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**Presentation at University of Florida Water Institute Symposium
February 2010**

¹Presenter

Cyberinfrastructure for Demand Side Management of Urban Water



Topics to Cover

- Cyberinfrastructure and urban water
- EZ Guide 2.0 macro to nano methodology
- Optimization methodology-toilet example
- Drilling down to find the most promising customers
- Selecting priority retrofit customers
- Summary and conclusions

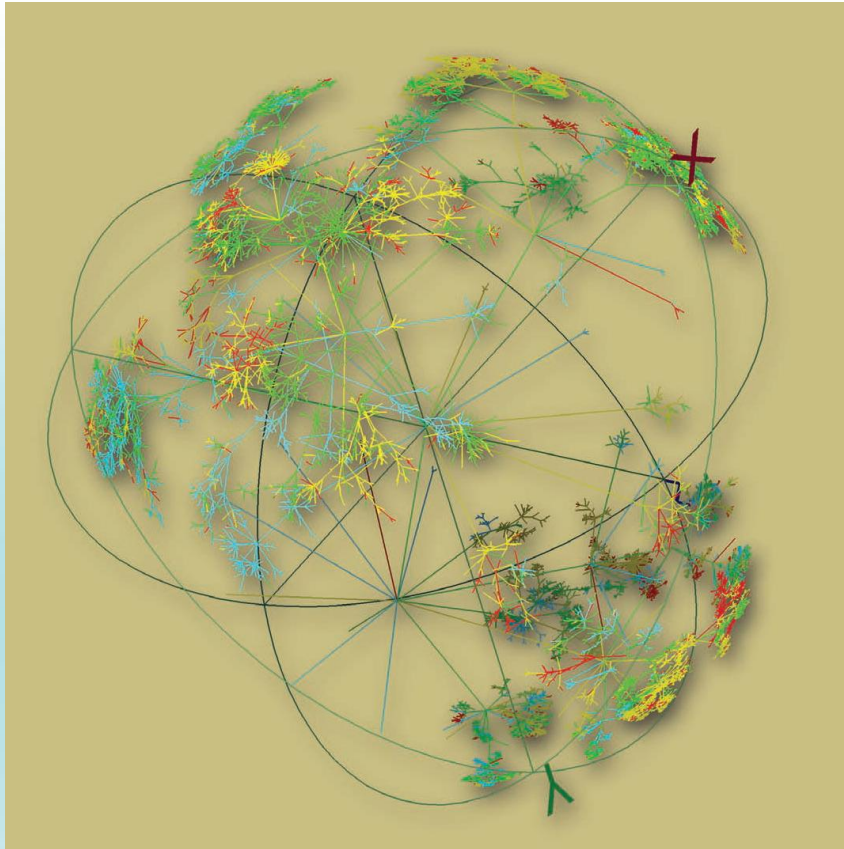
Cyberinfrastructure and Urban Water-2010 NSF Initiative

<http://www.nsf.gov/pubs/2010/nsf10524/nsf10524.pdf>

- How can our built water systems be made more reliable, resilient and sustainable to minimize consumption of water for energy generation, industrial and agricultural production and built environment requirements, and reuse for both potable and non-potable needs?

NSF Cyberinfrastructure Vision for the 21st Century (March 2007)

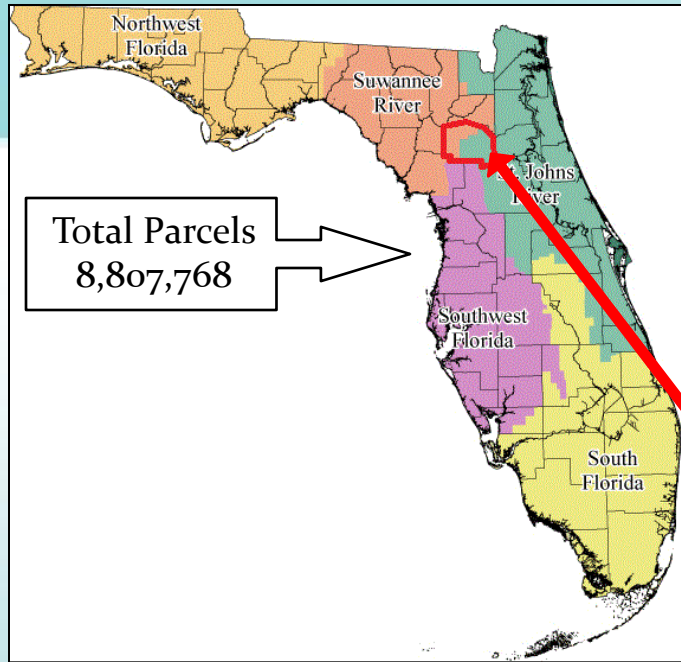
<http://www.nsf.gov/pubs/2007/nsf0728/nsf0728.pdf>



- Computing systems
- Data
- Information resources
- Networking
- Digitally enabled sensors
- Interoperable suite of software services and tools

