	12,641,600
6/30/14	10,605,000	2.50	2,038,700	12,643,700
6/30/15	10,870,000	5.00	1,773,575	12,643,575
6/30/16	11,415,000	5.25	1,230,075	12,645,075
6/30/17	12,015,000	5.25	630,788	12,645,788
	\$65,545,000		\$12,720,288	\$78,265,288

Serial Maturities

# Term Bond

- Nominally, a term bond matures at the final date
  - Annual “sinking fund” payments of principal are made prior to the term bond’s final maturity
  - Sinking fund payments call a portion of the outstanding principal of the term bond in accordance with a schedule
  - Some investors like term bonds because they are large “blocks” and increase secondary market “liquidity”

**\$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 below:

<b><u>Sinking Fund Payment Date (November 1)</u></b>	<b><u>Principal Amount Redeemed</u></b>
2032	\$2,720,000
2033	2,875,000
2034	3,040,000
2035	3,210,000
2036	3,390,000

# Types of Bonds

- Current Interest Bond
  - Most fixed rate bonds pay semi-annual interest at the same rate over their entire life...the coupon rate on the bond.
  
- Capital Appreciation Bonds
  - Do not pay any interest until maturity. Since they don't have any "coupon", sometimes referred to as "**Zero Coupon**" bonds

Year	Current Interest Bond			Capital Appreciation Bond or CAB	Accreted Value of Zero Coupon Bond or CAB
	Principal	Interest	Total		
0					10,000,000
1		500,000	500,000		10,500,000
2		500,000	500,000		11,025,000
3		500,000	500,000		11,576,250
4		500,000	500,000		12,155,063
5		500,000	500,000		12,762,816
6		500,000	500,000		13,400,958
7		500,000	500,000		14,071,004
8		500,000	500,000		14,774,554
9		500,000	500,000		15,513,282
10	10,000,000	500,000	10,500,000	16,288,946	16,288,946
	<b>10,000,000</b>	<b>5,000,000</b>	<b>15,000,000</b>	<b>16,288,946</b>	

# Bond Pricing

- Each maturity can be sold at a “premium” (more than par), or a “discount” (less than par), reducing or increasing the “yield”
- The relationship between price and yield is inverse:
  - If you own a bond and the market yield rises the price of the bond falls
  - If you own a bond and the market yield falls the price of the bond rises
- Pricing reflects investor preference and market outlook
  - Retail investors like to buy bonds at par
  - Premium bond: Institutional investors like because there is less price volatility. If interest rates rise after you purchase the bond the value of the bond will not fall as quickly
  - Discount bond: Institutional investors like for call protection. In a market environment where interest rates are falling it will take longer for a bond with a lower coupon to be profitably called for refunding

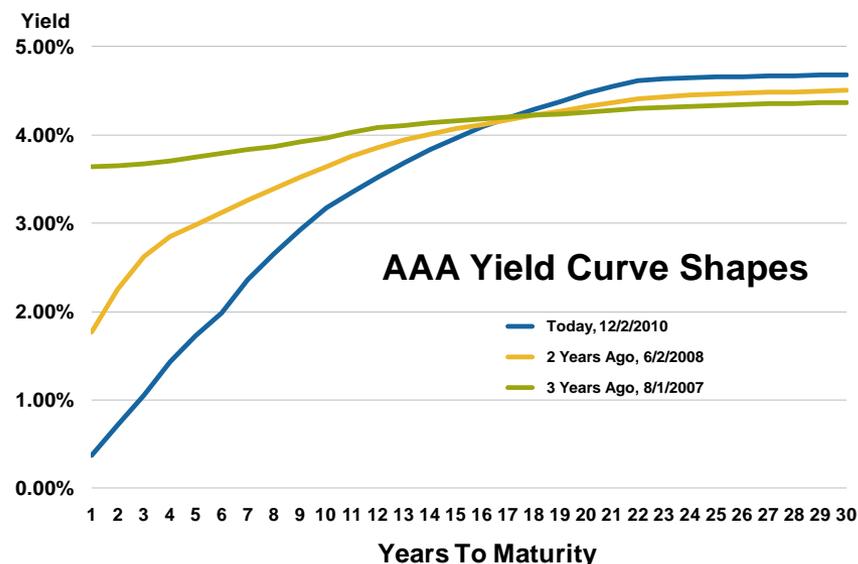
Maturity Date	Principal	Coupon	Yield	Price	
1/1/12	\$10,245,000	1.50%	1.69%	99.627	} Discount Bonds
1/1/13	10,395,000	2.00	2.08	99.768	
1/1/14	10,605,000	2.50	2.50	100	} Par Bond
1/1/15	10,870,000	5.00	2.80	110.198	} Premium Bond
	\$42,115,000				

