

This presentation premiered at WaterSmart Innovations

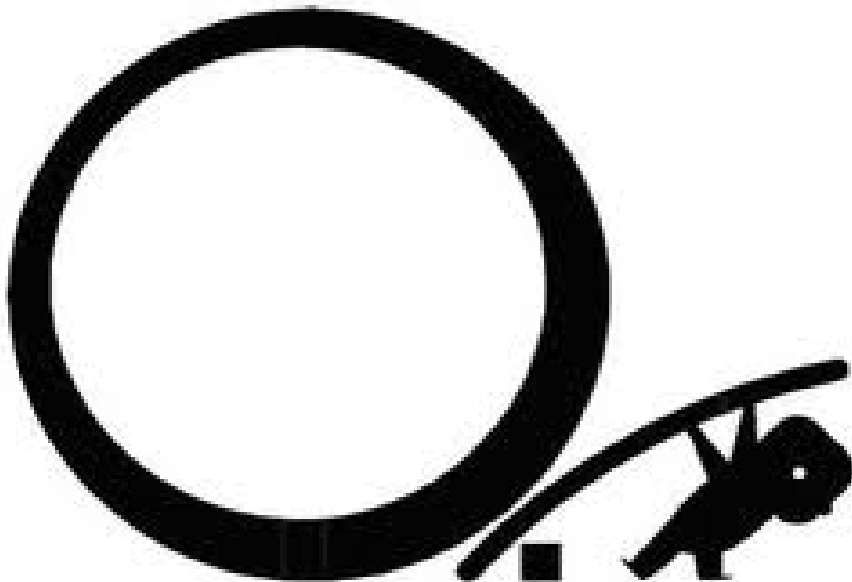
watersmartinnovations.com



Just Add Water:

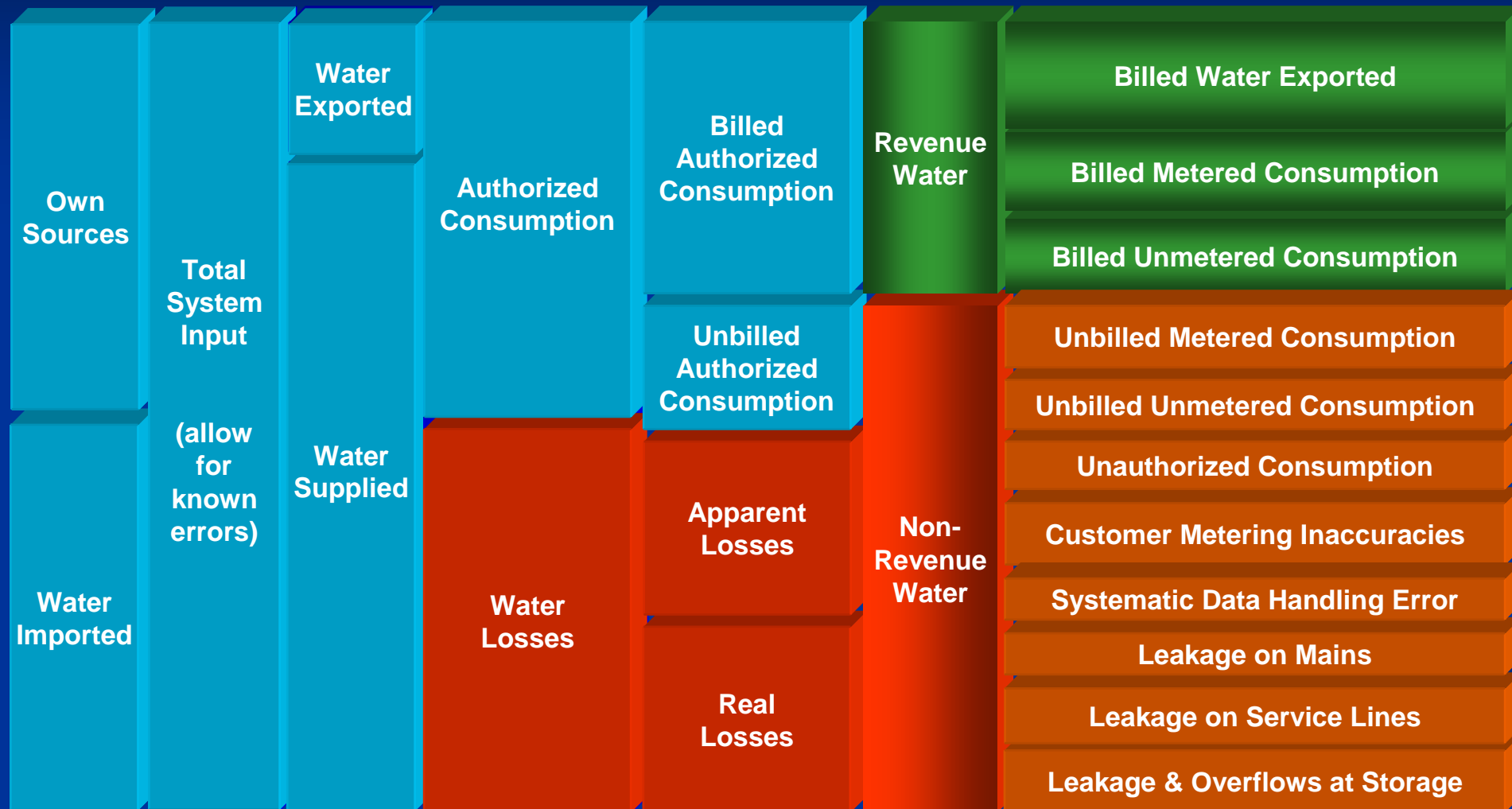
Leveraging Existing Water System Data to Launch Pilot District Metered Areas for Advanced Leakage Management