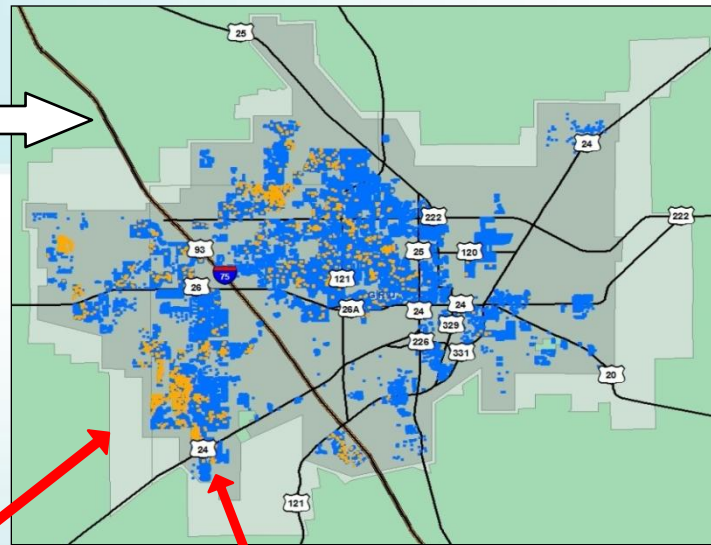
Overall Urban Water System Problem

- Objective:
 - Maximize: (Total Benefits – Total Costs)
- Options to Consider:
 - Traditional groundwater and surface water sources-limited future option for Florida
 - Alternative water supplies-wastewater and stormwater reuse, desalination, etc.
 - Water conservation-indoor and outdoor BMPs, water loss management

