



CARIBBEAN ACTUARIAL ASSOCIATION



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# Session 9: Models for Managing Mine Reclamation Obligations:

Rose Hall Resort and Spa, a Hilton Resort in Montego Bay, Jamaica.

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# **Models for Managing Mine Reclamation Obligations: A Case Study Combining Pension and Casualty Actuarial Expertise**

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# Models for Managing Mine Reclamation Obligations: A Case Study Combining Pension and Casualty Actuarial Expertise



# Models for Managing Mine Reclamation Obligations

## ❑ Funding Land Reclamation

- ❑ Mining, oil and gas companies that operate on federal lands are required by the federal government to restore that land to safe environmental conditions when they are finished. To do so the federal government requires the mining companies to demonstrate sufficient financial capacity, otherwise they are not allowed to operate.

# Models for Managing Mine Reclamation Obligations

- ❑ **Financial Instruments Used to Fulfill the Obligation**
- ❑ Mining companies use various financial instruments to fulfill the bond posting requirement by various states. Of the available financial instruments, states typically require surety bonds, corporate guarantees, and incrementally funded trusts. In addition to the above instruments, various states have their own bond pools. A mining company can enter such a pool if it meets the requirements and pays the appropriate dues.

# Models for Managing Mine Reclamation Obligations

|                             |  |
|-----------------------------|--|
| Surety Bonds                | The surety company issues these bonds. These bonds are financial assurance instruments that hold funds or collateral in reserve.   |
| Corporate Guarantees        | Of the 24 states that have taken primary land reclamation responsibility, 20 states accept corporate guarantees as a form of financial solvency for reclamation.   |
| Bond Pools                  | A bond pool is a fund into which a group of qualified mining operators pay fees to participate. The pool in return provides financial assurance for its participants. The qualified mining operators can begin operations after paying the joining fee and the ongoing fees. |
| Incrementally Funded Trusts | These are administered by a third party and are accounts into which a mine operator makes payments that are dedicated to fully fund its own land reclamation obligation.   |
| Fees per ton mined          | Additional fees to provide funds to cover reclamation costs not covered by the above bonds   |

# Case Study

## Coal Mining Reclamation in WV

- ❑ **West Virginia is the 4<sup>th</sup> largest coal producing state in the USA**
- ❑ **Federal Mine Reclamation Requirements**
- ❑ **States can exempt themselves from the Federal Requirements**
- ❑ **West Virginia exempt from federal requirements, established a trust fund to pay for reclamation activities, statutory required valuations to ensure funds collected to cover reclamation costs**

# Actuarial Assignment

- ❑ **Statutory valuation**
  - ❑ **Results to be included in the State CAFR**
- ❑ **Dynamic valuation**
  - ❑ **Model options for managing the trust fund to cover reclamation costs**
  - ❑ **Deliver model to Department of Environmental Protection**
- ❑ **Explain the results to the Special Reclamation Fund Advisory Committee**
- ❑ **Testify before Legislative body (as needed)**

# Actuarial Responsibilities

## Casualty Actuary

- Review permit data
- Review claims cost data
- Clean up data
- Develop rates for:
  - Underground permits
  - Surface permits
  - Other permits
  - Land capital costs
  - Water capital costs
  - Ongoing water treatment costs

## Pension Actuary

- Review permit forfeiture and release rates
- Develop rates for:
  - Underground permits
  - Surface permits
  - Other permits
- Build permit population projection model
- Dovetail with cost data
- Build cash flow, investment and liability model

# Permitting Process

**Operators post a bond when they obtain a permit**

- Amount of bond varies by type of permit (Surface, Underground, Other), acreage, disturbed acreage, and other factors**
- While mining, operators pay a tax per clean ton of coal**
- After mining activity is completed, operators are required to reclaim the land**
  - After clean up the permit is released**
  - If site not reclaimed, then operator forfeits the permit, the Trust Fund collects the bond**
  - Reclamation Fund becomes responsible for reclamation costs from forfeited permits**

**We needed to develop Surface Mine Land Reclamation Costs.  
These were developed on a per acre of disturbed land basis.**



**Before reclamation**



**After Reclamation**

**The Department of Environmental protection maintains a database of historical costs, which varies significantly from site to site.**



**Before reclamation**



**After Reclamation**

**Acid mine drainage (AMD) is a major concern for the State. The high cost of treating AMD is one reason why mine operators default on their permits.**



**Acid mine drainage before reclamation**



**Pond and new pipe after reclamation**

**As the State issued more contracts for reclamation work, the additional demand led to increases in prices.**



**Mine site before reclamation**

**Mine site after reclamation**

**As the State expertise and experience grew, it was able to tighten the permitting process so that new mine operators were less likely to default on their permits.**



**Excavated polishing pond**



**Sludge pumping line and sludge cells**

**Treatment facility and settling ponds**



**Pond cleanout**

# Reclamation Liabilities

## What are the reclamation liabilities?

- Costs for reclaiming sites for permits that have been forfeited?

## When is the liability established?

- When the permit is forfeited - or when it is issued?
- GASB 10 states
  - State and local governmental entities other than public entity risk pools are required to report an estimated loss from a claim as an expenditure/expense and as a liability if both of these conditions are met:
  - Information available before the financial statements are issued indicates that it is probable that an asset had been impaired or a liability had been incurred at the date of the financial statements. It is implicit in this condition that it must be probable that one or more future events will also occur, confirming the fact of the loss.
  - The amount of the loss can be reasonably estimated.

# Reclamation Assets

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**What are the reclamation assets?**

- Market value of assets in the trust**
- Future coal tax revenues**
- Future income from bonds when permits are forfeited**
- Income from court settlements**
- Investment income**

# Actuarial Assumptions

## Permits — forfeiture and release experience

- ❑ Separate rates for Underground, Surface, and “Other” permits
- ❑ Separate rates for permits issued before and after 1/1/1996 to reflect improvements in permitting process that resulted in lower forfeiture rates

## Following tables show the Actual Experience and Valuation Rates

- ❑ Large number of permits issued prior to 1996, so experience is fairly complete up to 20 years after issuance
- ❑ Emerging experience for recently issued permits
- ❑ Valuation rates developed to “fit” the experience rates, with rates projected for the recently issued permits based on typical permit life for surface and underground permits

