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So Many Water Conservation Models, What's the Difference?

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Presentation Outline

- Water conservation background
- Need for water conservation models
- Description of various water conservation models
- Comparison of water conservation models

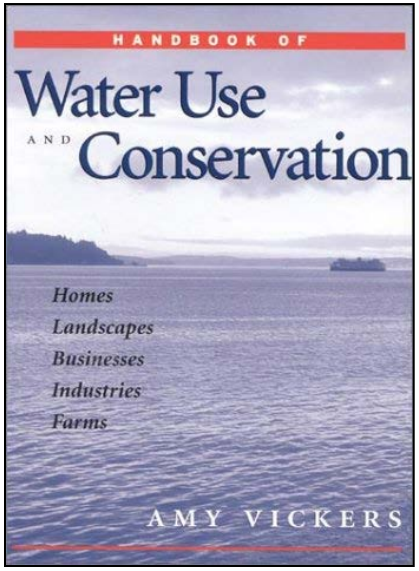
Definition of Water Conservation

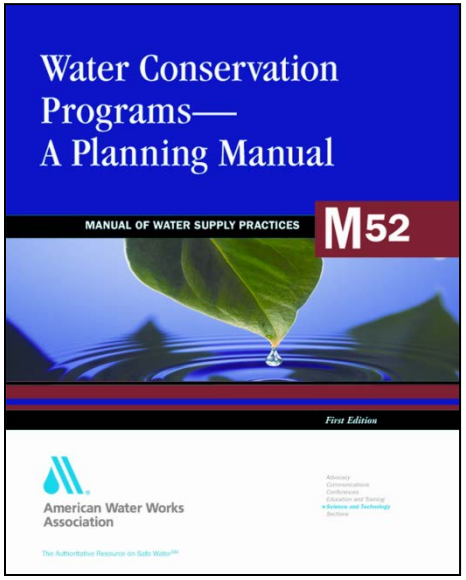
- Reduction of water use, waste, or loss
- Extend the life of current water supplies
- Program Goals
  - Indoor vs. Outdoor
  - Education Program
  - Utility, Customer, Environmental Benefits
  - Support Rate Increases

- Revenue Impacts?
  - Community Impacts
  - Customer Impacts
  - Utility Impacts

Water Conservation Planning Resources

- Handbook of Water Conservation
  by Amy Vickers (WaterPlow Press, 2001)
- Water Conservation Programs: A Planning Manual, M52
  by AWWA (2006)





10 Steps in Conservation Planning (Vickers)

1. Identify conservation goals
2. Develop a water use profile and forecast
3. Evaluate planned facilities
4. Identify and evaluate conservation measures
5. Identify and assess conservation incentives
6. Analyze benefits and costs
7. Select conservation measures and incentives
8. Prepare and implement the conservation plan
9. Integrate conservation and supply plans, modify forecasts
10. Monitor, evaluate, and revise program as needed

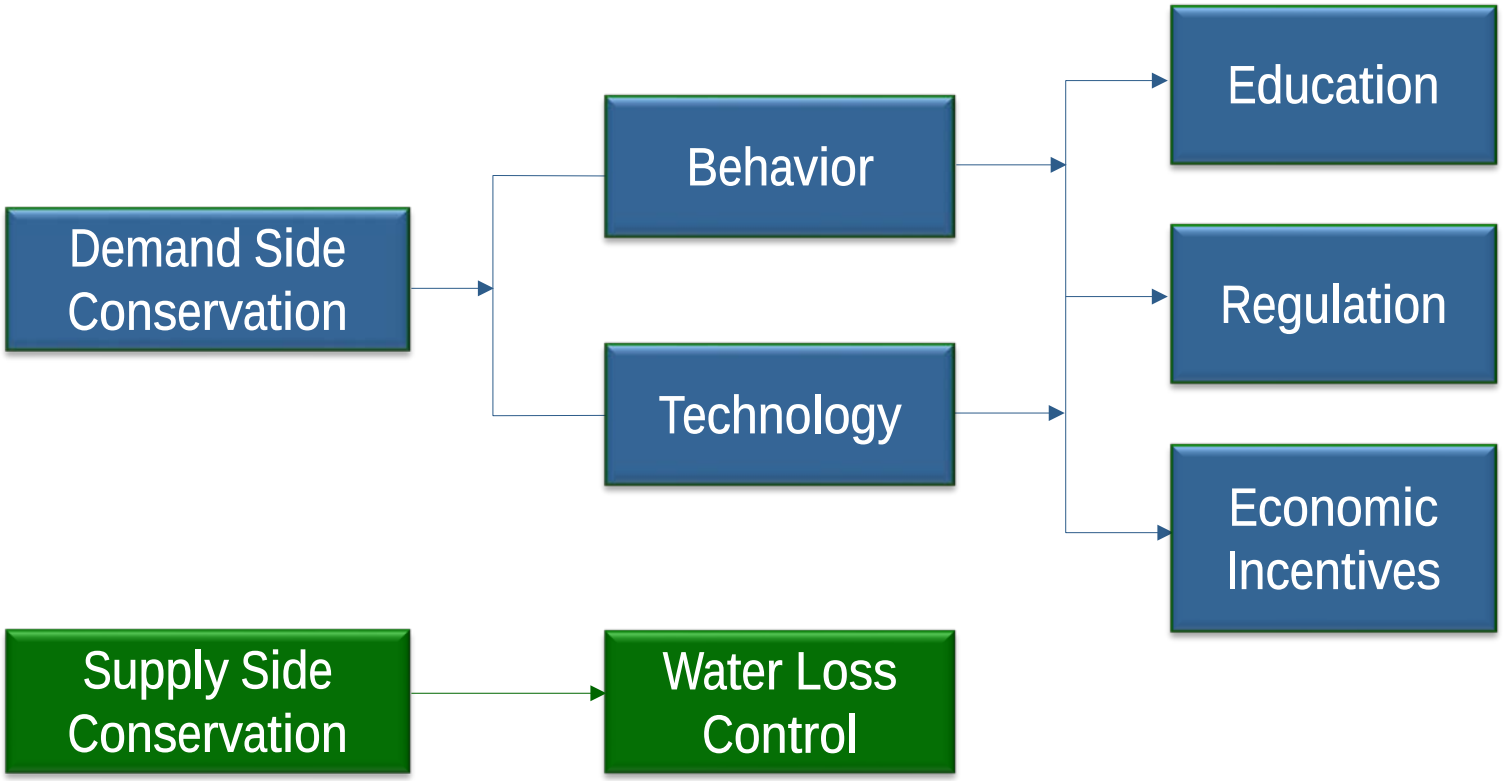
10 Steps in Conservation Planning (AWWA)