By: Will J. Jernigan, P.E., LEED® AP

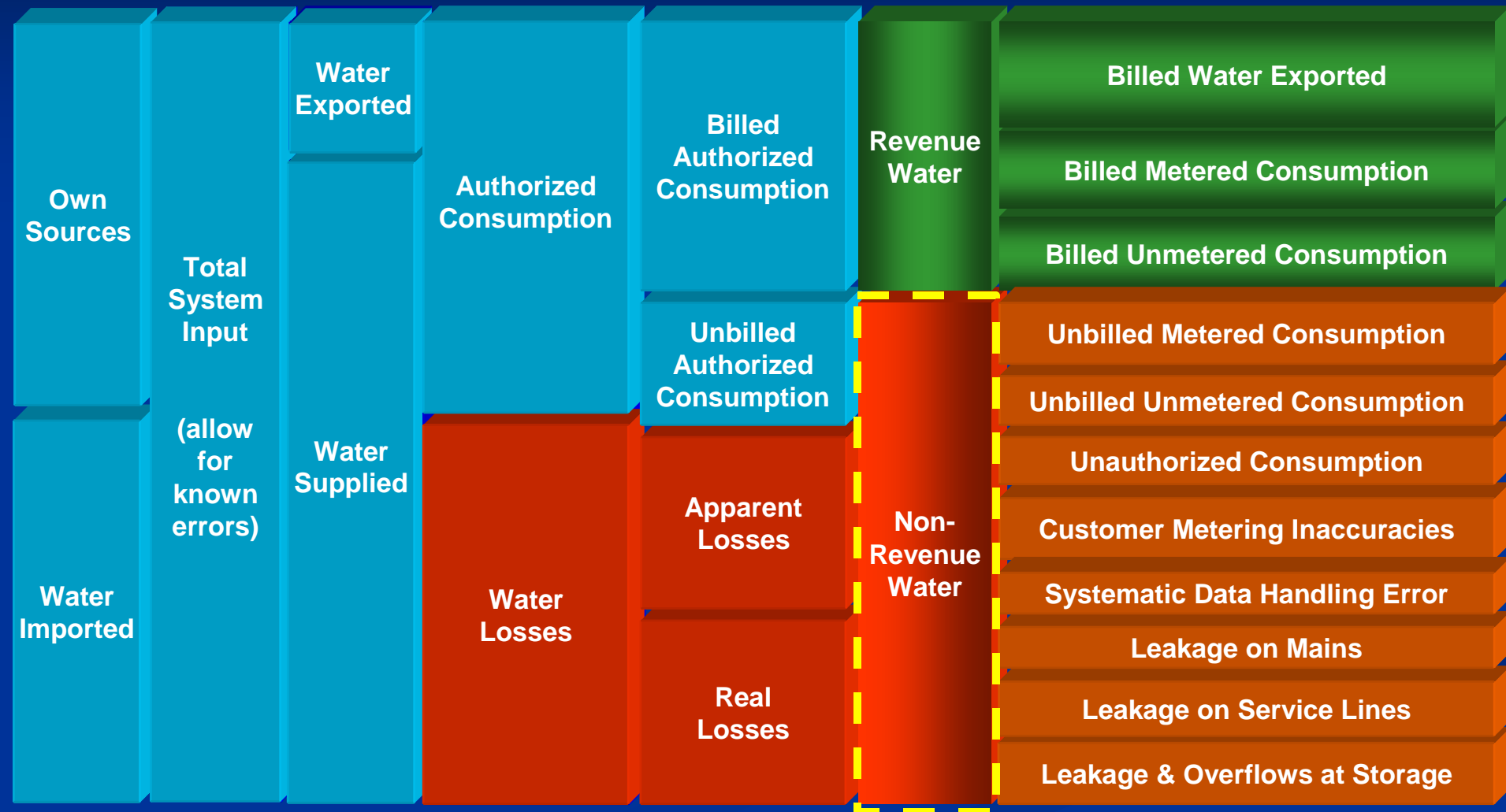


CAVANAUGH
Stewardship Through Innovation

Water Balance: Categorizing Use and Loss



Water Balance: Categorizing Use and Loss