# Bond Pricing

Bond Component	Maturity Date	Principal	Coupon	Yield	Price	Yield to Maturity	Call Date	Call Price	Premium (Discount)	Takedown
Serial Bonds	6/1/2015	940,000	3.00%	1.85%	103.158				29,685	3.25
	6/1/2016	970,000	4.00%	2.15%	106.770				65,669	3.75
	6/1/2017	1,005,000	4.00%	2.36%	107.447				75,215	3.75
	6/1/2018	1,045,000	4.00%	2.74%	106.747				70,844	4.25
	6/1/2019	1,090,000	3.00%	3.09%	99.446				(6,039)	4.25
	6/1/2020	1,120,000	5.00%	3.34%	111.354				127,733	5.00
	6/1/2021	1,175,000	5.00%	3.56%	110.827				127,759	5.00
	6/1/2022	1,235,000	5.00%	3.73%	110.369				128,576	5.00
	6/1/2023	1,300,000	5.00%	3.84%	109.420 C	3.92%	6/1/2022	100.00%	122,460	5.00
	6/1/2024	1,365,000	5.00%	3.92%	108.737 C	4.06%	6/1/2022	100.00%	119,260	5.00
	6/1/2025	1,430,000	4.00%	4.01%	99.896				(1,492)	5.00
	6/1/2026	1,490,000	4.00%	4.12%	98.739				(18,789)	5.00
	6/1/2027	1,550,000	4.50%	4.21%	102.310 C	4.29%	6/1/2022	100.00%	35,805	5.00
	6/1/2028	1,615,000	5.00%	4.30%	105.559 C	4.51%	6/1/2022	100.00%	90,056	5.00
6/1/2029	1,700,000	5.00%	4.39%	104.823 C	4.59%	6/1/2022	100.00%	81,991	5.00	
		19,030,000							1,048,731	
Term Bond due 2032	6/1/2030	1,785,000	4.50%	4.60%	98.702				(23,169)	5.00
	6/1/2031	1,865,000	4.50%	4.60%	98.702				(24,208)	5.00
	6/1/2032	1,950,000	4.50%	4.60%	98.702				(25,311)	5.00
		5,600,000							(72,688)	
Term Bond due 2037	6/1/2033	2,035,000	4.75%	4.82%	98.986				(20,635)	5.00
	6/1/2034	2,130,000	4.75%	4.82%	98.986				(21,598)	5.00
	6/1/2035	2,235,000	4.75%	4.82%	98.986				(22,663)	5.00
	6/1/2036	2,340,000	4.75%	4.82%	98.986				(23,728)	5.00
	6/1/2037	2,450,000	4.75%	4.82%	98.986				(24,843)	5.00
		11,190,000							(113,467)	
Term Bond due 2042	6/1/2038	2,565,000	5.00%	4.88%	100.921 C	4.94%	6/1/2022	100.00%	23,624	5.00
	6/1/2039	2,695,000	5.00%	4.88%	100.921 C	4.94%	6/1/2022	100.00%	24,821	5.00
	6/1/2040	2,830,000	5.00%	4.88%	100.921 C	4.94%	6/1/2022	100.00%	26,064	5.00
	6/1/2041	2,970,000	5.00%	4.88%	100.921 C	4.94%	6/1/2022	100.00%	27,354	5.00
	6/1/2042	3,120,000	5.00%	4.88%	100.921 C	4.94%	6/1/2022	100.00%	28,735	5.00
		14,180,000							130,598	
<b>TOTAL:</b>		<b>50,000,000</b>							<b>NET ORIGINAL ISSUE PREMIUM: 993,174</b>	