1. Review detailed demand forecast
2. Review existing water system profile and descriptions of planned facilities
3. Evaluate the effectiveness of existing conservation measures
4. Define conservation potential
5. Identify conservation measures
6. Determine feasible measures
7. Perform benefit-cost evaluations
8. Select and package conservation measures
9. Combine overall estimated savings
10. Optimize demand forecasts

Water Conservation Plan

- A comprehensive plan can include the following:
  - Current Water Use Profile
  - Water Conservation Goals
  - Demand-side vs. Supply-side Conservation
  - Program Evaluation
    - Cost Effectiveness
    - Benefit/Cost Analysis
  - Effect on Demand Projections
  - Revenue Impacts
  - Demand Hardening
  - Implementation Planning
  - Tracking and Reporting
  - Update Schedule

Water Conservation Practices Implementation Mechanisms

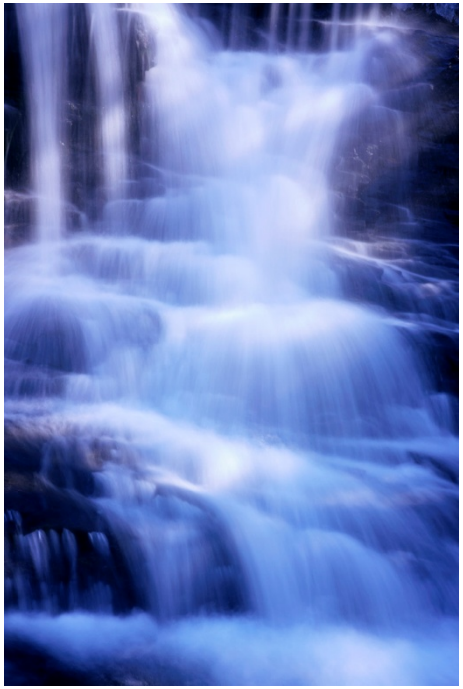


Before you can screen or evaluate conservation measures…

- You need to know:
  - What are the current demographics of your service area?
  - What or who makes up your target market?
  - How much of that target market can you or do you want to reach?
  - What is the level of consumption of the target market?
  - What is your service area going to look like in the future?

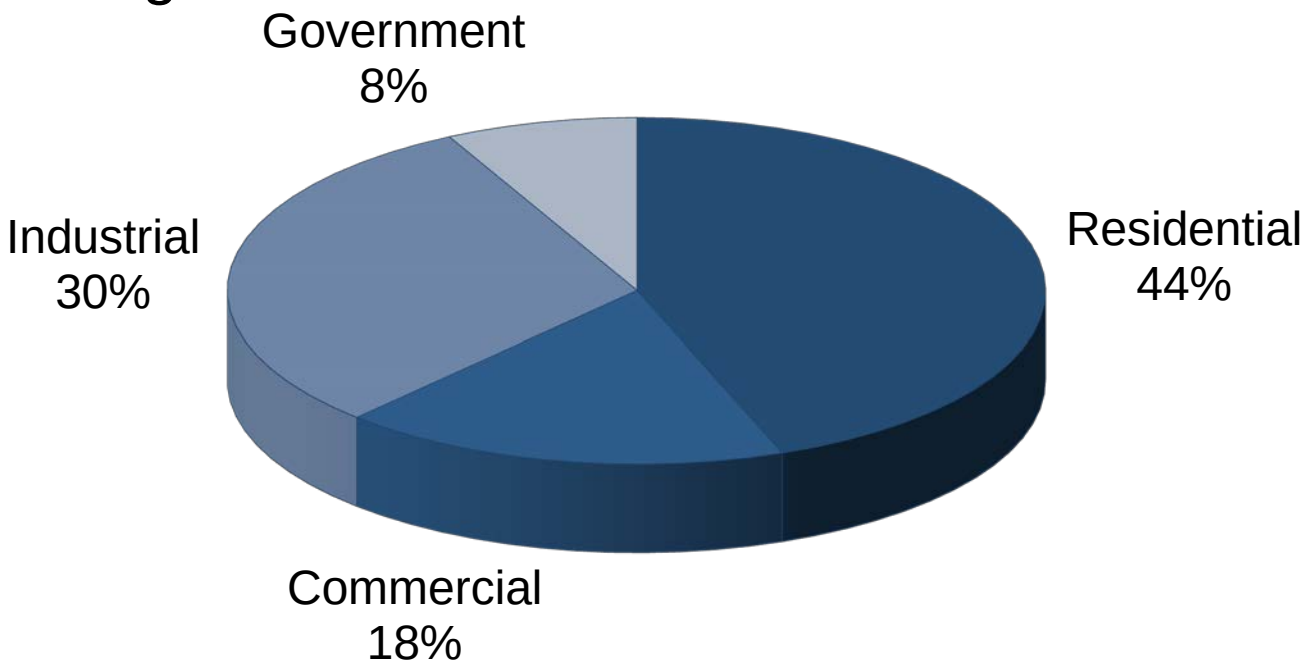
Current Water Use Profile

- Allows for comparison (with others)
- Gives credit for past success
- Sets a starting point
- Indicators:
  - Per capita (residential and overall)
  - non-revenue water
- Identifies potential targets