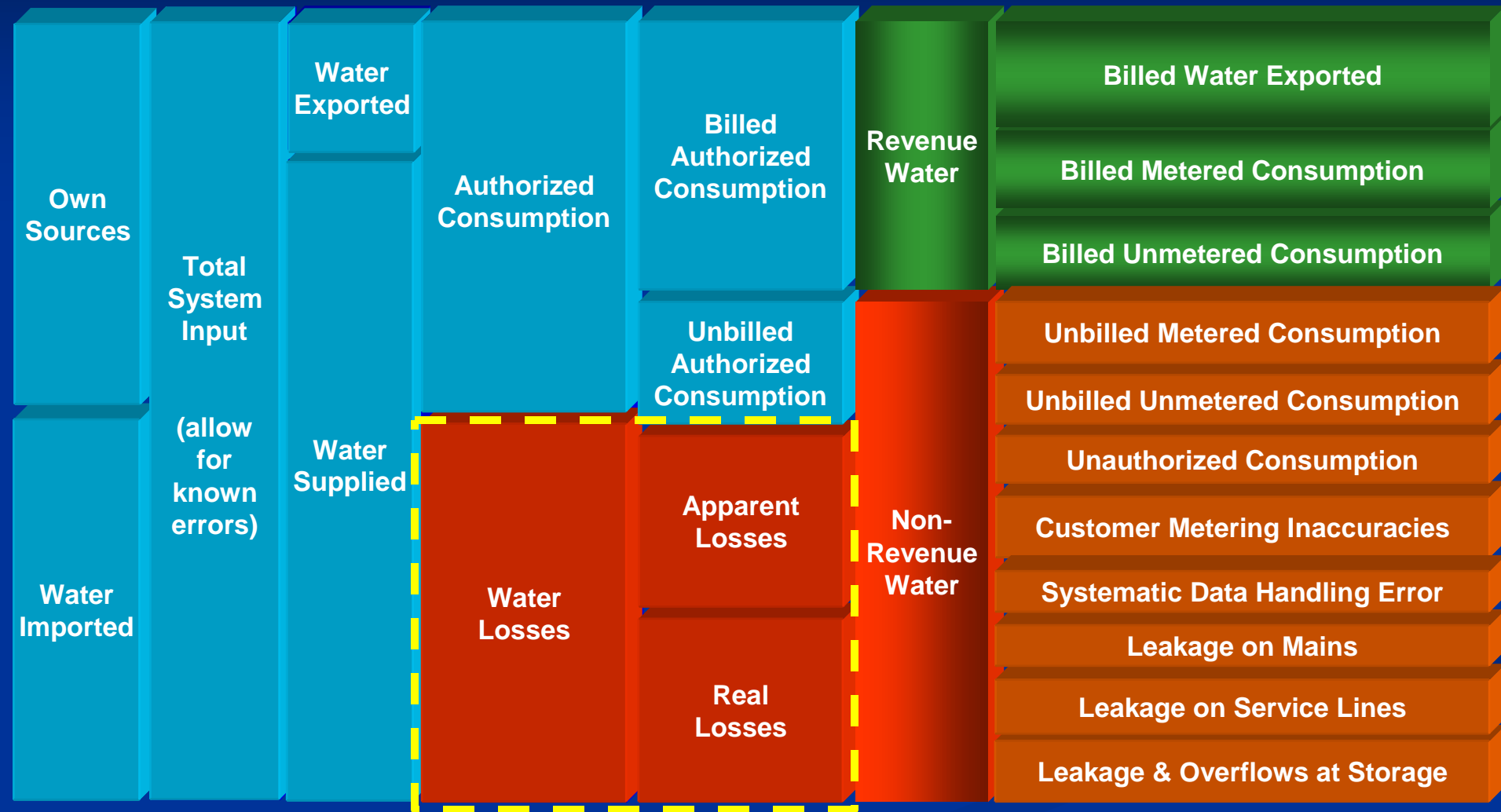


Non-Revenue Water

1. Water put into the system that does NOT return revenue to the Utility.
2. All Water Loss plus Unbilled Consumption.
3. “Unaccounted-for water” has been abandoned forever.