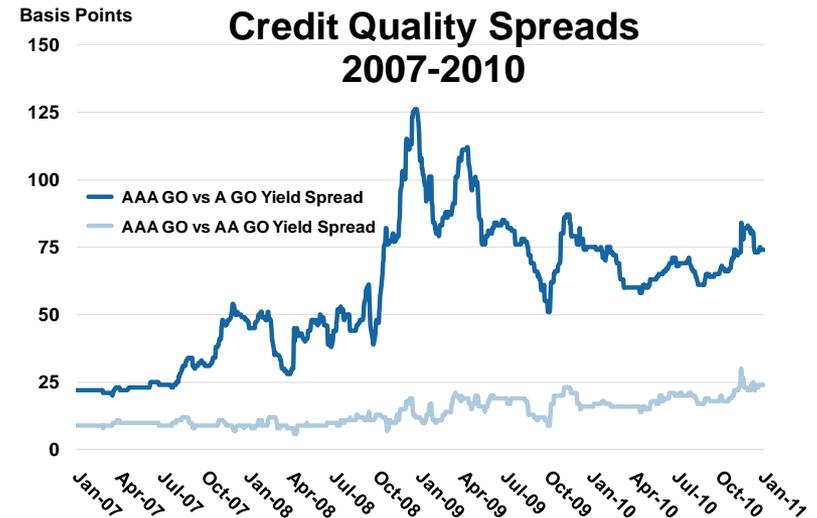
# The Yield Curve

- A curve on a graph in which the yields of fixed-interest securities are plotted against time
- Under normal conditions, interest rates on bonds with shorter maturities are lower than bonds with longer maturities
  - Investors face greater uncertainty holding longer term bonds than shorter term bonds.
  - Risks include changes in overall rates, changes in tax-treatment of interest, or the credit quality of the borrower
- The yield curve can, and does, change over time as economic conditions change
- The yield curve can even become inverted, meaning investors believe interest rates will be lower in the future often meaning that economic activity is likely to slow



# What Determines Interest Rates on Municipal Bonds?

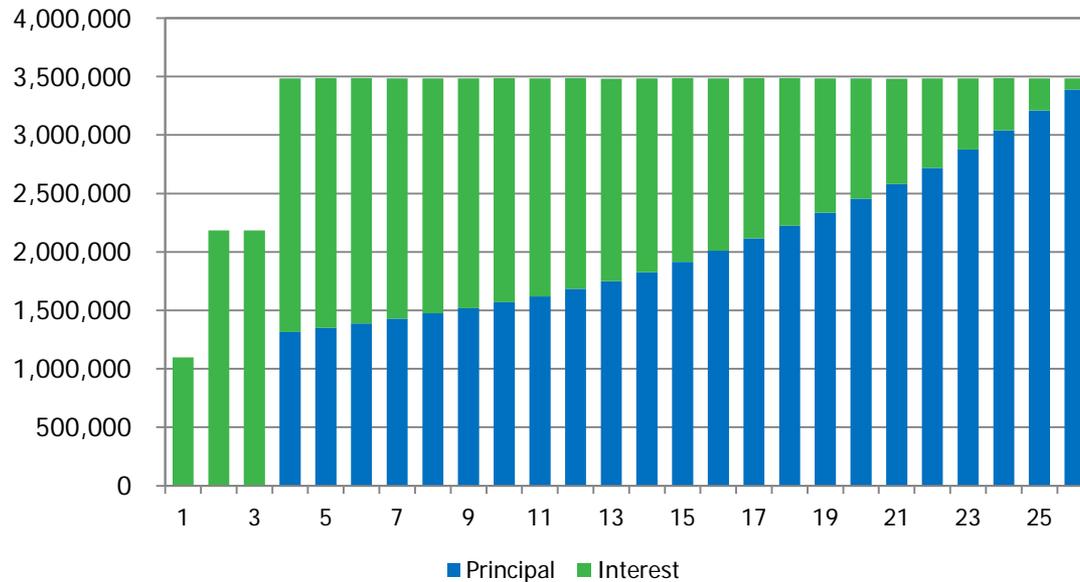
- Interest Rates, Generally
  - Inflation and other economic activity
  - Treasury bonds are the “benchmark” rate
- Supply
  - Abundance or scarcity of tax-exempt bonds available on the market
- Demand
  - Money flows between stocks and bonds
  - Liquidity (short-term) or yield (long-term)
  - The need to shelter income from taxes
- Credit Spread
  - Ratings
  - Buyer sentiment