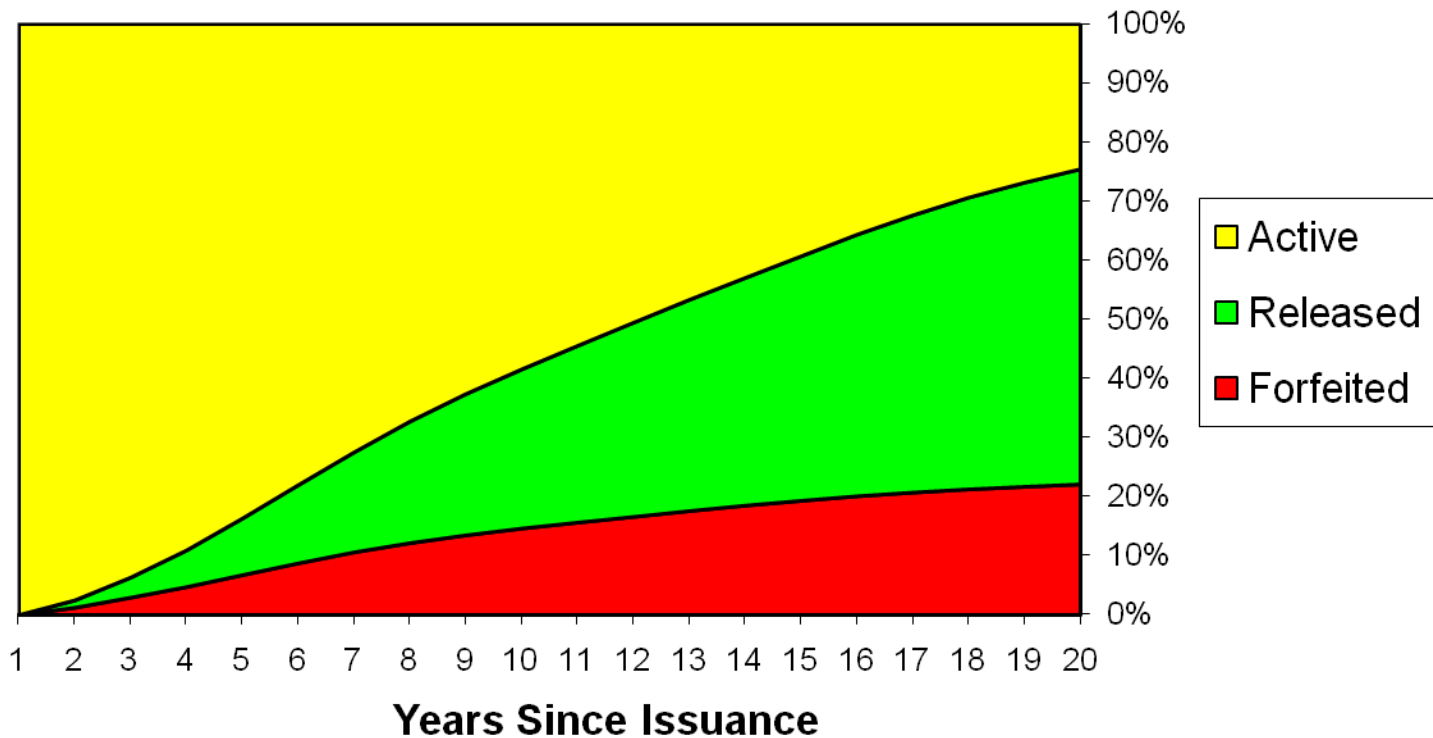
# Actuarial Assumptions

## How to read the charts

- ❑ **Red area shows percent of permits forfeited**
  - ❑ Just over 20 percent of pre-1996 Surface and Underground permits are forfeited after 20 years, compared with under 15 percent for “Other”
- ❑ **Green area shows percent of permits released**
  - ❑ After 20 years, over 60 percent for pre-1996 Surface, 50 percent of Underground and 45 percent of “Other” have been released
- ❑ **Yellow area shows permits still in force**
  - ❑ After 20 years, 40 percent of pre-1996 “Other”, 25 percent of Underground, and 15 percent of Surface permits are still in force

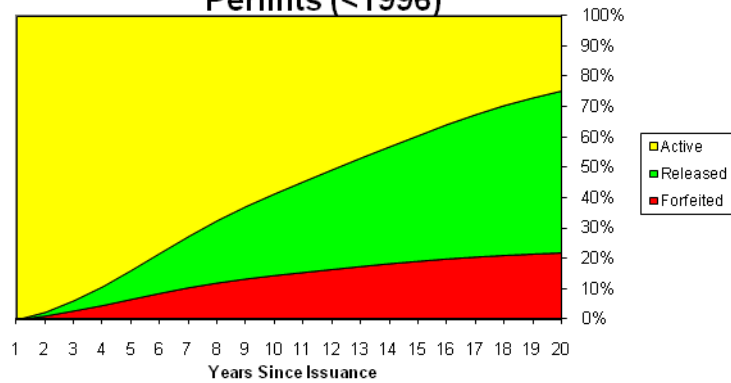
# Underground Permits Forfeiture and Release Rates

Experience Rates for Underground Permits (<1996)

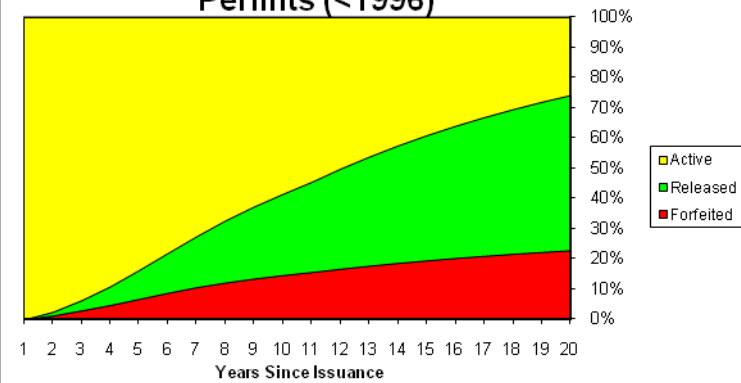


# Underground Permits Forfeiture and Release Rates

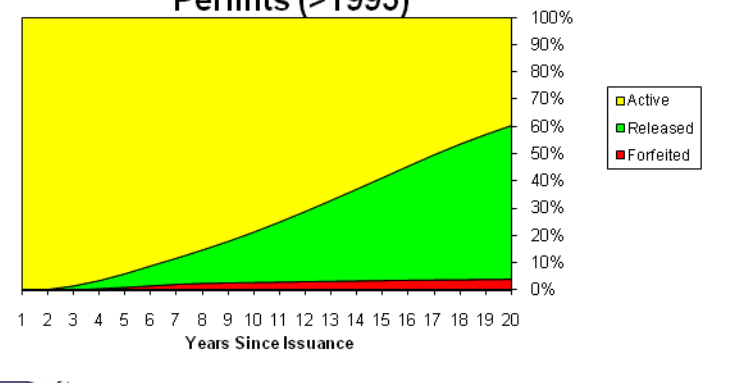
Experience Rates for Underground Permits (<1996)



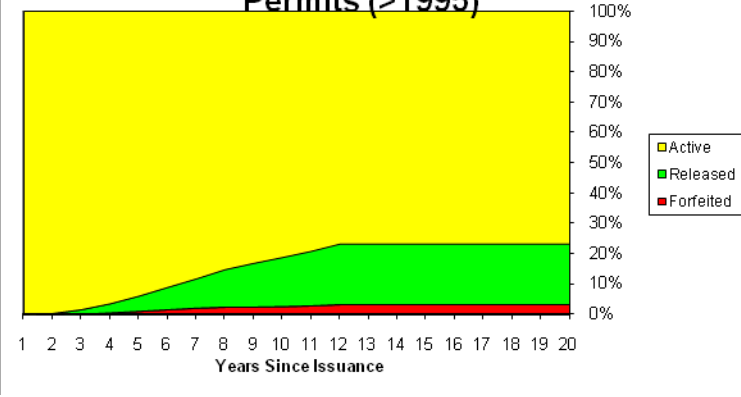
Valuation Rates for Underground Permits (<1996)