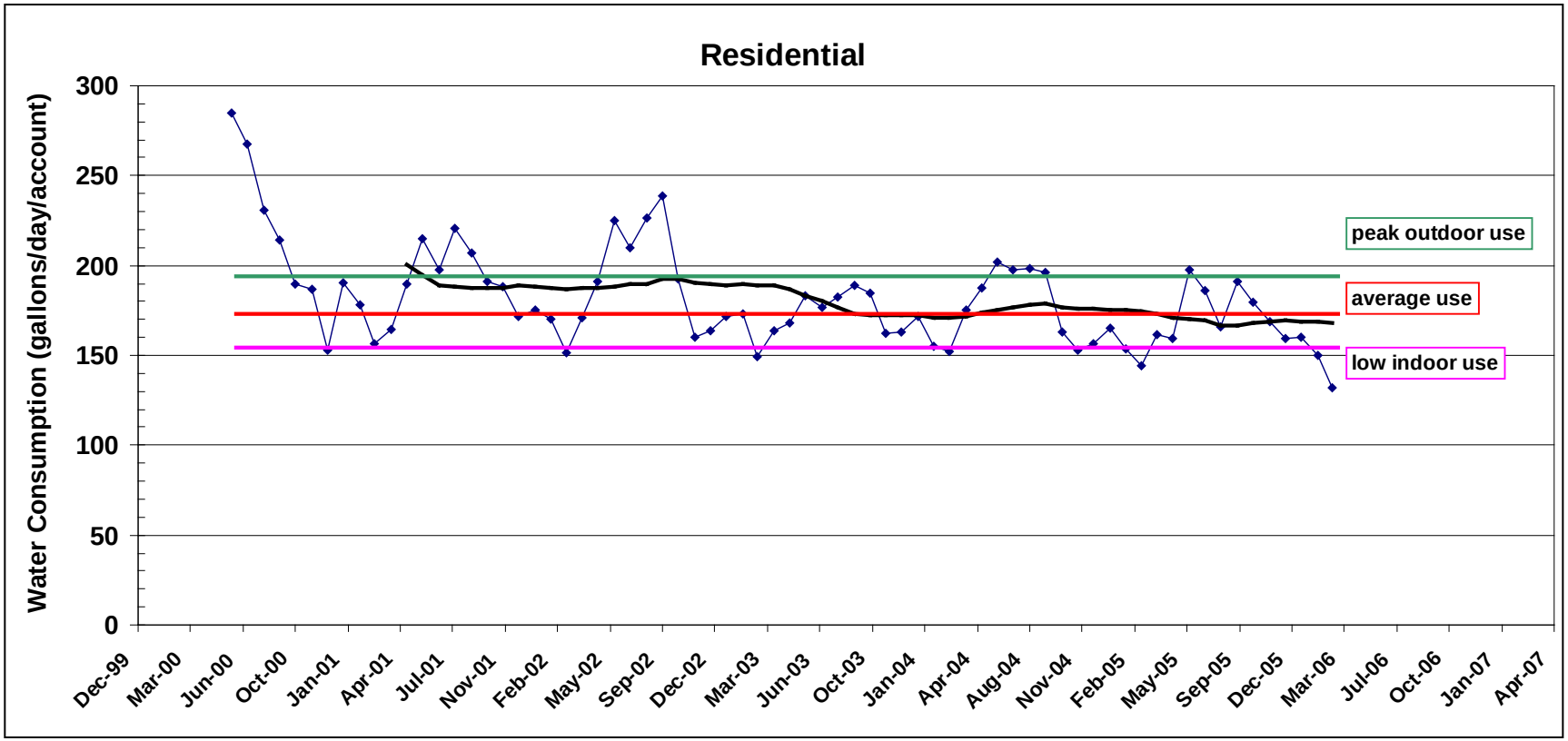
Develop the Water Use Profile

- Understand your customer water use profile
- Gather historical billing data
- Billing system categories



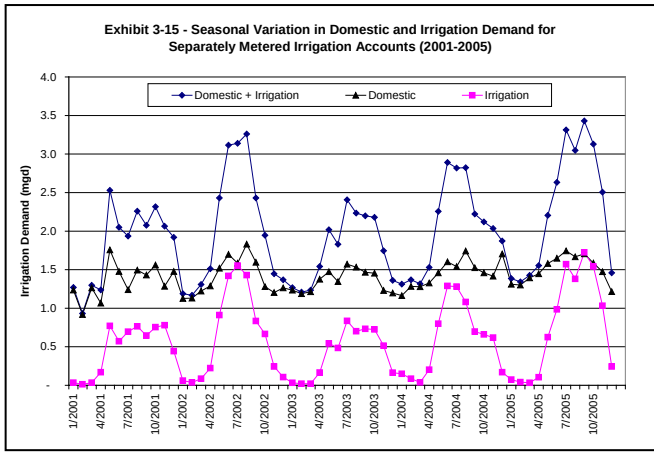
Understand Seasonal Variability

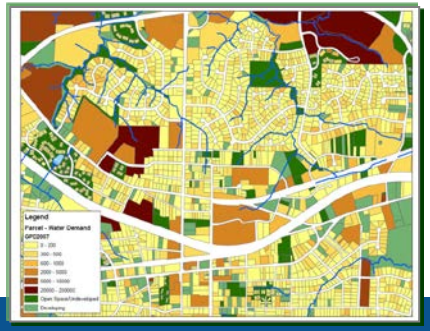
- Graph monthly usage by category
- Use multiple years (≥ 2 years)