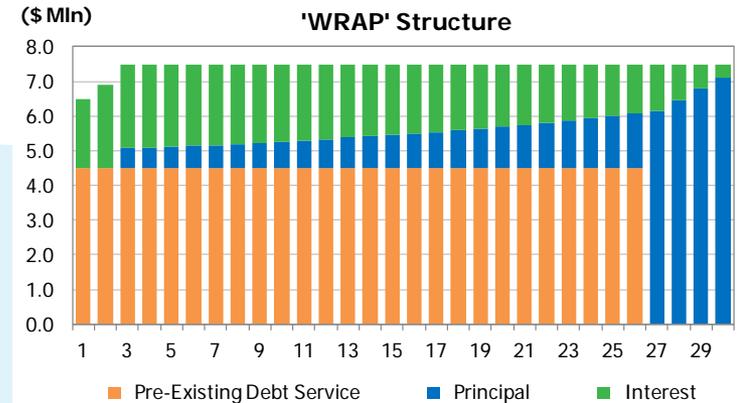
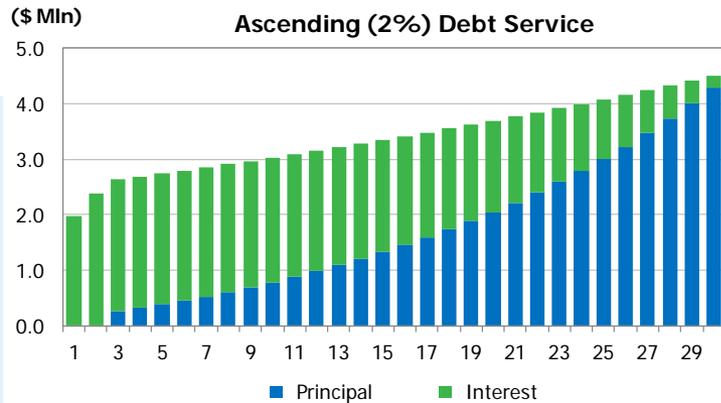
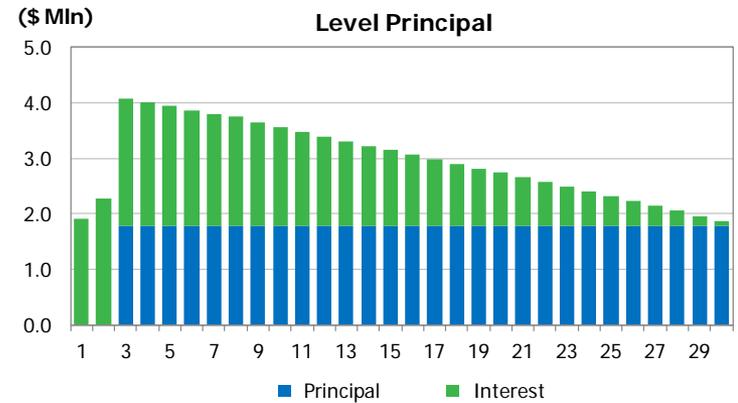
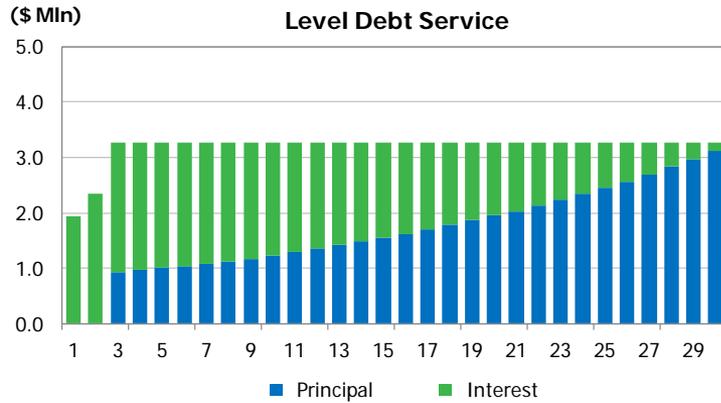
Sources: MMD

# How the “Bond Issue” is Structured

- Most bond issues are structured to produce level debt service
  - “Amortization” occurs by paying all interest due and some principal each year
  - Example:
    - Interest only until year 4
    - Level debt service after three years



# Alternative Amortization Structures



# Net Debt Service

- Gross Debt Service minus
  - Capitalized Interest
  - DSRF Earnings
  - DSRF at maturity