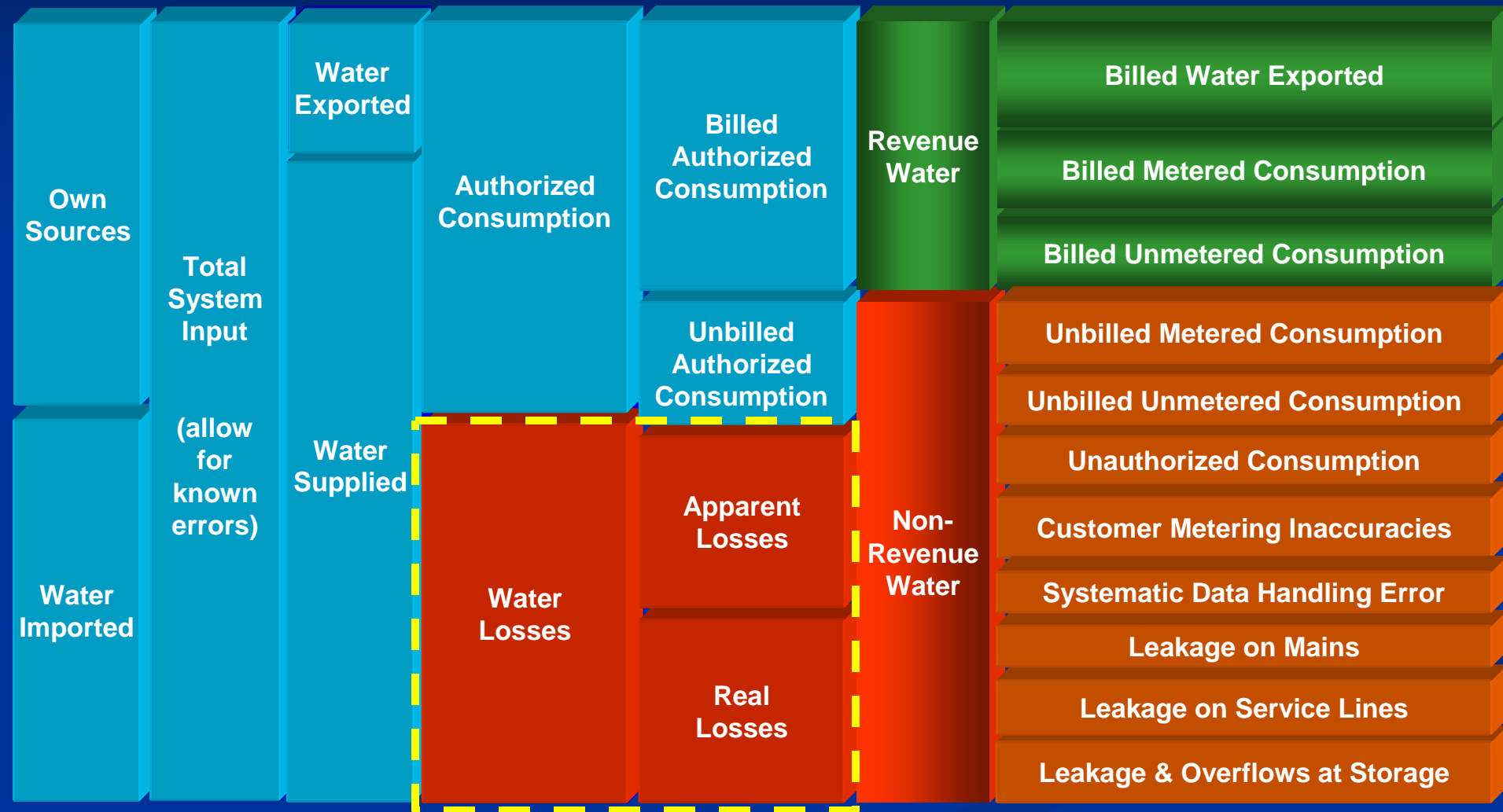
Water Balance: Categorizing Use and Loss