Parcel-level Water Use Profile

- Billing Data Assessment - What to look for…
  - Consumption totals, by year and month
    - by Use Classification (C,SFR,MFR,IND,INS)
    - Service area/river basin/pressure zone
    - Monthly/Seasonal Variations
    - Irrigation and Reclaimed Water
    - Per Capita Use
    - Highest-use accounts, by Classification Category
- Parcel matching land-use type to historical use
  - University of Florida is using extensively, due to statewide database





Calculate Existing Per Capita

- Population Served
  - Jurisdictional boundaries
  - EPA SDWIS
  - Residential Accounts x household size (from census)
- Overall Per Capita Water Use
  - Influenced by non-residential users
  - not good for setting goals
- Residential Per Capita Water Use
  - Well defined
  - Known water “end-uses”

Select the Right Conservation Programs

- Based on Water Use Profile Analysis
  - residential vs. non-residential
  - indoor vs. outdoor
  - old vs. new
- Customer Acceptance
- Cost Effectiveness

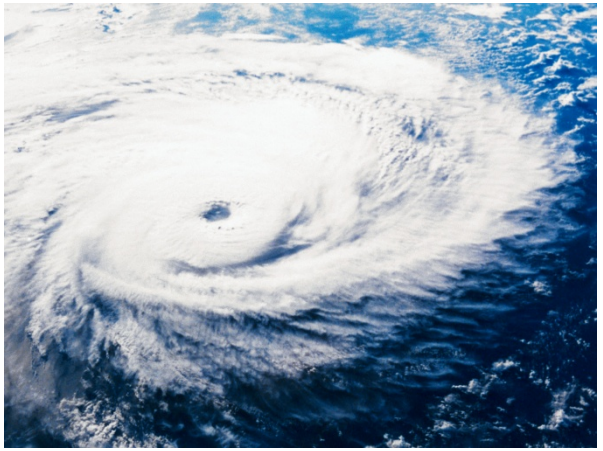
Water Conservation Measure Screening

- Evaluate based on 4 different criteria (AWWA)
  - Technology/Market Maturity
  - Service Area Match
  - Customer Acceptance/Equity
  - Better Measure Available

Measure		Criteria					
Device or Program	**Method / Incentive**	**Technology /Market Maturity**	**Service Area Match**	**Customer Acceptance / Equity**	**Better Measure Available**	**Score**	**Pass (>16)**
Single Family Residential – Indoor							
Existing Accounts							
Require 1.6 gal/flush toilet to be installed at the time of sale	requirement at time of sale	5	4	4	4	17	Y
Rebates for 6/3 dual flush or 4-liter toilets	rebate	4	3	3	2	12	N
Rebates for high efficiency clothes washers	rebate	5	4	4	4	17	Y
Low income home leak detection and repair	promote	2	3	3	2	10	N
Distribute retrofit kits w/low flow showerheads	requirement	5	4	4	4	17	Y
Increase school education programs	sponsor	5	4	3	4	16	Y
New Homes							
Require high efficiency clothes washing machines	requirement	5	4	2	3	14	N
Insulate hot water piping	requirement	5	4	3	3	15	N
Residential hot water recirculation - require for new homes	requirement	3	4	2	3	12	N
Residential hot water recirculation - incentives for new homes	rebate	3	4	3	3	13	N
Rebates for 6/3 dual flush or 4	rebate	3	4	3	4	14	N

Understand Interactions

- Weather
  - Drought can make peaks increase, but restrictions can make revenue decrease
  - Wet year can give false sense of conservation success
- Economic
  - High gas prices can make folks think twice about other expenses
  - Home building trends
  - Industrial fluctuations or efficiencies
- Others?

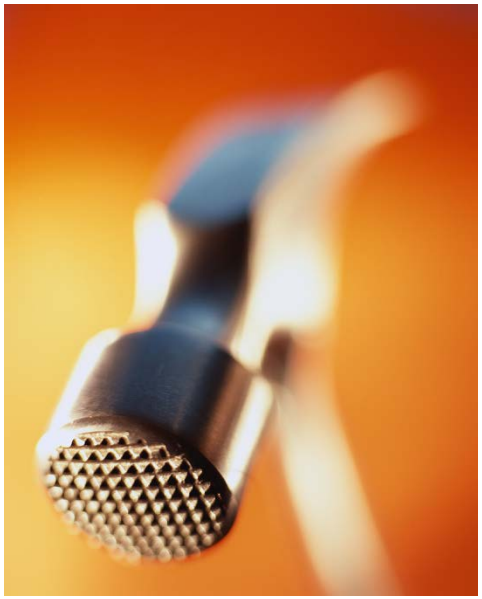


Program Evaluation

- Not all measures can be evaluated based on water savings (education, retrofit kits)
- Water savings take time to appear (multiple years)
- Progress can be measured by:
  - Implementation
  - and/or
  - Water Savings
- Programs can overlap (don't over estimate the savings)