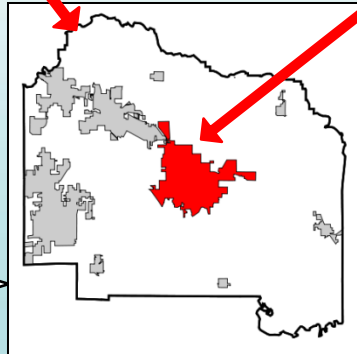


Total Parcels
8,807,768

Total Parcels GRU
55,551



Parcels Alachua
99,305



SFR parcels GRU
30,910



EZ Guide 2.0 Databases

FDOR data

Census data

Conserve Florida Water
database

Parcel info
by sector

People per
house

WMD utility
boundaries

Parcel and Census
info by sector for
each utility

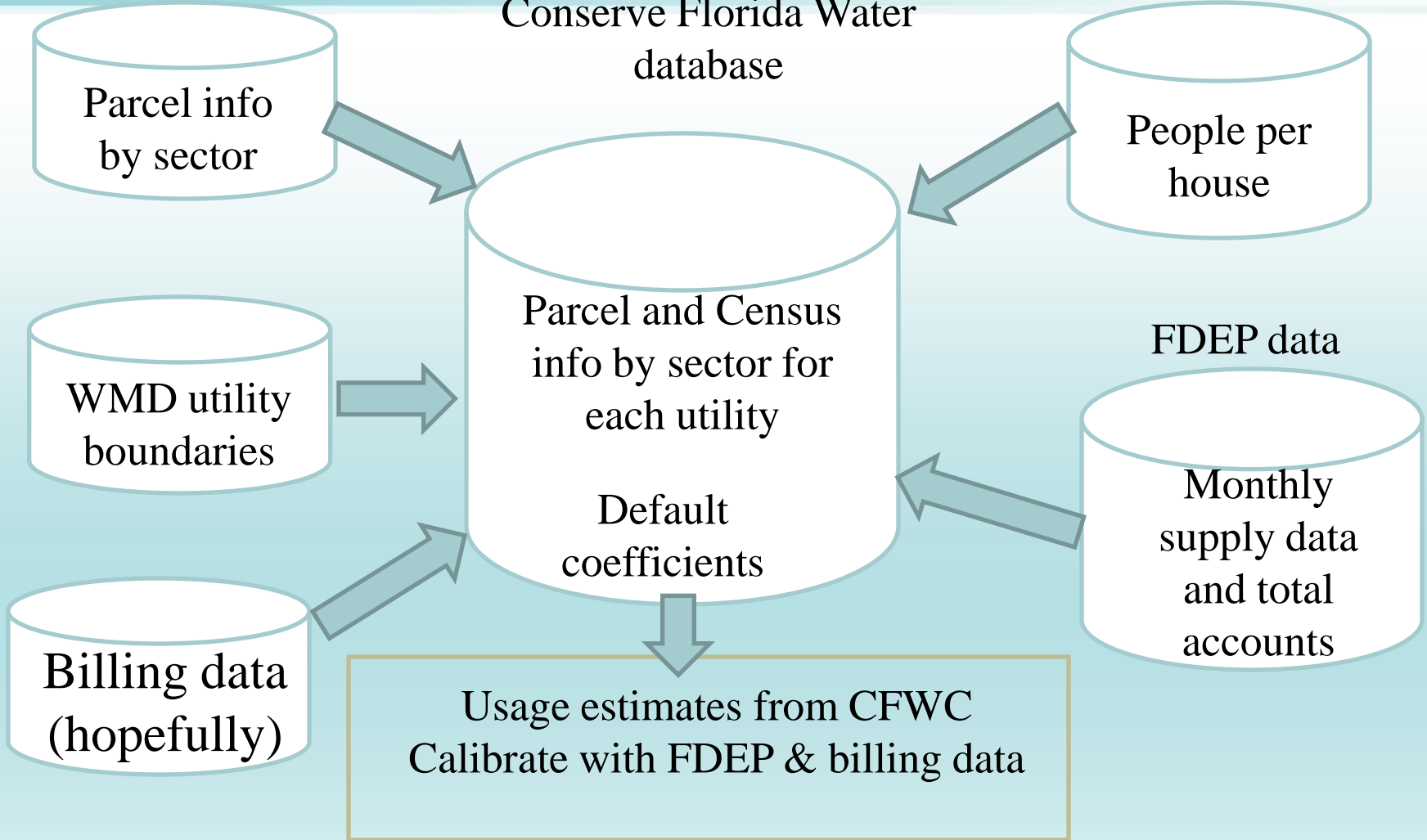
FDEP data

Default
coefficients

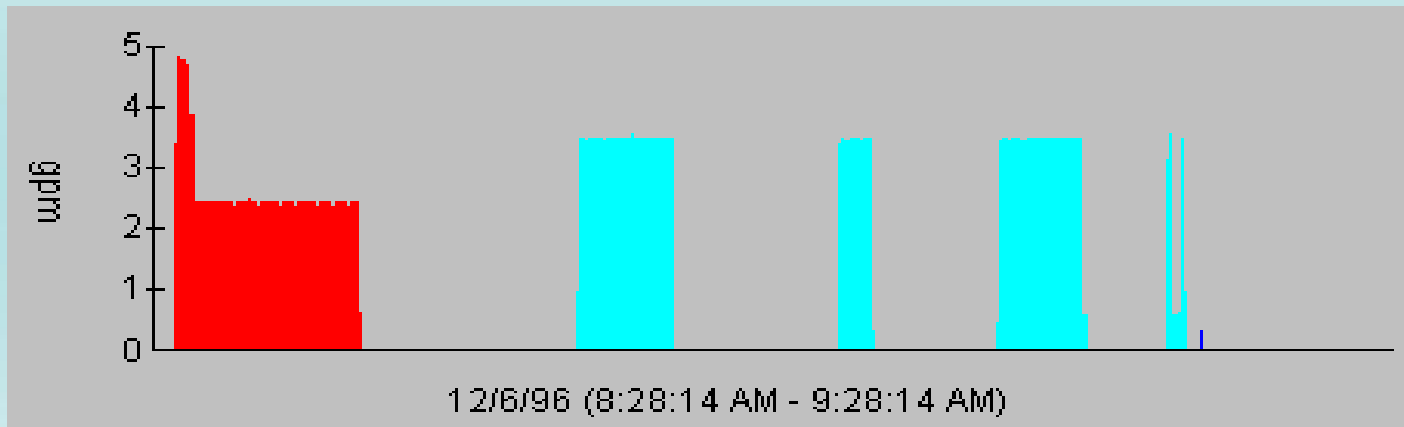
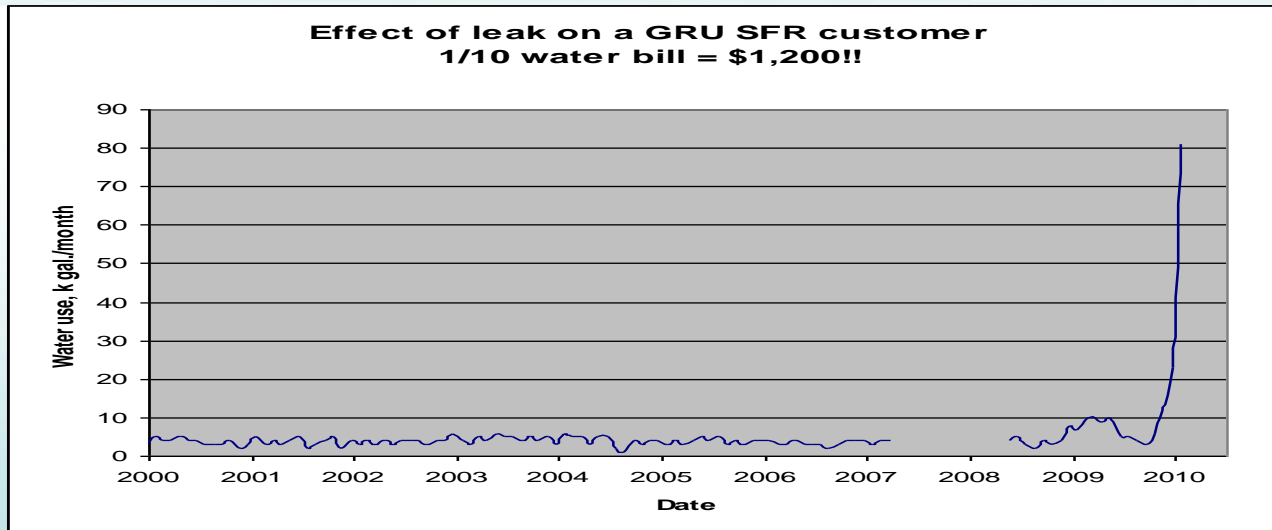
Monthly
supply data
and total
accounts

Billing data
(hopefully)

Usage estimates from CFWC
Calibrate with FDEP & billing data



Examples of Monthly and 10 Second Data



Shower (red) and clothes washer cycles (blue)

Conserve Florida Data Retrieval Service

Web page to access web service available

<http://ees-onservefl.ad.ufl.edu:8082>

Data can be previews and downloaded as .csv file and opened in Excel

- DOR Query Parameters

- County Name
- City Name
- Zip Code
- DOR Land Use Code
- Census Block Group
- Sector Type

- BFR/MOR Query Parameters

- County Name
- City
- Zip Code
- PWS Mailing Name
- PWSID

Home **DOR Parcel Attributes Raw Data Interface** Basic Facility Report Raw Data Interface

DOR Parcel Attributes Interface

County Name: City: Zip Code:

DOR Land Use Code: Census Block: Sector Type:

Preview Records: 25; Total Records: 3,038; Estimated File Size (MB): 0.7

County Number	County Name	Parcel Key	Parcel ID	Tax Roll Year	Land Use Code	PA_Code	Special Assesment Code	Just Value	Land Sq Foot	Effective Year Built
11	ALACHUA	11-01360002000	01360 002 000	2009	007	00		66000	136245	
11	ALACHUA	11-01832002000	01832 002 000	2009	007	00		111000	149411	
11	ALACHUA	11-04305003001	04305 003 001	2009	003	00		5773500	1031065	2003
11	ALACHUA	11-04310020003	04310 020 003	2009	007	00		241800	218671	
11	ALACHUA	11-04422020025	04422 020 025	2009	007	00		143400	245243	
11	ALACHUA	11-05879007000	05879 007 000	2009	007	00		38100	272686	2000

Home **DOR Parcel Attributes Raw Data Interface** **Basic Facility Report Raw Data Interface**

Basic Facility Report Interface

County Name: City: Zip Code:

Mailing Name: PWSID:

BFR Total Records: 3; Preview MOR records: 25; Total MOR Records: 121

Status Date	District	County Number	County Name	PWSID	Type	Surface Source	Ground Source	Mailing Name	Address1
00-18-2009	2	11	ALACHUA	2010406	NONCOMMUNITY	NA	Y	GAINESVILLE RACEWAY	11211 N. COUNTY ROAD 22
00-18-2009	2	11	ALACHUA	2010946	COMMUNITY	NA	Y	GRU - MURPHREE WTP	1600 NE 53RD AVENUE
00-18-2009	2	11	ALACHUA	2011124	COMMUNITY	NA	Y	TACACHALE WTP	1621 NE WALDO ROAD

Preview: Detail - Monthly Operation Reports (MOR); To Preview corresponding MOR data click on row in BFR grid

PWSID	System Name	Plant Name	Plant Number	Design Capacity	Status	Max Treated	Average Treated	Year Month	Date Reported
2010946	GAINESVILLE (MURPHREE WTP)		1	40000000	ACTIVE	24534000	21792000	199901	00-01-1999
2010946	GAINESVILLE (MURPHREE WTP)		1	40000000	ACTIVE	25185000	22414000	199902	00-01-1999
2010946	GAINESVILLE (MURPHREE WTP)		1	40000000	ACTIVE	29811000	24903000	199903	00-01-1999
2010946	GAINESVILLE (MURPHREE WTP)		1	40000000	ACTIVE	34063000	30515000	199904	00-01-1999

EZ Guide 2.0 Optimization Methodology

Toilet Example

- Public data obtained along with billing database provided by GRU
- Alachua County Property Appraiser (ACPA) provided data on pools, heated areas, and number of bathrooms
- GRU SFR billing database:
 - 30,906 customers
 - 1,402 dual metered customers
 - Monthly billing data from 10/07-9/08

Best Savings Opportunities for Indoor Residential Sector

Indoor Residential Savings Potential

Fixture	Base gpcd	SOTA gpcd	Savings gpcd	% Savings
Toilets	17.9	7.8	10.1	26.0%
Leaks	18.8	3.7	15.1	38.8%
Clothes Washers	14.7	7.8	6.9	17.7%
Showers	12.4	9.1	3.3	8.5%
Faucets	9.4	6.2	3.2	8.2%
Baths	2.6	2.4	0.2	0.5%
Dishwasher	0.6	0.5	0.1	0.3%
Other	0.8	0.8	0	0.0%
Total	77.2	38.3	38.9	100.0%

- Toilets, leaks, and clothes washers provide over 80% of potential savings
- Focus on older houses with fewer baths- higher uses per day
- Some of leaks are outdoor

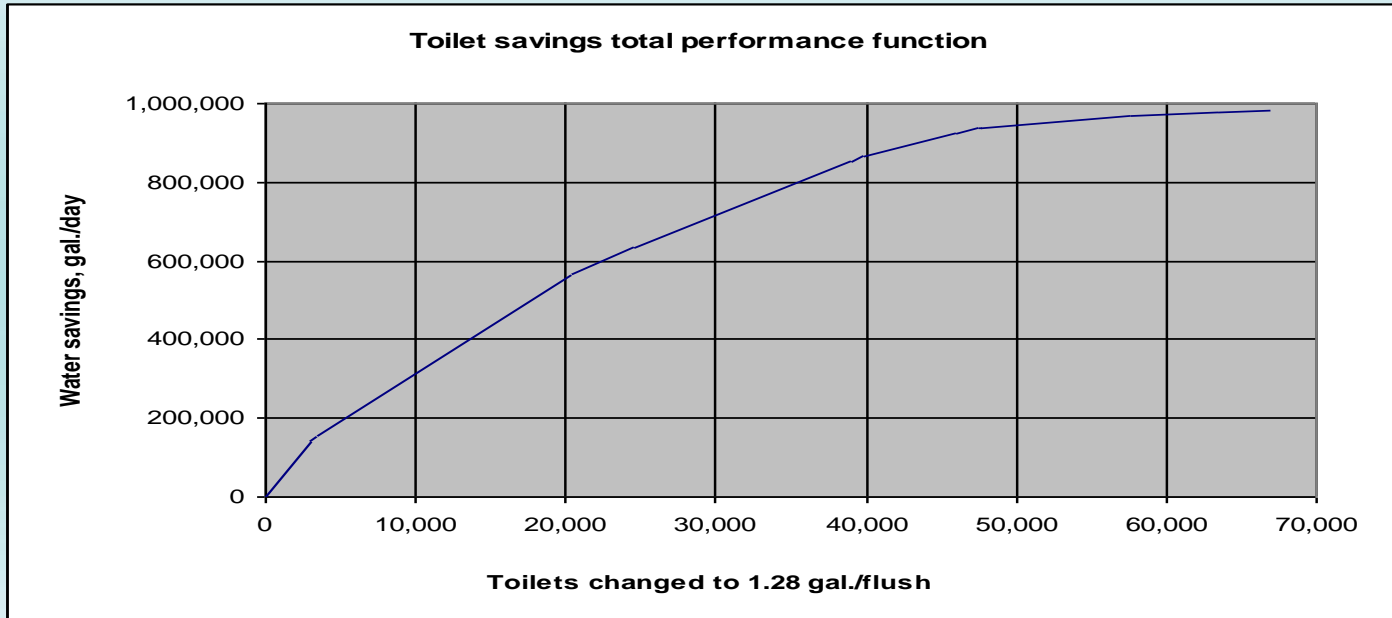
Development of Toilet Performance Function