Period Ending	Gross Debt Service	DSRF / Cap I Funds and Earnings	Capitalized Interest Fund	Net Debt Service	Fiscal Year
5/1/2012	1,097,872	(1,097,872)	1,097,872	0	0
11/1/2012	1,091,806	(1,091,806)	1,091,806	0	0
5/1/2013	1,091,806	(1,091,806)	1,091,806	0	0
11/1/2013	1,091,806	(1,091,806)	1,092,352	0	0
5/1/2014	1,091,806	(44,183)	0	1,047,624	1,047,624
11/1/2014	2,406,806	(8,718)	0	2,398,089	0
5/1/2015	1,078,656	(8,718)	0	1,069,939	3,468,027
11/1/2015	2,428,656	(8,718)	0	2,419,939	0
5/1/2016	1,058,406	(8,718)	0	1,049,689	3,469,627
11/1/2016	2,448,406	(8,718)	0	2,439,689	0
5/1/2017	1,037,556	(8,718)	0	1,028,839	3,468,527
11/1/2017	4,436,270	239,605	0	4,675,875	
5/1/2018	4,435,958	239,605	0	4,675,563	
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
5/1/2025	809,838	(8,718)	0	801,120	801,120
11/1/2025	2,724,838	(8,718)	0	2,716,120	0
5/1/2026	761,963	(8,718)	0	753,245	3,469,365
11/1/2026	2,771,963	(8,718)	0	2,763,245	0
.	.	.	.	.	.
5/1/2030	544,838	(8,718)	0	536,120	536,120
11/1/2030	2,999,838	(8,718)	0	2,991,120	0
5/1/2031	483,463	(8,718)	0	474,745	3,465,865
11/1/2031	3,063,463	(8,718)	0	3,054,745	0
.	.	.	.	.	.
5/1/2035	181,500	(8,718)	0	172,782	172,782
11/1/2035	3,391,500	(8,718)	0	3,382,782	0
5/1/2036	93,225	(8,718)	0	84,507	3,467,290
11/1/2036	3,483,225	(3,495,780)	0	(12,555)	0
	<b>27,914,584</b>	<b>(4,548,238)</b>	<b>4,373,836</b>	<b>23,366,346</b>	<b>23,366,346</b>

# Key Bond Statistics

- Bond professionals usually rely on two proprietary software systems to model bond issues
  - DBC
  - Munex
  
- Yield = Rate at which Present Value of debt service equals the Target Value on the Target Date

<b>Dated Date</b>	<b>10/31/2011</b>
<b>Delivery Date</b>	<b>10/31/2011</b>
<b>Last Maturity</b>	<b>11/01/2036</b>
<b>Arbitrage Yield</b>	<b>4.798%</b>
<b>True Interest Cost (TIC)</b>	<b>4.835%</b>
<b>All-In TIC</b>	<b>4.865%</b>
<b>Average Coupon</b>	<b>4.962%</b>
<b>Average Life (years)</b>	<b>15.943000</b>

	<b>TIC</b>	<b>All-In TIC</b>	<b>Arbitrage Yield</b>
<b>Par Value</b>	\$ 47,800,000	\$ 47,800,000	\$ 47,800,000
<b>+ Accrued Interest</b>	-	-	-
<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%

# Additional Jargon to Impress Your Friends

- **Basis Point**
  - Yields on bonds are usually quoted in terms of basis points, with one basis point equal to one one-hundredth of one percent
  - 0.50% = 50 basis points
- **Day Count**
  - Different kinds of bonds have different methods for counting the days between dates, whether it is the actual number of days or a simplified way assuming 30 day months
  - Fixed-rate municipal bonds use the 30 day month/360 day year convention
- **MMD**
  - Municipal Market Data service
  - A yield curve published daily by TM3 (Thompson Municipal Market Monitor)
  - Pricing (i.e., interest rates) is often discussed in terms of a basis point spread to the “AAA” MMD
    - “AAA” MMD is the benchmark for all tax-exempt pricings and represents an index of the highest quality municipal bonds
- **A security by any other name...**
  - Bond: a security sold according to a bond law
  - COP (certificate of participation): A bond-like security secured by a contract (a lease or installment purchase agreement), often used when an issuer wants to leverage its revenues but lacks legal authority to sell bonds
  - Note: a bond that matures in less than three years



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