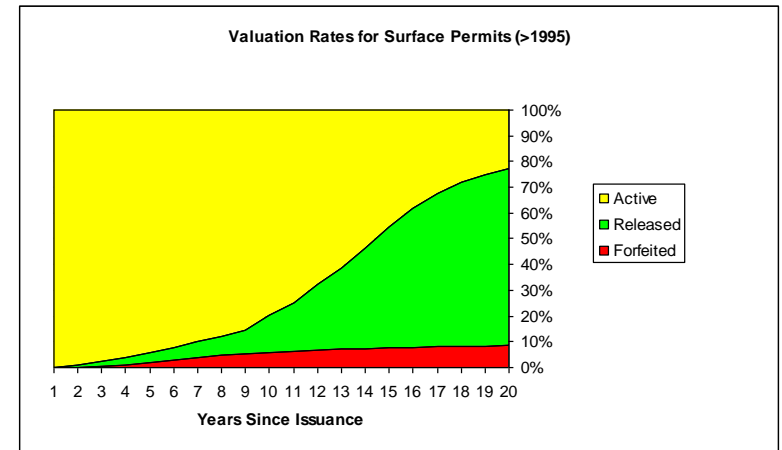
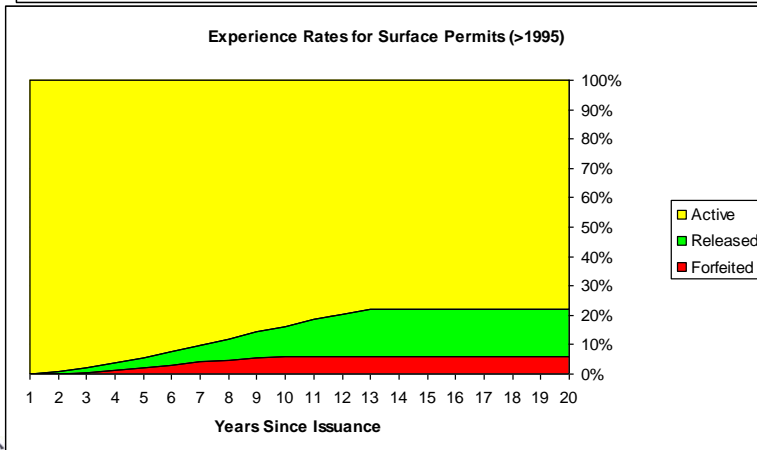
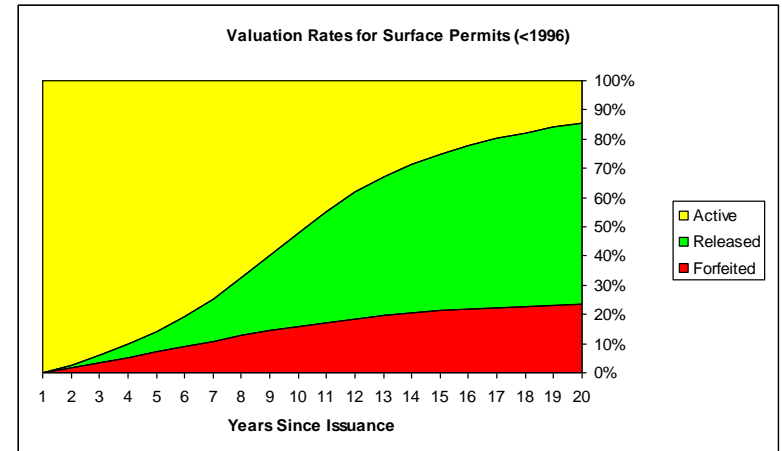
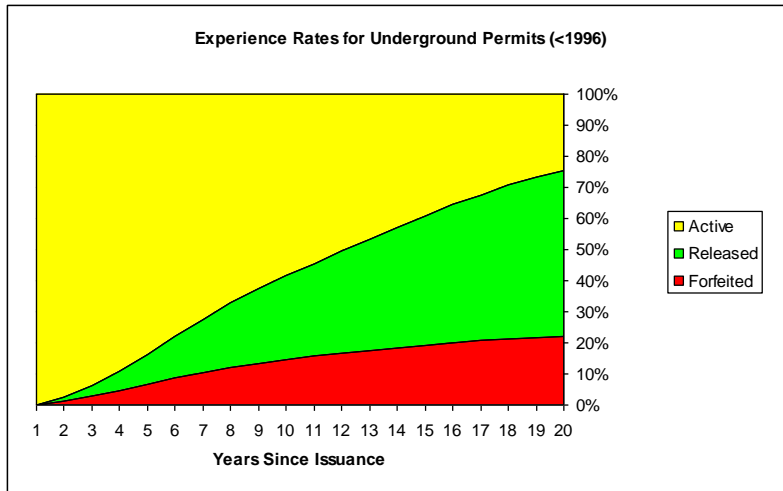
Valuation Rates for Underground Permits (>1995)



Experience Rates for Underground Permits (>1995)

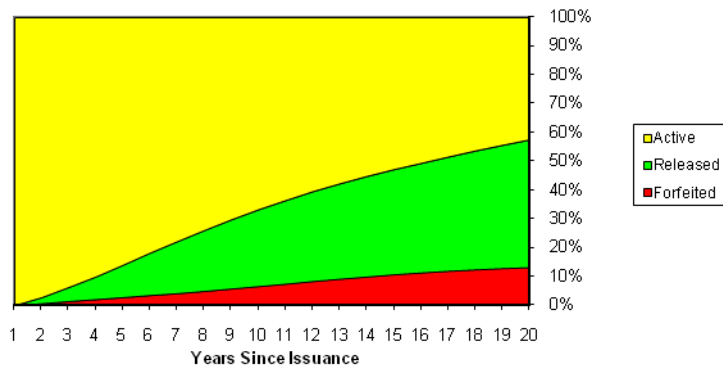


# Surface Permits Forfeiture and Release Rates

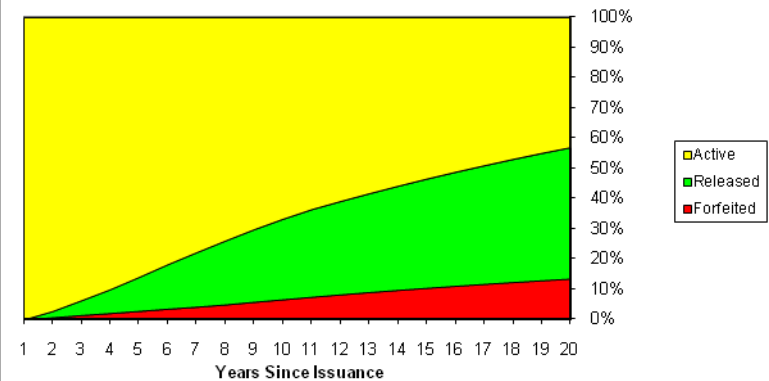


# Other Permits Forfeiture and Release Rates

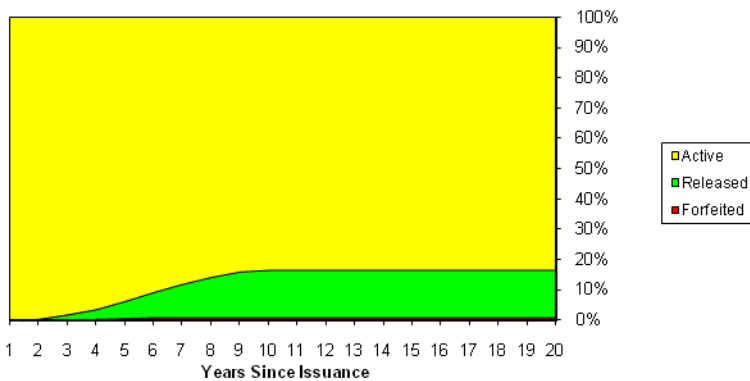
Experience Rates for Other Permits (<1996)



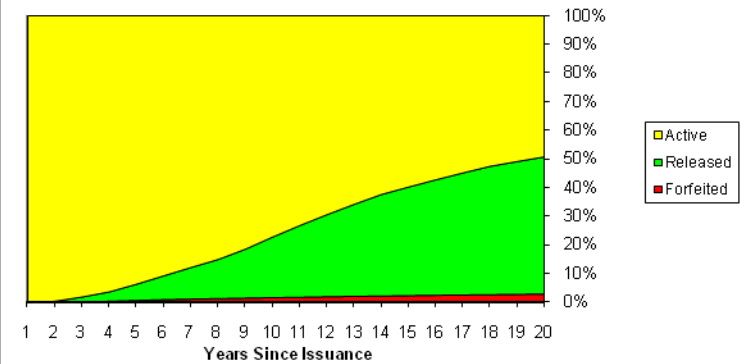
Valuation Rates for Other Permits (<1996)