Water Conservation Models

- Need for conservation models
- History of conservation models
- Basic methodology
- List of different available models
- Comparison of features
- Evaluation of differences
- Conclusions



Need for Water Conservation Models

- Provides a way to compare effectiveness of water conservation practices
  - water savings
  - cost
- Municipal, Commercial, Urban Irrigation

History of Water Conservation Models

- 1968 – early developments of IWR-MAIN
- 1992 – CUWCC BMP models
- 1998 – US EPA Guidelines
- 1998 – Confluence
- 1999 – Maddaus DSS model
- 1998 + Custom Utility/Consultant models
- 2006 – WaterRF/CUWCC model
- 2006 – Conserve Florida GUIDE
- 2009 – AWE model

Source: Water Efficiency, September-October 2009

Basic Methodology

- Profile customer base, describe characteristics
- Using pre-determined assumptions, calculate water savings and costs for selected conservation programs
- Incorporate plumbing code effects
- Forecasts of growth and/or water savings
- Benefit/Cost and/or Cost-Effectiveness Analysis

Cost Effectiveness or Benefit-Cost Analysis

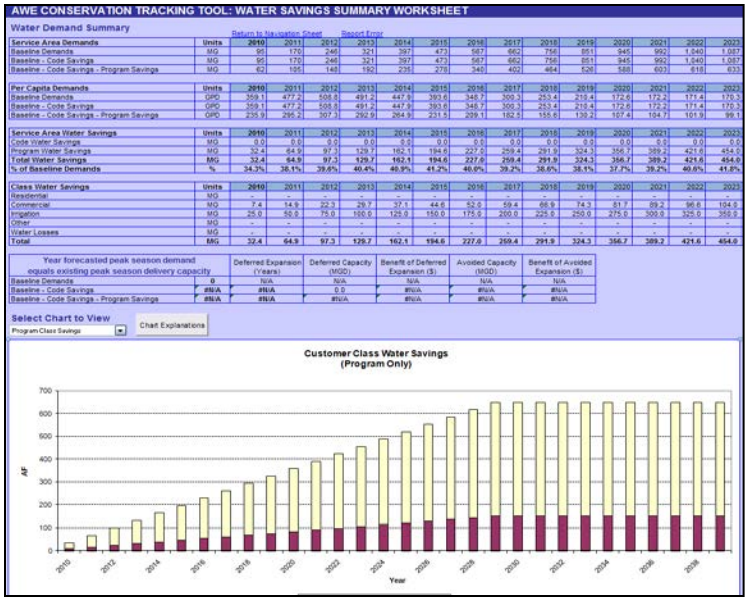
- Cost Effectiveness Analysis
  - Use models to evaluate the cost effectiveness of each program ($/gal or $/kgal saved)
  - Compare with cost of new or expanded supplies/production or alternate conservation programs
- Benefit-Cost Analysis
  - Assess benefits of conservation measures
    - Avoided cost of water savings
      - Utility savings
      - Customer savings
    - Environmental benefits
  - Evaluate full cost of water conservation measures
    - Set up, marketing, admin, unit costs
    - Revenue adjustments
    - Customer costs

List of Available Models

- AWE (free with membership)
- Maddaus DSS (proprietary)
- IWR-MAIN (proprietary)
- Conserve Florida EZ GUIDE (free, Florida-specific)
- Various consultant and utility spreadsheet models
- WaterRF/CUWCC Models (cost of WaterRF report)
- CH2M HILL Voyage™ integrated conservation module

AWE Conservation Tracking Tool

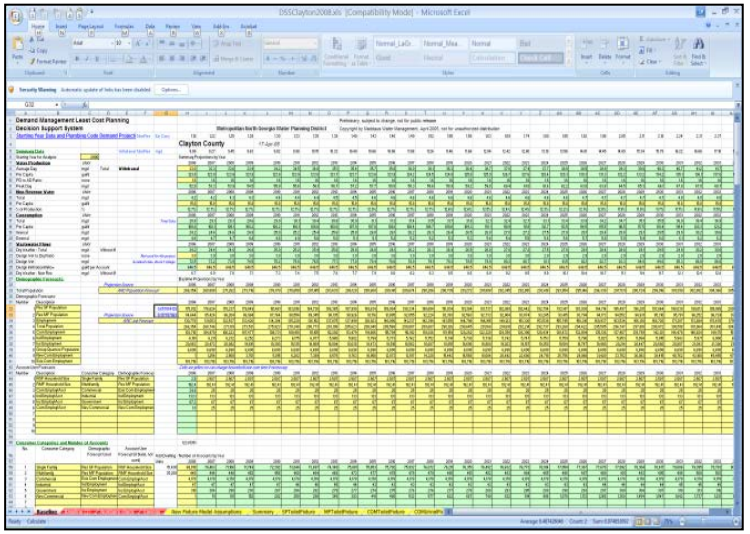
- Meant for use by member utilities
- Data entry screens
- Growth by sector
- Conservation practice library (25 built-in)
- Customizable practices
- Revenue Impact module
- Multi-scenario capability
- Implementation tracking
- Further development is ongoing