Table 1. Daily savings in gal./ toilet switched to 1.28 gpf

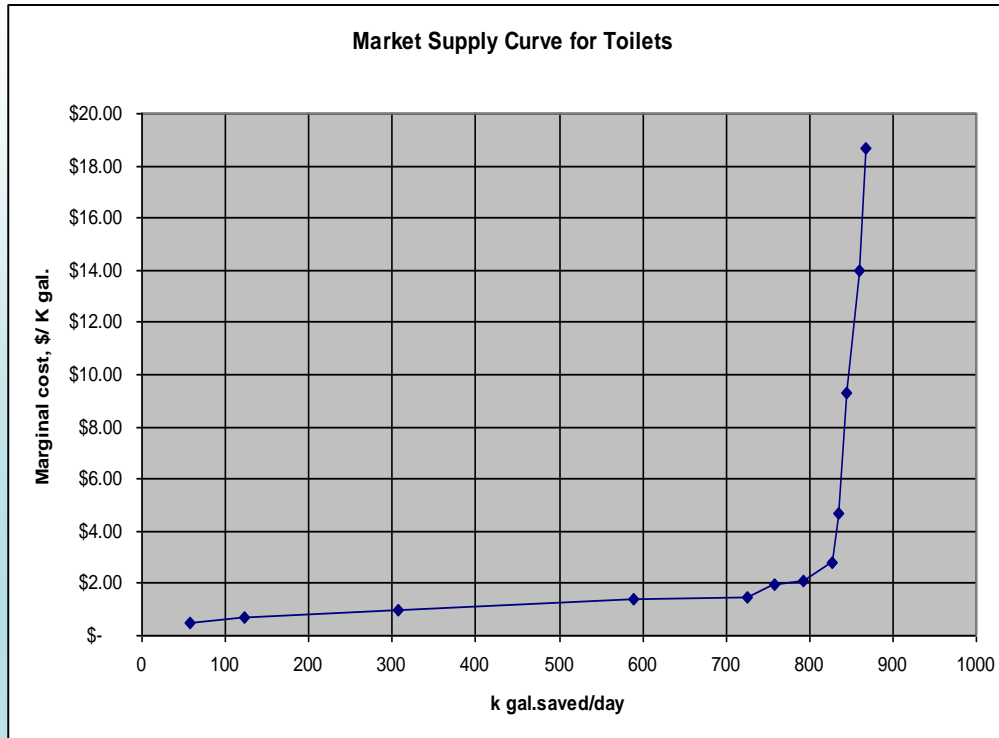
Period	Toilets/ house >	1	2	3	4
All	Persons/ toilet >	2.53	1.27	0.84	0.63
Pre 1983	5 gpf	48.32	24.16	16.11	12.08
1983-1994	3.5 gpf	30.22	15.11	10.07	7.55
1995-2008	1.6 gpf	5.84	2.92	1.95	1.46

Table 2. Toilets in each category

Period	Total	1	2	3	4
Pre 1983	24,934	2,917	17,006	4,143	868
1983-1994	22,693	542	14,460	6,051	1,640
1995-2008	19,387	20	10,078	5,721	3,568
total	67,014	3,479	41,544	15,915	6,076