Experience Rates for Other Permits (>1995)



Valuation Rates for Other Permits (>1995)



# Other Valuation Assumptions

## Construction Cost Increase Rates

- ❑ Reviewed cost per permit acre for construction completed since 2001
- ❑ Land costs/acre for Surface permits have varied greatly from year to year and increased about 9 percent on average since 2001
- ❑ Land costs/acre for Underground permits have declined recently but increased just over 4 percent on average since 2001
- ❑ Sparse number of completed Water construction sites, so unable to develop pattern of cost increases from historical data
  - ❑ Surface permit water costs/acre have increased from 2002-2006
  - ❑ Underground permit water costs/acre have decreased from 2003 to 2007

# Other Valuation Assumptions

## Construction Cost Increase Rates

- ❑ Land construction costs for surface permits are projected to increase by 9 percent in FY 2007, 8 percent in FY 2008, declining to annual increases of 5 percent in FY 2011 and later years
- ❑ Land construction costs for underground and “other” permits are projected to increase by 5 percent annually
- ❑ Water construction costs (for all types of permits) are projected to increase by 3 percent annually

# Other Valuation Assumptions

- ❑ **Discount Rate – 5 percent (expected annual investment return)**
- ❑ **Administration costs increasing at 3 percent per annum**
- ❑ **Ongoing Water Treatment Costs**
  - ❑ **Legacy cost of \$2.1 million per annum (not increasing)**
  - ❑ **Pre 7/1/07 treatment site costs increasing at 5 percent per annum**
  - ❑ **Future treatment sites costs increasing at 5 percent per annum**
- ❑ **Timing between permit revocation and completion of construction costs**
  - ❑ **Three to four years for permits forfeited in FY 2008 and FY 2009, declining in FY 2010 to three years, and ultimately reaching 2 years in FY 2013 and later periods.**

# OSR Database – Forfeited Permits by Permit Type

## Forfeited Permits by Permit Type (Data from All Years)

| <u>Permit Type</u> | <u>Number of Forfeits</u> | <u>Percentage</u> |
|--------------------|---------------------------|-------------------|
| Other              | 228                       | 12%               |
| Surface            | 1,178                     | 63                |
| Underground        | 478                       | 25                |
| <b>TOTAL</b>       | <b>1,884</b>              | <b>100%</b>       |

# OSR Database – Forfeited Permits by Site Type

## Comparison of Data between 2005 and 2007

| Claim Type       | 2005  | 2007  | Difference |
|------------------|-------|-------|------------|
| Open Water       | 171   | 62    | -109       |
| Closed Water     | 58    | 111   | +53        |
| Closed Not Water | 673   | 771   | +98        |
| Land Only        | 903   | 940   | +37        |
| Total            | 1,805 | 1,884 | 79         |

# OSR Database – Forfeited Permits by Permit Type and Site Type

| Site Type           | Other–<br>Number | Other–<br>Percentage | Surface–<br>Number | Surface–<br>Percentage | Underground<br>– Number | Underground-<br>Percentage |
|---------------------|------------------|----------------------|--------------------|------------------------|-------------------------|----------------------------|
| Open Water          | 6                | 3%                   | 47                 | 4%                     | 9                       | 2%                         |
| Closed Water        | 13               | 6%                   | 78                 | 6%                     | 20                      | 4%                         |
| Closed Not<br>Water | 83               | 36%                  | 396                | 34%                    | 292                     | 61%                        |
| Land Only           | 126              | 55%                  | 657                | 56%                    | 157                     | 33%                        |
| Total               | 228              | 100%                 | 1,178              | 100%                   | 478                     | 100%                       |

# OSR Database – Forfeited Permits by Land Dates

## Forfeited Permits by Land Dates (Data from All years)

| <u>Available Dates</u>               | <u>Number of Forfeits</u> | <u>Percentage</u> |
|--------------------------------------|---------------------------|-------------------|
| Revocation &<br>Land Start Dates     | 741                       | 39%               |
| Revocation But<br>No Land Start Date | 893                       | 48                |
| No Revocation Date                   | 250                       | 13                |
| TOTAL                                | 1,884                     | 100%              |

Analysis conducted on the 741 permits for which complete data existed.

# OSR Database – Forfeited Permits With Land Start Dates

## Forfeited Permits With Both Revocation and Land Construction Start Dates

| <u>Status</u> | <u>Number of Forfeits</u> | <u>Percentage</u> |
|---------------|---------------------------|-------------------|
| Completed     | 634                       | 86%               |
| Not Completed | 107                       | 14%               |
| TOTAL         | 741                       | 100%              |

# OSR Database – Average Days to Land Construction Start

## Average Days from Revocation to Land Construction Start Date

| <u>Permit Type</u> | <u>Average Days</u> |
|--------------------|---------------------|
| Other              | 1,425               |
| Surface            | 1,753               |
| Underground        | 1,711               |
| Average            | 1,677               |

# OSR Database – Average Days to Land Completion

## Average Days from Land Construction Start Date to Land Completion Date

| <u>Permit Type</u> | <u>Average Days</u> |
|--------------------|---------------------|
| Other              | 603                 |
| Surface            | 619                 |
| Underground        | 650                 |
| Average            | 625                 |

# OSR Database – Forfeited Permits by Water Dates

## Forfeited Permits by Water Dates

| <u>Available Dates</u>                | <u>Number of Forfeits</u> | <u>Percentage</u> |
|---------------------------------------|---------------------------|-------------------|
| Revocation &<br>Water Start Dates     | 120*                      | 69%               |
| Revocation But<br>No Water Start Date | 53                        | 31                |
| No Revocation Date                    | 0                         | 0                 |
| TOTAL                                 | 173 *                     | 100%              |

9% of Grand Total

Note: \* Includes 5 closed water sites with no water start dates.

# OSR Database – Forfeited Permits With Water Start Dates

## Forfeited Permits With Both Revocation and Water Construction Start Dates

| <u>Status</u> | <u>Number of Forfeits</u> | <u>Percentage</u> |
|---------------|---------------------------|-------------------|
| Completed     | 111*                      | 93%               |
| Not Completed | 9                         | 7%                |
| TOTAL         | 120*                      | 100%              |

Note: \* Includes 5 closed water sites with no start date and another 15 with no completion date.

# OSR Database – Average Days to Water Construction Start

## Average Days from Revocation to Water Construction Start Date

| <u>Permit Type</u> | <u>Average Days</u> |
|--------------------|---------------------|
| Other              | 3,167               |
| Surface            | 4,937               |
| Underground        | 3,317               |
| Average            | 3,573               |

# OSR Database – Average Days to Water Completion

## Average Days from Water Construction Start Date to Water Completion Date

| <u>Permit Type</u> | <u>Average Days</u> |
|--------------------|---------------------|
| Other              | 190                 |
| Surface            | 226                 |
| Underground        | 266                 |
| Average            | 197                 |

# OSR Database – Average Land Cost Per Disturbed Acre

## Average Land Cost Per Disturbed Acre

| <u>Permit Type</u>    | <u>Average Cost</u> |
|-----------------------|---------------------|
| Other                 | \$6,524             |
| Surface               | 1,857               |
| Underground           | 8,907               |
| Average               | \$2,890             |
| Average - Prior Study | \$2,697             |

# OSR Database – Average Water Capital Cost Per Disturbed Acre

## Average Water Capital Cost Per Disturbed Acre

| <u>Permit Type</u>    | <u>Average Cost Per Disturbed Acre</u> | <u>Average Cost Per Disturbed Water Acre</u> |
|-----------------------|--|--|
| Other                 | \$ 757                                 | \$ 3,535                                     |
| Surface               | 759                                    | 3,095  |
| Underground           | 2,808                                  | 32,108                                       |
| Average               | \$ 932                                 | \$ 4,076                                     |
| Average – Prior Study | \$ 444                                 |  |

# OSR Database – Average Water Operating Cost Per Disturbed Acre

## Average Water Operating Cost Per Disturbed Acre Per Year

| <u>Permit Type</u> | <u>Average Annual Cost Per Disturbed Acre</u> | <u>Average Annual Cost Per Disturbed Water Acre</u> |
|--------------------|---|---|
| Other *            | \$40.38                                       | \$191.21  |
| Surface            | 1.98  | 8.08  |
| Underground        | 31.73   | 362.77  |
| Average *          | \$8.09  | \$35.35   |

Note: \* Includes one unusual closed site.