Maddaus DSS Model

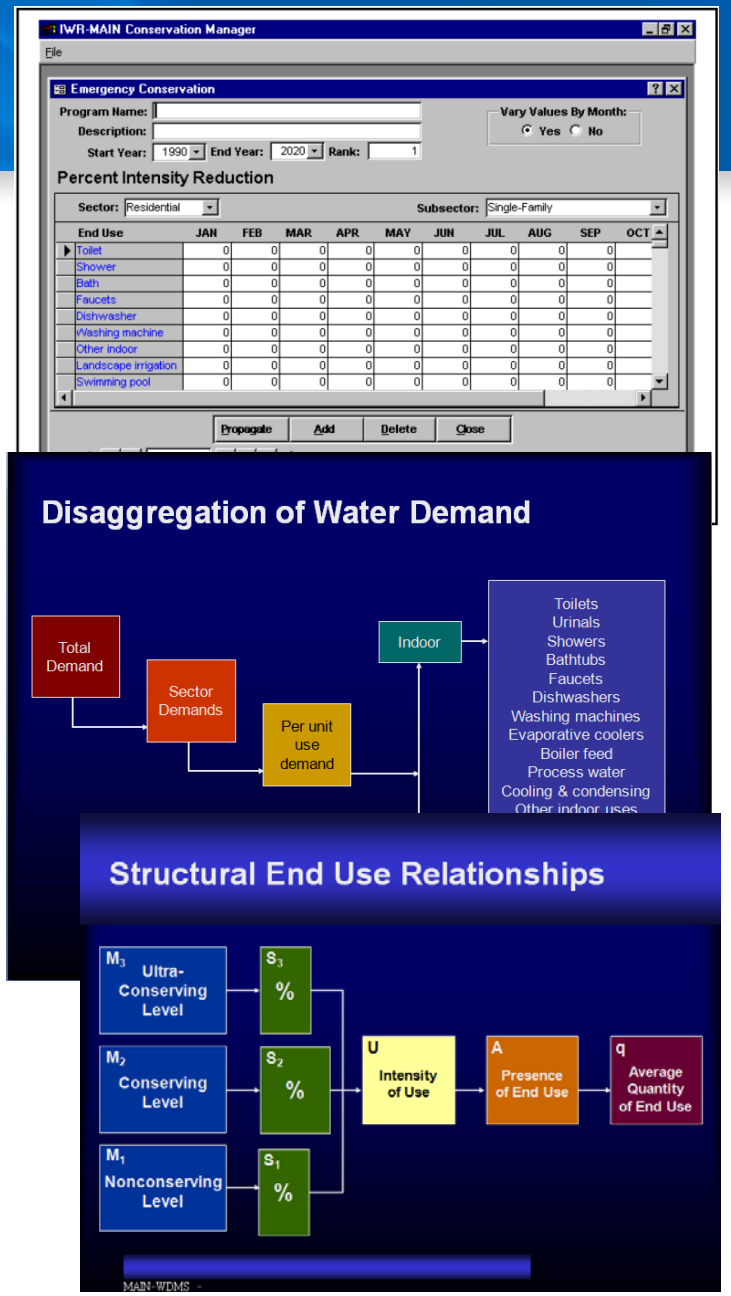
- Used in Metro Atlanta and Bay Area planning (among others)
- End-use model
- Sophisticated forecasting model
- Detailed water billing data needed
- Top-down calculation and bottom-up verification
- Calculates practice interaction, to avoid overestimation
- Includes project cost deferral and downsizing
- Program customization by combining practices
- Per capita tracking capability
- Plumbing code calculation and customization
- Not so user friendly, no built in practices
- No tracking capabilities

Maddaus Water Management



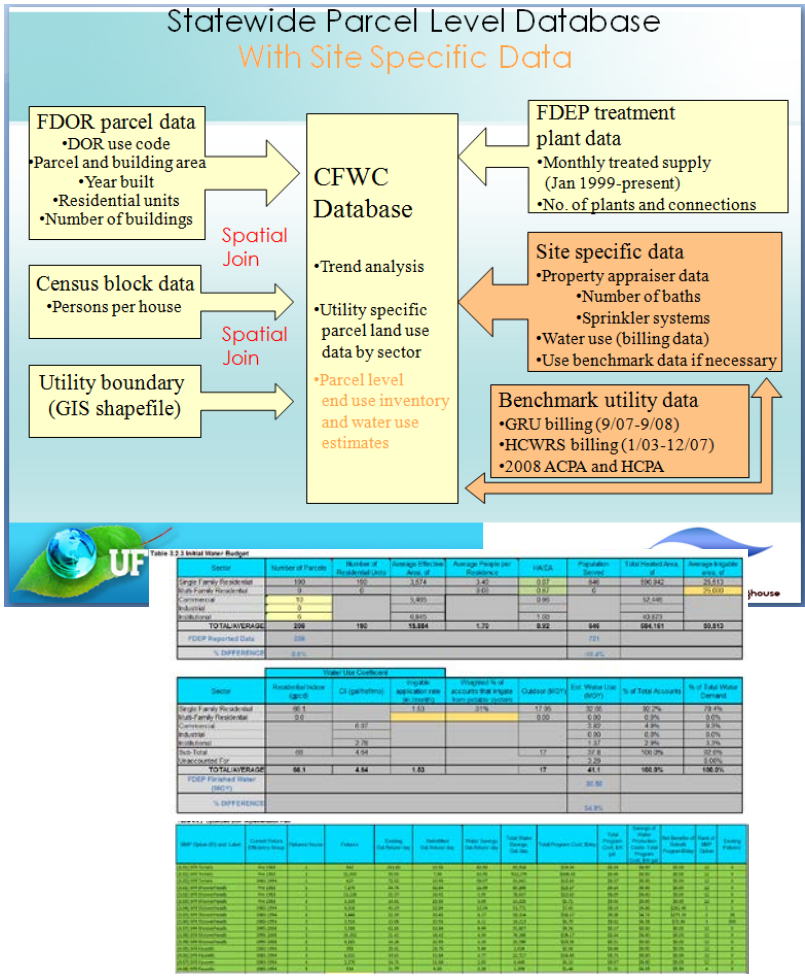
IWR-MAIN

- Municipal And Industrial Needs (MAIN)
- Proprietary use with CDM (PMCL)
- End-use methodology with calibration
- Calculates practice interaction on end-uses
- MS Access-based forecast manager
- MS Excel-based conservation manager
- Detailed forecasting ability
- Benefit-Cost Results calculation
- Includes project cost deferral and downsizing
- Economic-driven results
- Extensive use on Corps water supply projects
- Long list of municipal applications
- Not so user friendly
- No built in practices
- No tracking capability