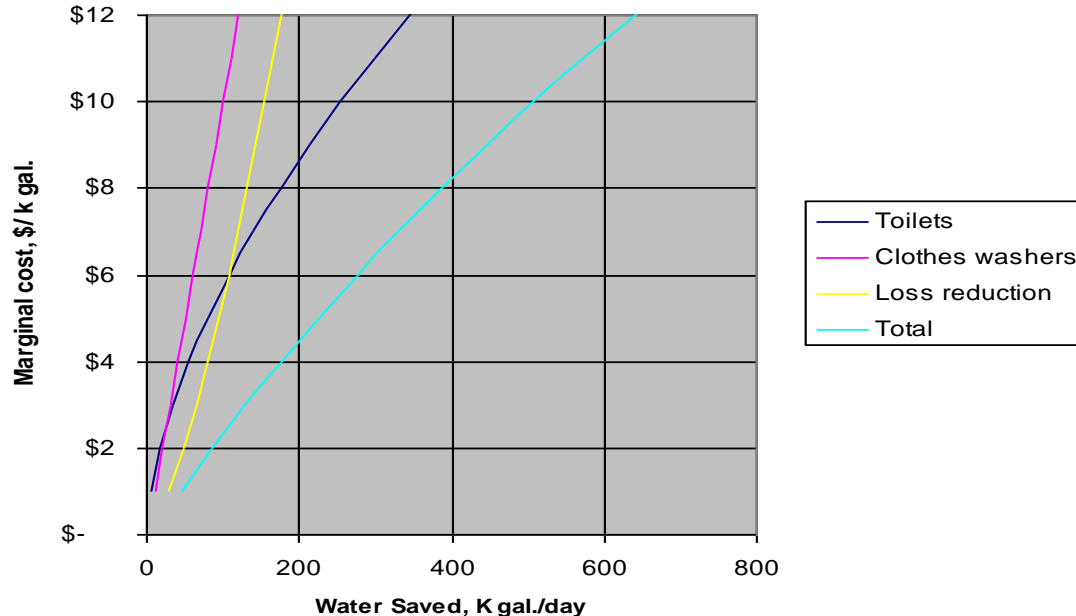
Market Supply Curve for Toilets



- Combine performance function with toilet cost data to develop supply curve
- For a given savings rate (MB), the optimal solution is where $MB = MC$ (Marginal Cost)

Least Cost Combination of Water Management Options

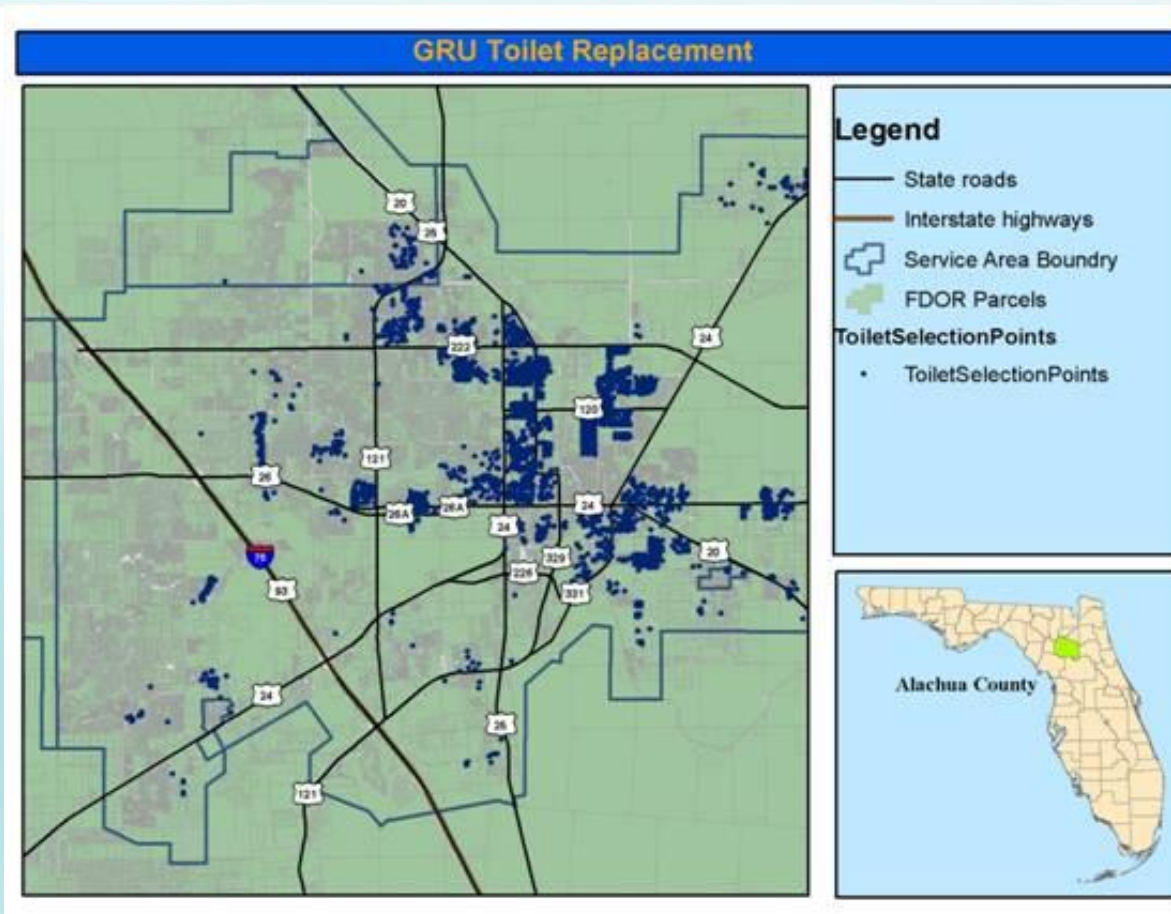
Least cost combination of BMPs-horizontal sum of savings for a given marginal cost