# OSR Database – Average Water Operating Cost Per Disturbed Acre

## Average Water Operating Cost Per Disturbed Acre

| <u>Permit Type</u>           | <u>Average Cost Per Disturbed Acre*</u> | <u>Average Cost Per Disturbed Acre**</u> |
|------------------------------|---|--|
| Other                        | \$1,579                                 | \$ 65                                    |
| Surface                      | 491                                     | 491                                      |
| Underground                  | 1,312                                   | 1,312                                    |
| Average                      | 662                                     | 520                                      |
| <b>Average – Prior Study</b> | <b>615</b>                              |  |

Notes: \* Includes one unusual closed site.

\*\* Excludes one unusual closed site.

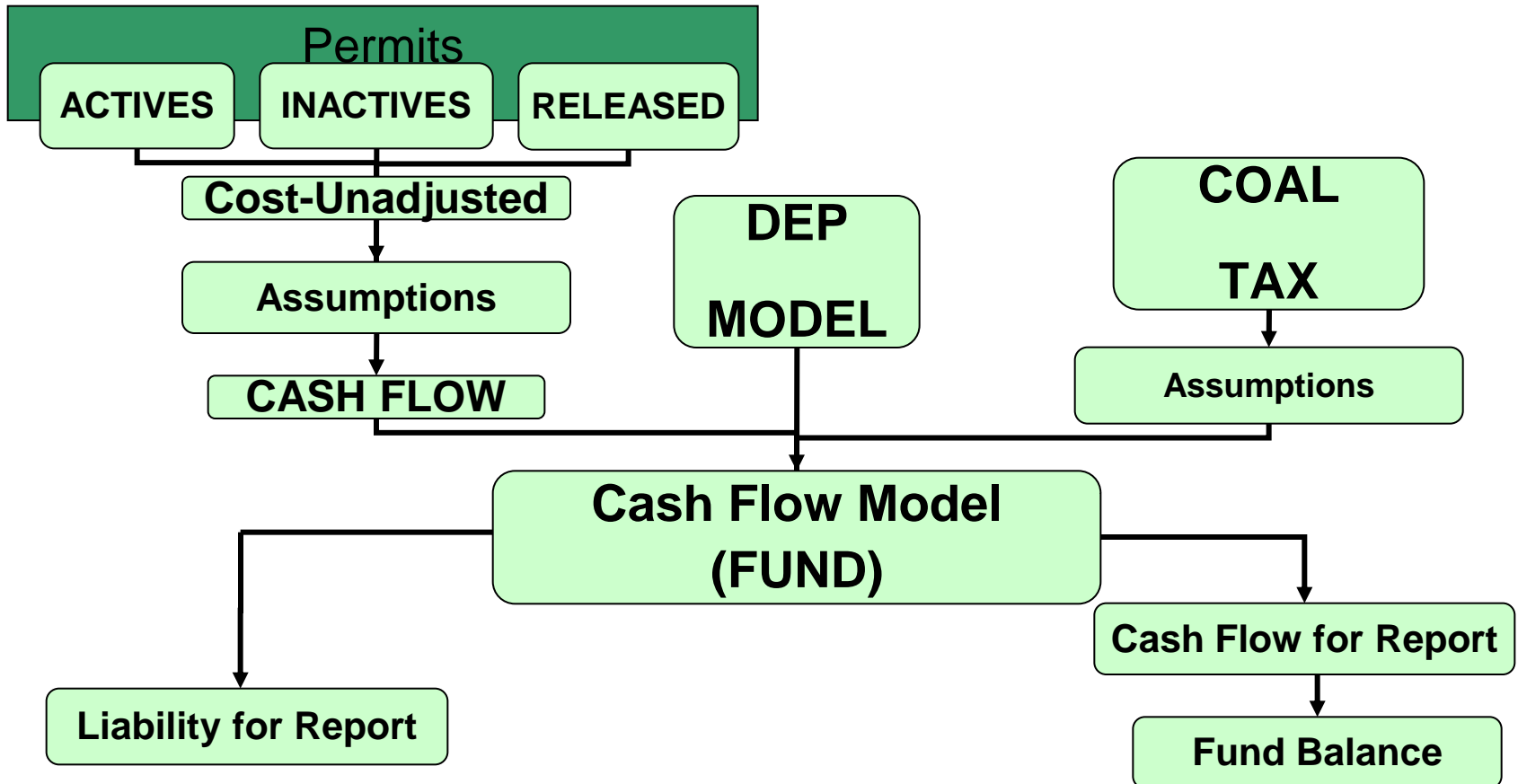


# Reclamation Cost Assumptions

## Valuation Cost Per Acre by Permit Type in 2007 Dollars

|                              | Other          | Surface        | Underground     |
|------------------------------|----------------|----------------|-----------------|
| <b>Land Capital Costs</b>    | <b>\$9,171</b> | <b>\$2,574</b> | <b>\$12,697</b> |
| <b>Water Capital Costs</b>   | <b>\$622</b>   | <b>\$615</b>   | <b>\$2,340</b>  |
| <b>Water Treatment Costs</b> | <b>\$33.19</b> | <b>\$1.60</b>  | <b>\$26.45</b>  |

# Visual Description of Actuarial Model



# Valuation Results

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- Liabilities
- Assets
- Funded Status
- Cashflow Forecast

# Liability Valuation as of June 30, 2007

## Reclamation Liability for Known and Expected Forfeitures

(Amounts shown in \$millions)

| Type of Liability       | For Permits<br>Forfeited Prior<br>To July 1, 2007 | For Expected<br>Forfeitures After<br>June 30, 2007 | Total Reclamation<br>Liabilities |
|-------------------------|---|--|----------------------------------|
| Land Capital            | \$46.1  | \$172.4  | \$218.5                          |
| Water Capital           | \$12.5  | \$61.7   | \$74.2                           |
| Ongoing Water Treatment | \$41.8  | \$7.9  | \$49.7                           |
| Administration Costs    |   | \$43.9   | \$43.9                           |
| <b>Total</b>            | <b>\$100.4</b>                                    | <b>\$285.9</b>                                     | <b>\$386.3</b>                   |

Note: Liabilities include expected costs through FY 2027 only



# Asset Valuation as of June 30, 2007

## Present Value of Future Revenue Sources

(Amounts shown in \$millions)

| Coal Tax Revenue | Bond Forfeiture, Civil Penalties, and Court Settlements | Interest Income | Total   |
|------------------|---|-----------------|---------|
| \$70.5           | \$53.7  | \$10.8          | \$135.0 |