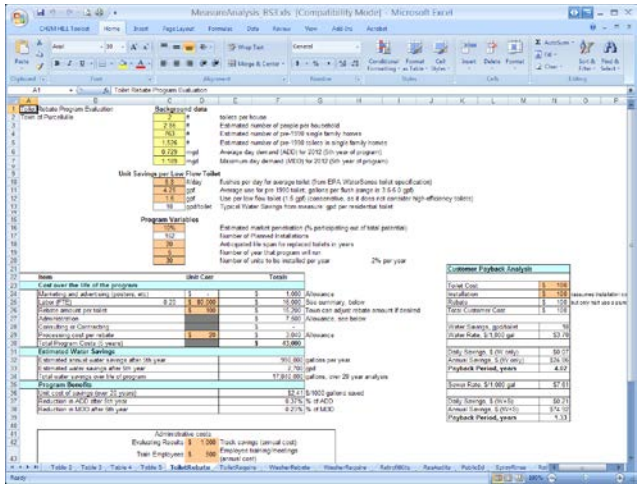
Conserve Florida Water EZ Guide 2.0

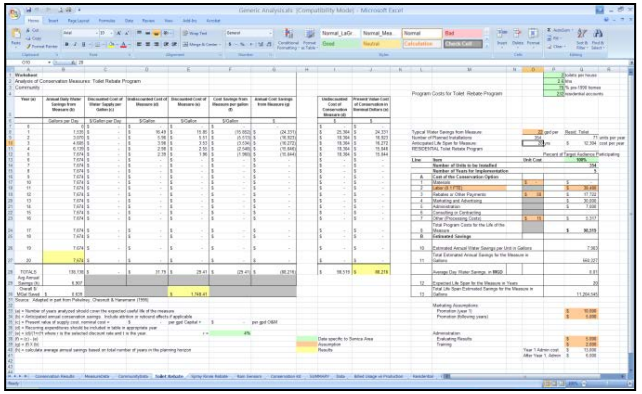
- Meant for use by Florida water systems
- Data entry screens
- Allows for loading of State data on Monthly Operating Reports and Parcel data
- Limited BMP library
- Residential only (SF and MF) (CII coming soon)
- No forecasting ability
- Tracking feature
- Further development is ongoing
- University of Florida



Spreadsheet Tools

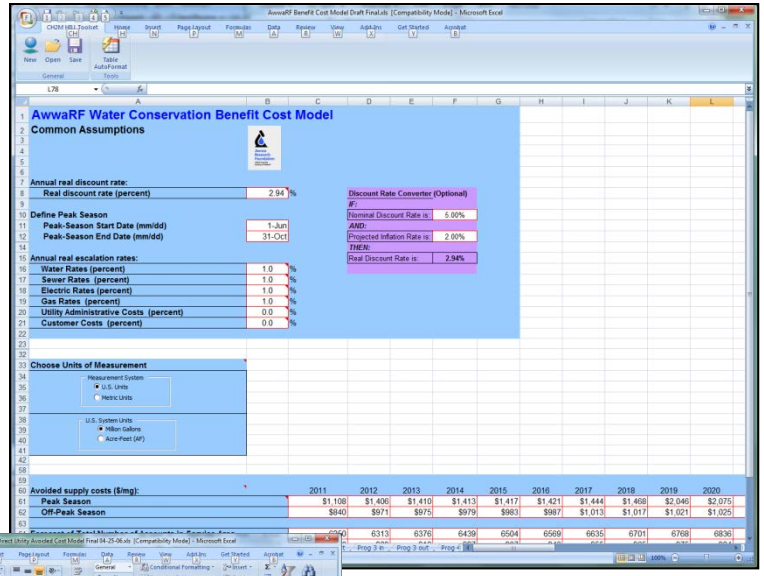
- Developed based on US EPA Report (1998)
- Customized to incorporate end-use modeling
  (to avoid overestimation of savings)
- Can be expanded to add many practices
- Evaluates full implementation, can be adjusted
- Detailed water billing data needed
- Semi-complex, training needed
- No tracking capability
- Limited existing forecasting capability