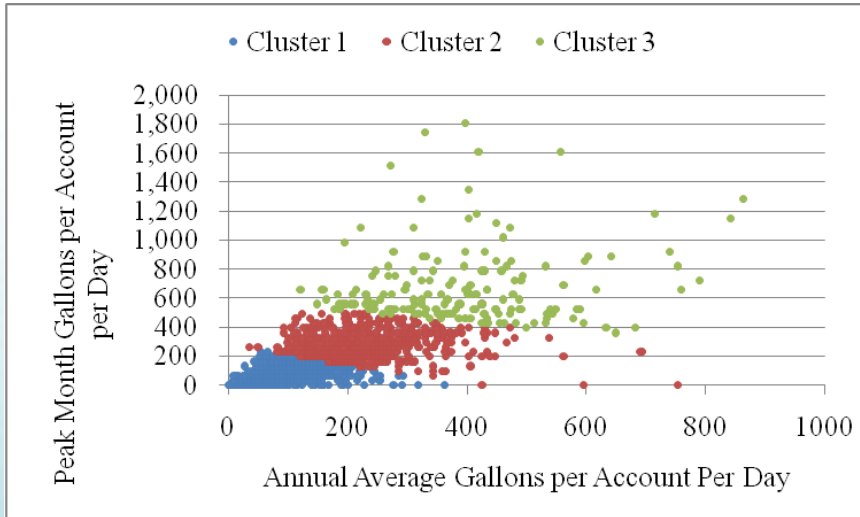
- Final result is the marginal cost curve for each option
- For a given savings rate, add water saved for each option to get the final answer
- EZG2.0 finds the best blend of options using linear programming

Drilling Down to Select the Most Promising Customers

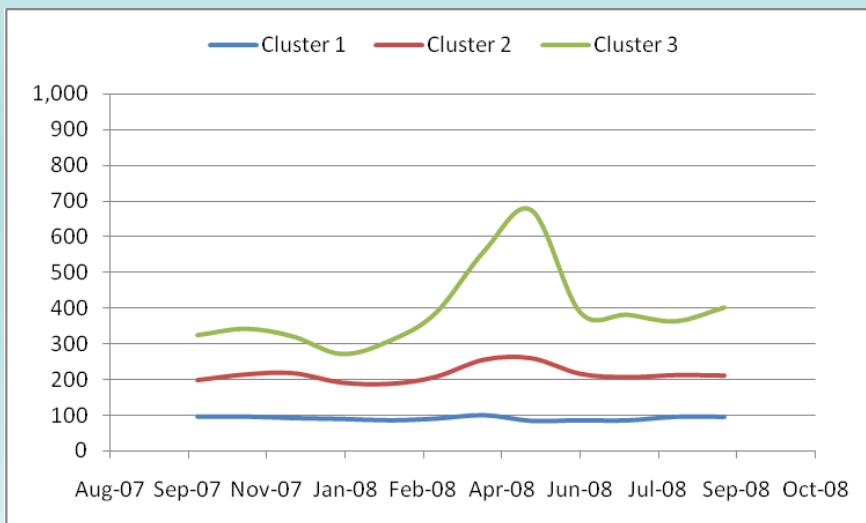
Location of 2,917 GRU Customers With One Bath Houses Built Before 1983



Select the Highest Priority Older Houses With One Bath Based on Historical Usage Pattern

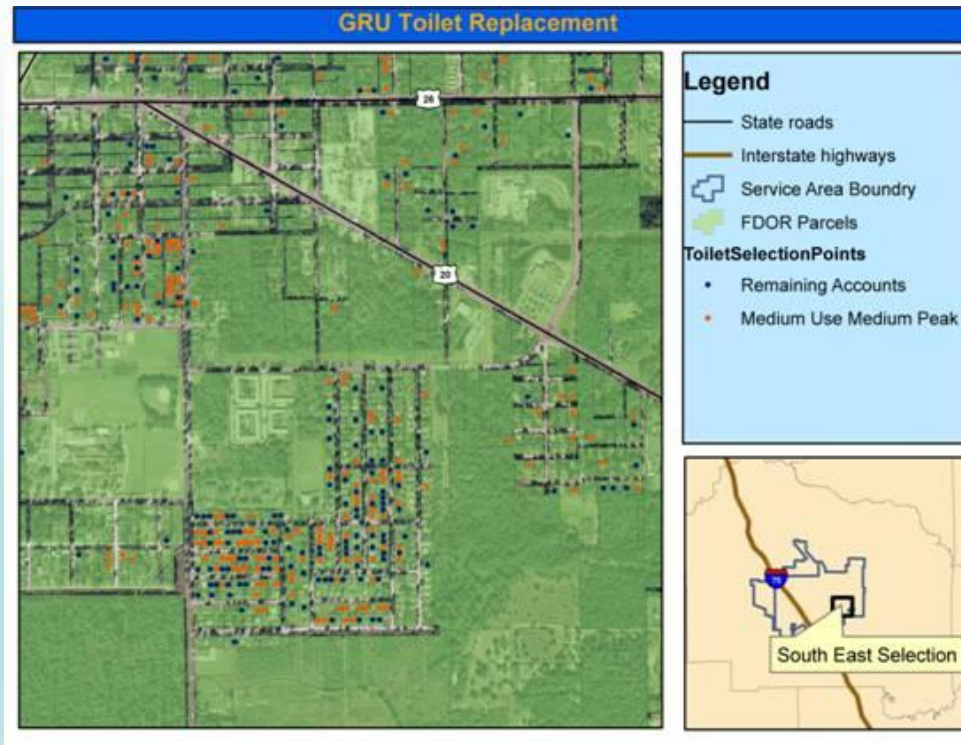


Use Category	Parcels	Persons/ house	Daily Gal./ Account	Daily Gal./ Capita
Low	1,852	2.34	92.1	38.7
Medium	895	2.49	215.8	86.8
High	170	2.51	392.7	156.5
Total	2,917			
Average		2.40	147.6	60.3