Note: Assets include expected revenues through FY 2027 only

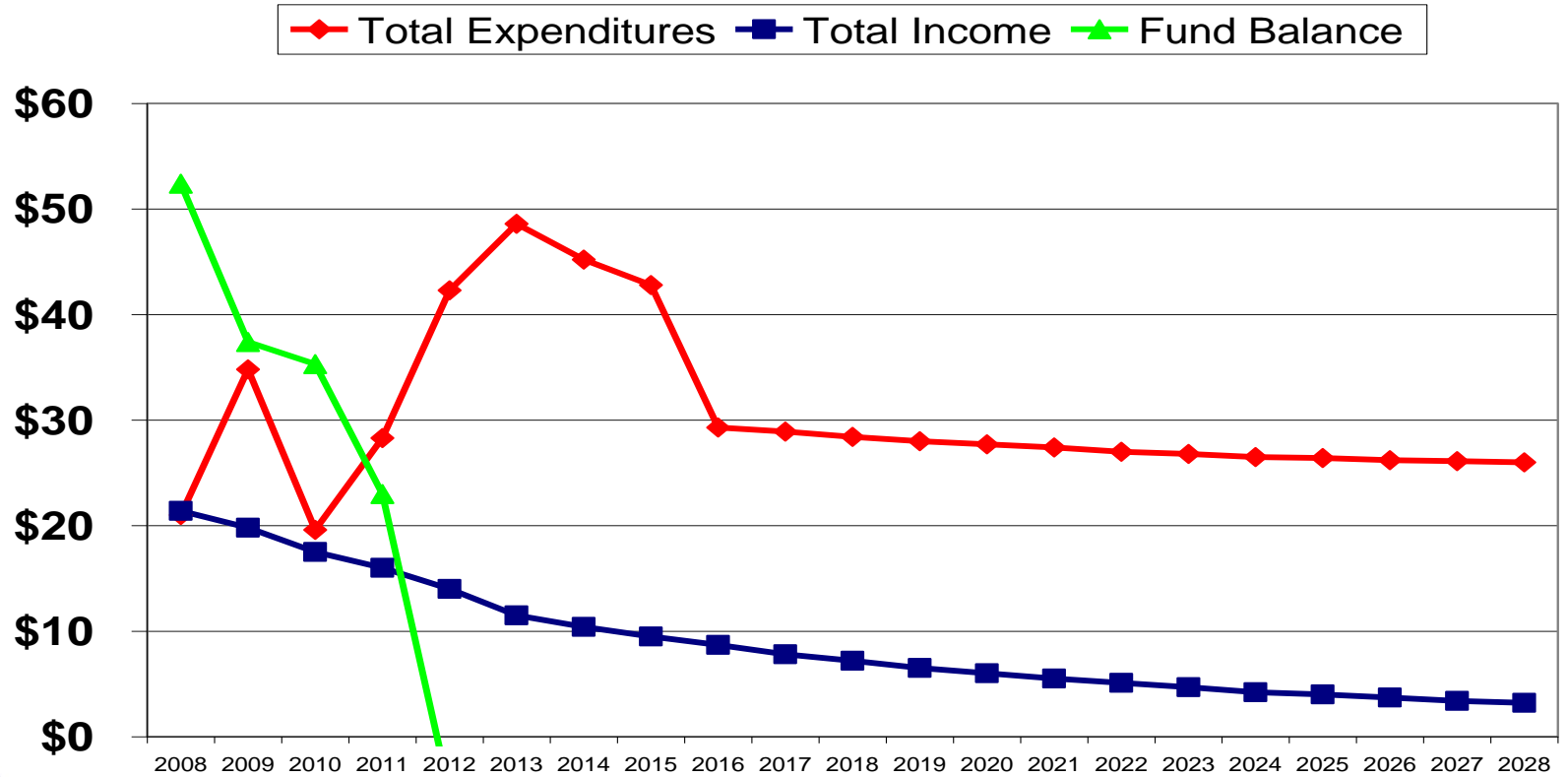
# Funded Status

## Funded Status as of June 30, 2007 Amounts in \$millions

|    |  |         |
|----|--|---------|
| 1. | Present Value of Future Revenues (FY2008-FY2027)                 | \$135.0 |
| 2. | SRF Fund Assets as of June 30, 2007                              | \$52.0  |
| 3. | SRF Fund Assets plus Present Value of Future Revenues (1. + 2.)  | \$187.0 |
| 4. | Present Value of Future Reclamation Expenditures (FY2008-FY2027) | \$386.3 |
| 5. | Funded Status = (3) / (4)  | 48.41%  |

# Statutory Valuation Projection

## SRF Projection



# Valuation Results and Observations

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**Projected expenses for known forfeitures and expected costs for anticipated future forfeitures will exceed available resources by FY 2012.**

**As DEP works to clear the backlog of current projects the time lag between forfeiture and construction will shrink – accelerating the outflow from the fund.**

**Long-term funding exceeds statutory income levels by over \$20 million per year.**

# Dynamic Modeling

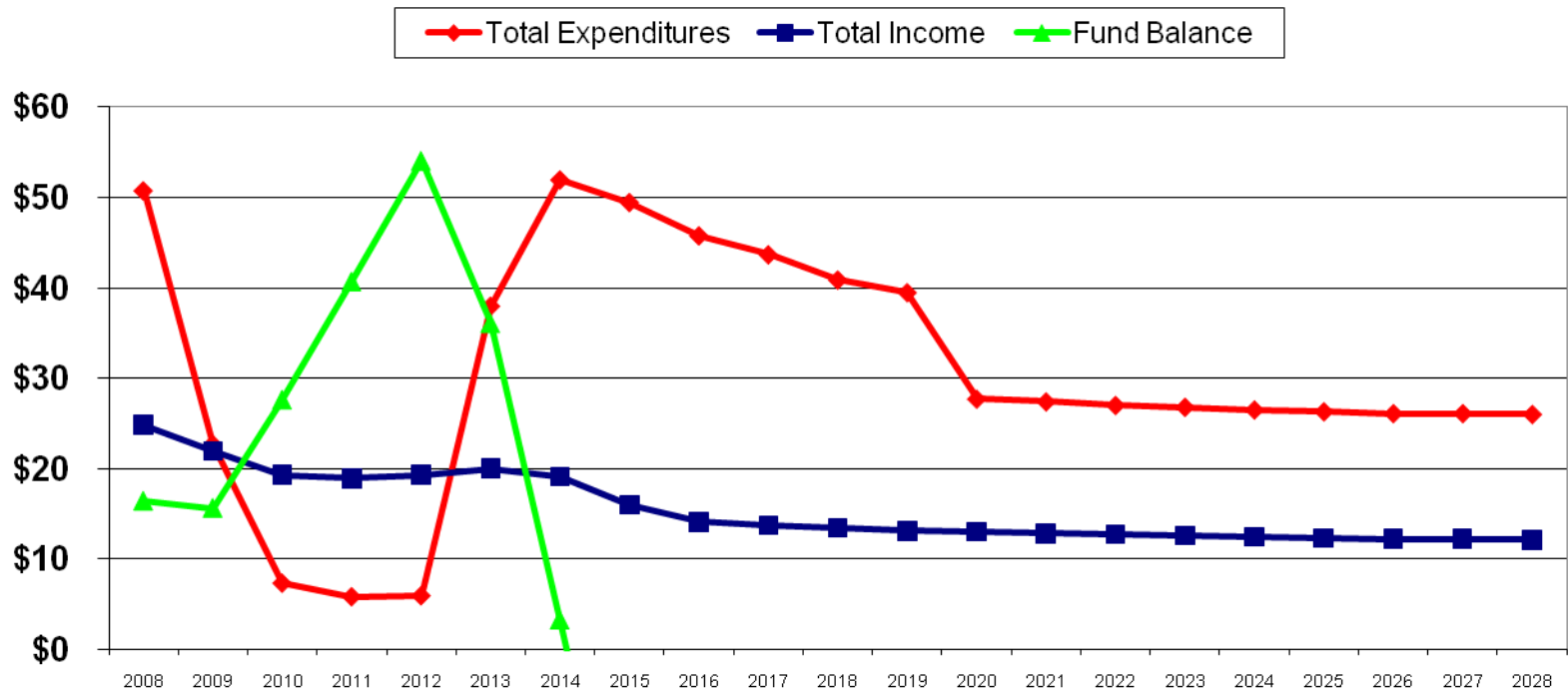
In addition to the static (statutory) valuation, a dynamic model allows the SRFAC to model “what if” scenarios.