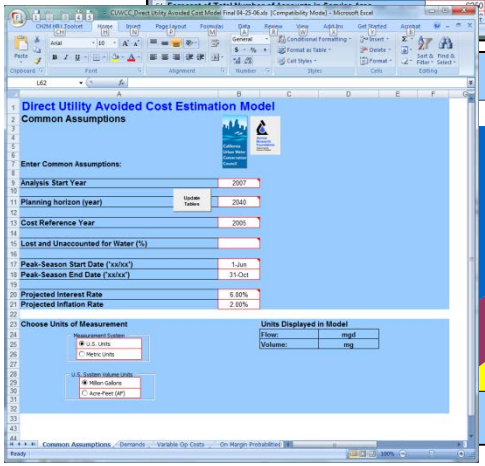


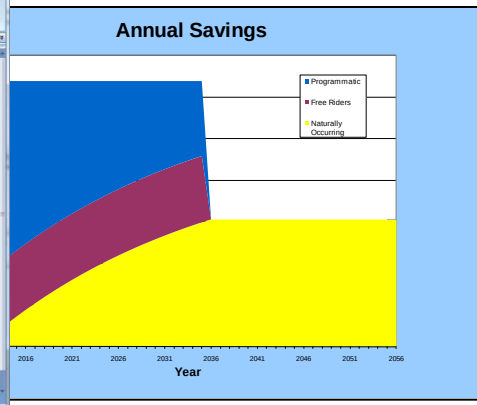


WaterRF/CUWCC Model

- Developed in 2006
- Benefit Cost Model
- Avoided Costs Model
- Environmental Benefits Model
- Forecasting Ability
- No water use profile
- Includes project cost deferral and downsizing
- Economics driven modeling tool
- No built-in practices
- No tracking capabilities
- No ongoing development

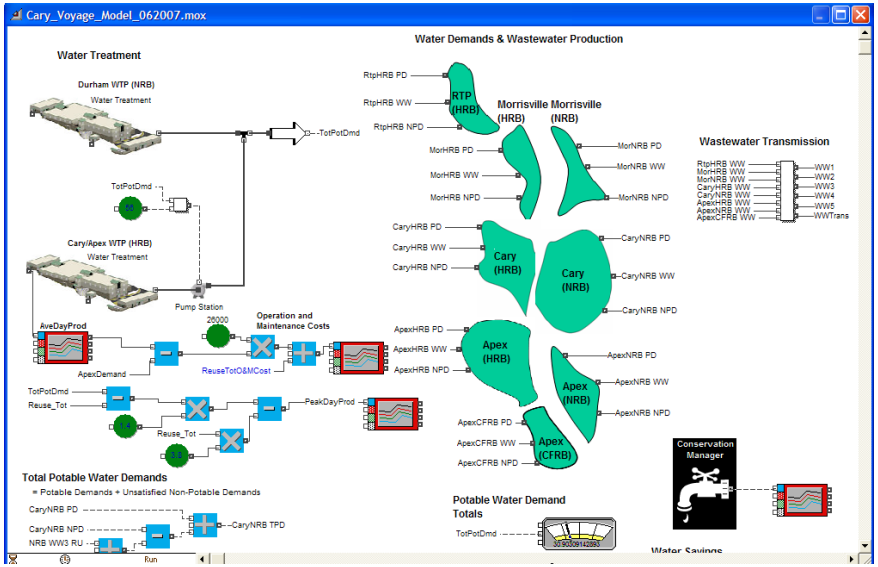


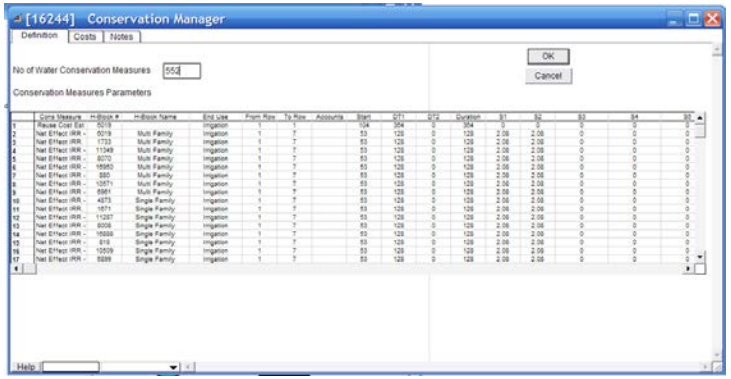




CH2M HILL Voyage™ Conservation Module

- Integrated into Voyage™ Total Water Management Model
- Cary, NC IWRMP
- See impacts of demand management on related issues
  - Interbasin Transfer
  - Reclaim water implementation





Model Comparison

- Alliance for Water Efficiency Conservation Tracking Tool (AWE)
- Demand Side Management Least-Cost Planning Decision Support System (DSS) (Maddaus Water Management)
- IWR-MAIN (CDM)
- Conserve Florida EZ-Guide 2.0 (University of Florida)
- Spreadsheet tools
- WaterRF/CUWCC Model

- All Microsoft Excel-based models

Comparison of Features

Feature	AWE	DSS	IWR-MAIN	Conserve FL	Spreadsheets	WaterRF/ CUWCC
Customer profile	Manual	Semi-automated	Semi-automated	Semi-automated	Semi-automated	Manual
Growth forecast	Yes	Yes, by sector	Yes, detailed	No	Limited	No
# of practices	50	50	Unlimited	Unknown	Unlimited	10
Practice interaction	No	Yes	Yes	No	No	No
Cost calculation	Yes, PV	Yes, PV	Yes, PV	Yes	Yes, PV	Yes, PV
Ease of use	Training required	Consultant required	Consultant required	Manual available	Training recommended	Manual available
Tracking	Yes	No	unknown	Yes	No	No

PV = Present Value

Summary

- AWE Tool is newest, and being developed actively
- DSS and IWR-MAIN are sophisticated, proven tools, still in active use
- Conserve Florida EZ Guide has support and is being developed, has advanced parcel analysis capability (in Florida only)
- Spreadsheet tools are readily available, need adaptation to local uses, and customization to needs
- Lots of tools are available

- What is the goal? How much detail is needed? How robust does the analysis need to be? What confidence in the savings estimates is required?

So Many Water Conservation Models, What's the Difference?

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