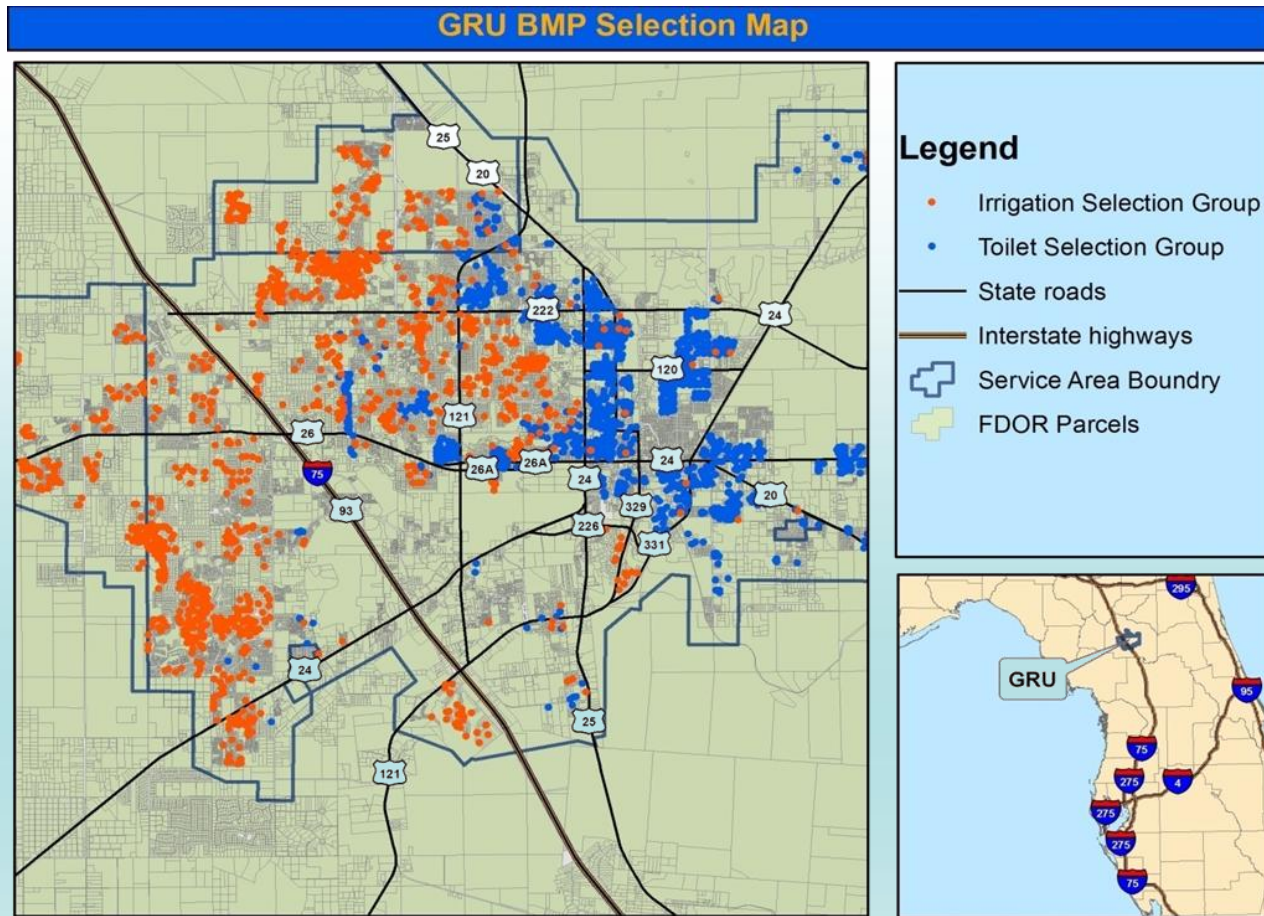
- 895 medium water use parcels are the highest priority
 - Above average indoor use
 - Not significant irrigators

Location of 895 Priority Older Houses With One Bath



- Confirm presence of older toilet
- Determine people per house
- Link with GRU energy retrofit program?
- Implement retrofit program

Selected Priority Irrigation and Toilet Retrofit Clusters in GRU



Summary & Conclusions

- Key cyberinfrastructure for conservation evaluations includes parcel level water use data linked with attribute data
- End use compilation of number of water using devices and their characteristics provides the basis for developing a performance function for each device
- Performance functions are combined with savings and costs data to find the optimal conservation program using linear programming
- Priority areas are identified and program is implemented
- Actual vs. predicted performance of the program is monitored to verify savings estimates
- Context for using EZ Guide 2.0 depends on the application, e.g., water supply planning, consumptive use permit application
- Please help us test and refine these methods



Conserve Florida Water Clearinghouse

Promoting Conservation in Our Public Water Supplies

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RESEARCH

LINKS



FEATURED:

More Eff...

www.conservefloridawater.org

adipiscing elit. Integer sed orci. Fusce dapibus, Morbi purus. Nulla facilisi. [Read More >>](#)

Information Here to Help You Conserve Water

Mission: The mission of the Conserve Florida Water Clearinghouse is to develop collaborative relationships with related programs, and to collect, analyze, and make available reliable information and technical assistance to public water supply utilities and water managers for use in developing effective and efficient water conservation programs.

recent news

[AWE and Others Urge Congress for Funding](#) (Jan 15,

upcoming events

[SUBMIT NEW EVENT >](#)

5/8/2008