- Full coal tax revenue
- Separate water fund
- Indexed bonding
- Coal tax rate change

# Dynamic Modeling

## Full Coal Tax Revenue

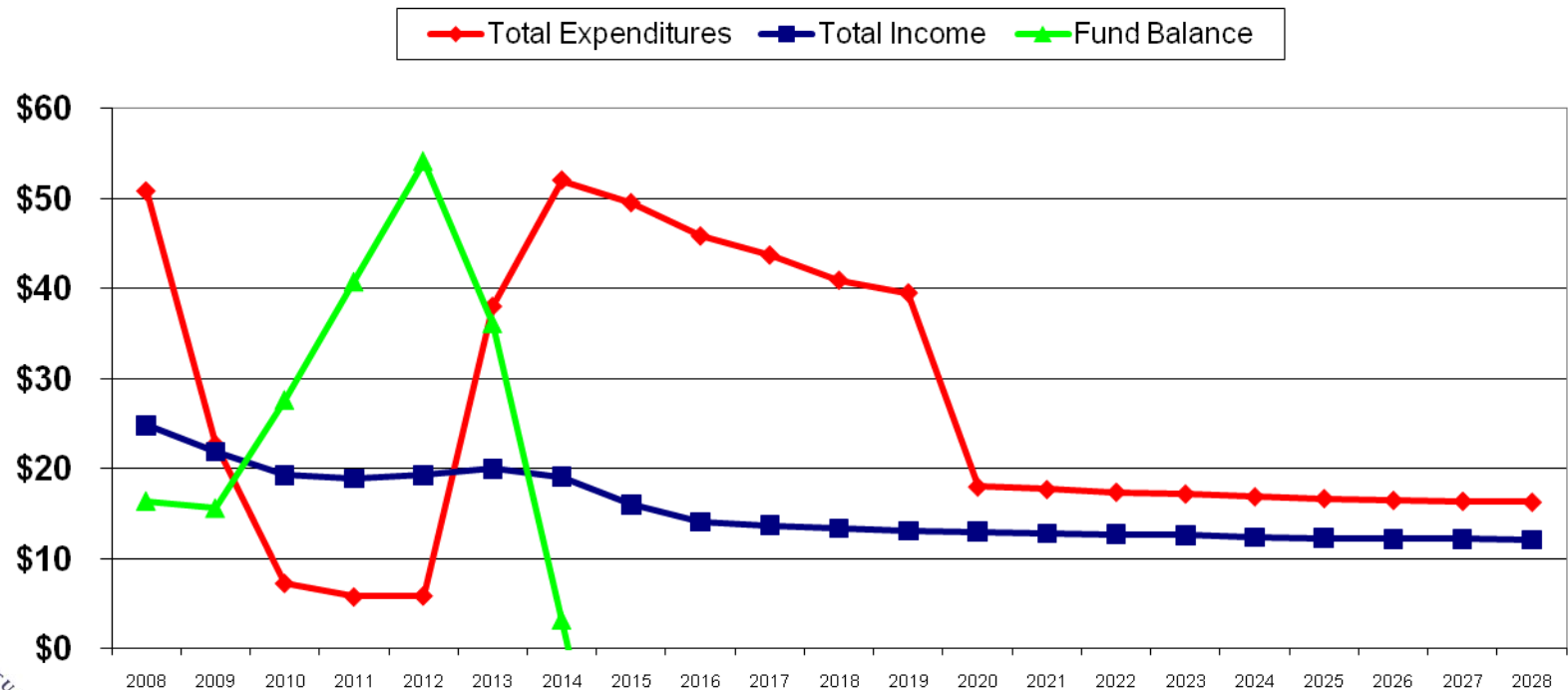
### SRF Projection



# Dynamic Modeling Separate Water Fund

All water capital and ongoing treatment costs are covered by a separate Water Fund after FY 2018

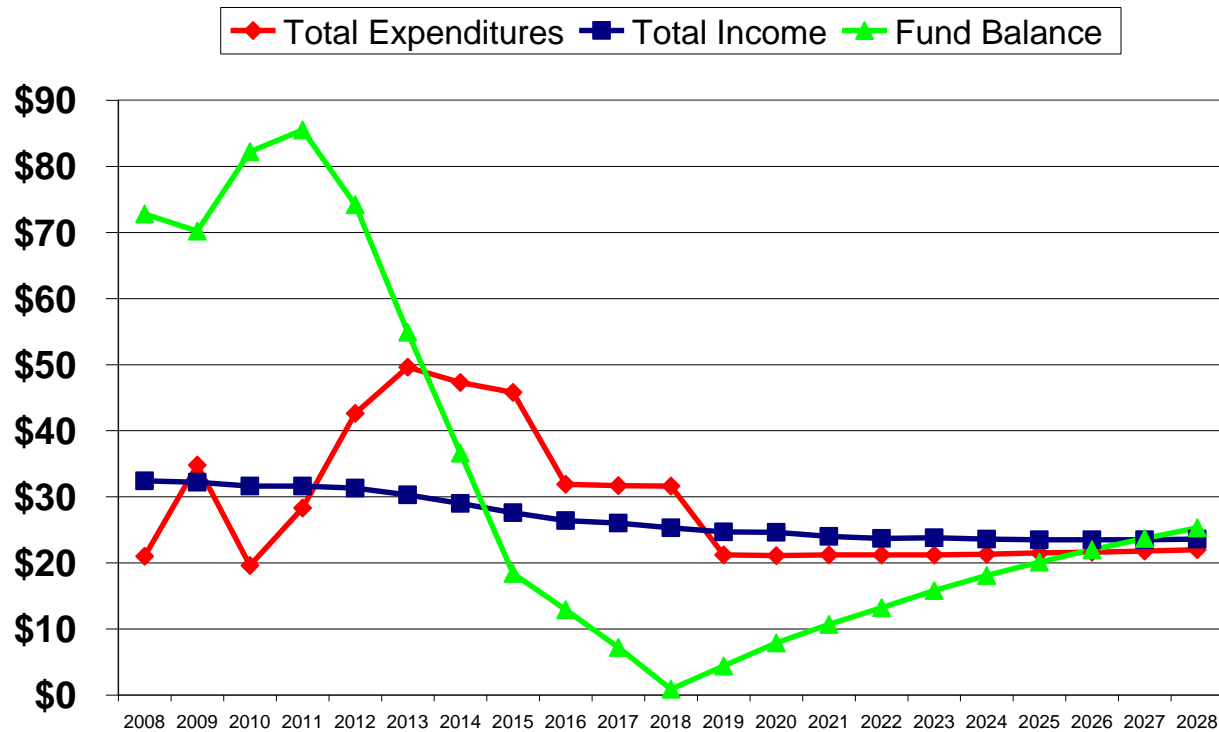
## SRF Projection



# Separate Water Fund Plus 5.9 Cents Additional Coal Tax

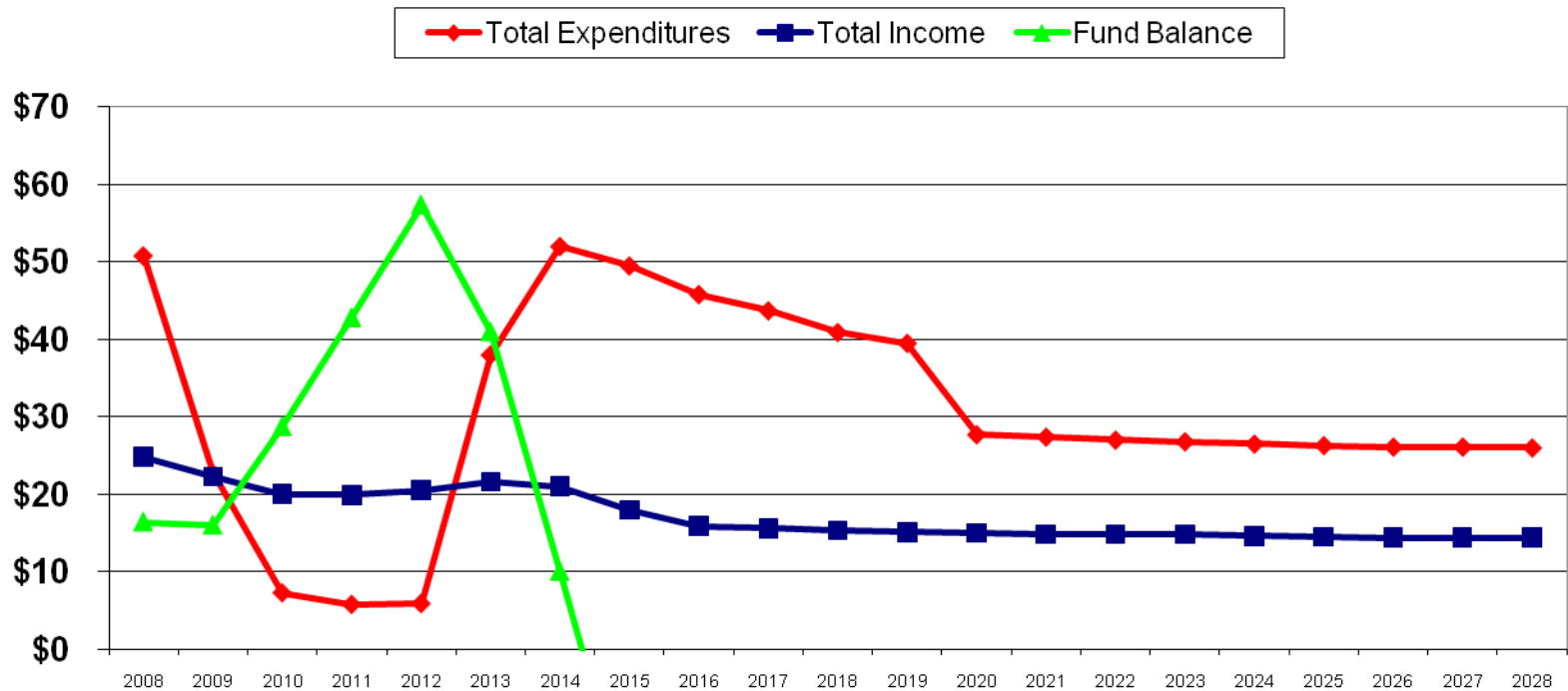
All water capital and ongoing treatment costs are covered by a separate Water Fund after FY 2018

## SRF Projection



# Indexed Bonding would require annual or periodic increases to the Bond amount to ensure the amount retains its purchasing power

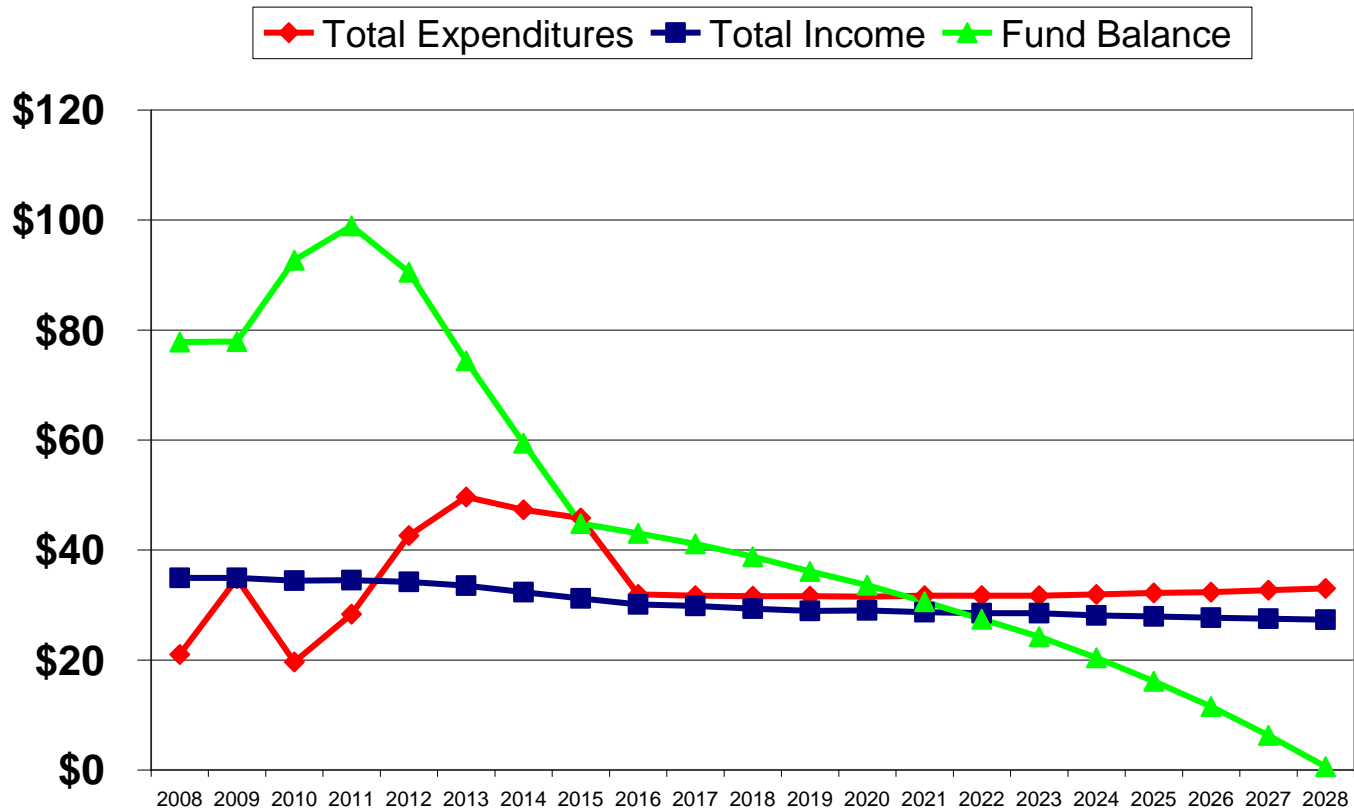
## SRF Projection



# Dynamic Modeling

## Additional Coal Tax of 7.4 cents

### SRF Projection



# Legislative Outcome

## Senate Bill No. 751

- ❑ The Special Reclamation Water Trust Fund is created within the State Treasury into and from which moneys shall be paid for the purpose of assuring a reliable source of capital to reclaim and restore water treatment systems on forfeited sites.
- ❑ For tax periods commencing on and after the first day of July, two thousand eight, every person conducting coal surface mining shall remit a special reclamation tax as follows: (A) For the initial period of twelve months, ending the thirtieth day of June, two thousand nine, **seven and four-tenths cents per ton of clean coal mined**, the proceeds of which shall be allocated by the secretary for deposit in the Special Reclamation Fund and the Special Reclamation Water Trust Fund; (B) an additional seven cents per ton of clean coal mined, the proceeds of which shall be deposited in the Special Reclamation Fund.

# Questions?

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