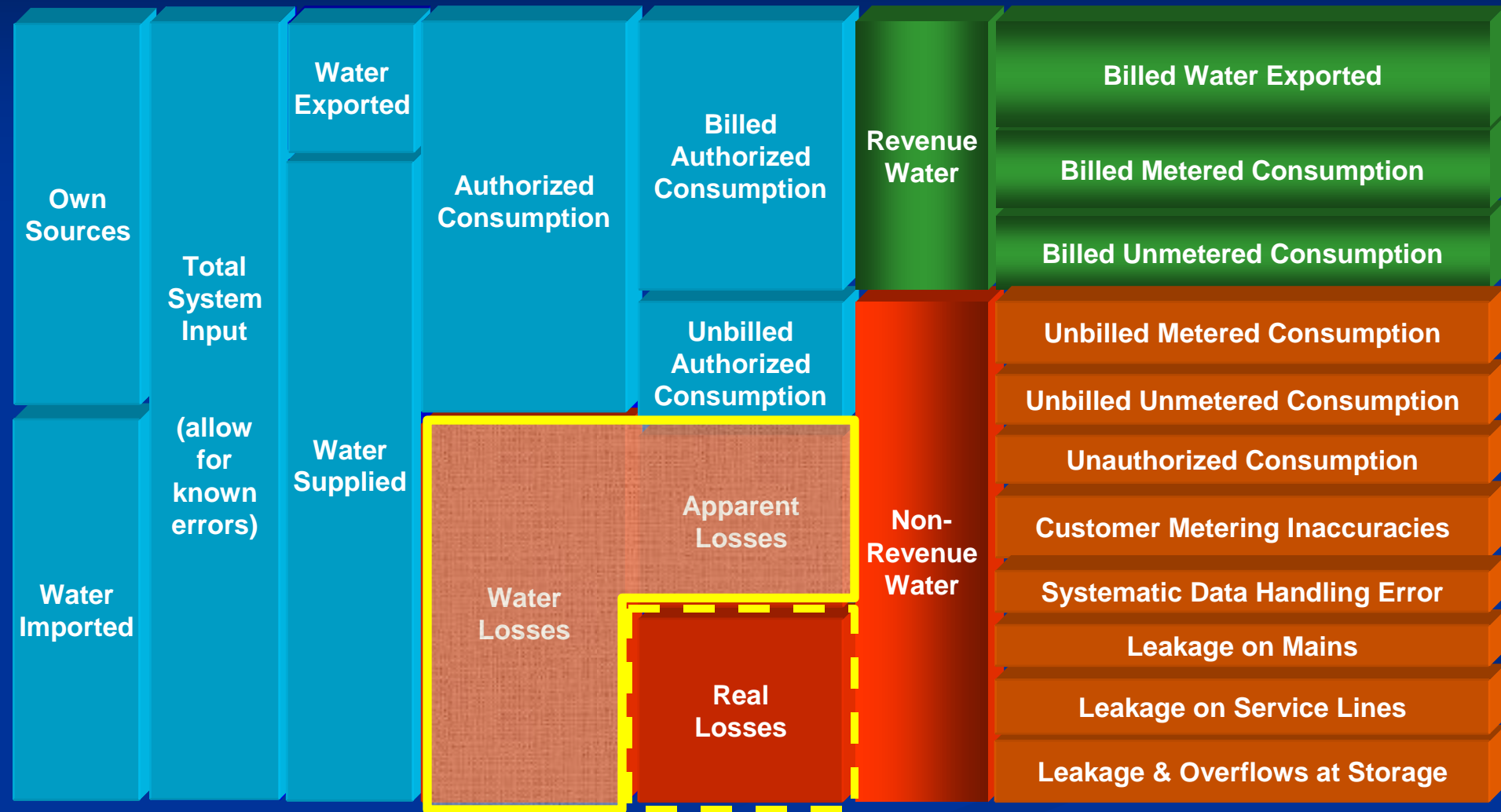
Real vs Apparent Loss

1. Water Loss comes in 2 forms: Real and Apparent.
2. Real Loss = Leakage. Cost is calculated as 'wholesale' rate.
3. Apparent Loss = Slow meters, billing issues and theft. Cost is calculated at 'retail' rate.

Water Balance: Categorizing Use and Loss



Water Balance: Categorizing Use and Loss



Objective

- Develop a proactive leakage management approach
- Utilize existing data that is already in place and being monitored through SCADA
- Launch Pilot District Metered Areas to prioritize and focus Leak Detection resources

Case Study Overview: Macon Water Authority (GA)

- 5 hydraulically independent pressure zones
- No zones are master metered
- 1,600 miles of distribution system
- 65,000 connections
- 10 BG produced/year

Project Approach

Phase 1: Top-Down Water Audit

Gather available financial and operational data and develop a Water Balance for the audit year

Phase 2: Bottom-Up Validation

In-depth analysis and staff interviews pertaining to billing accounts and methods, customer metering database and methods, distribution system management and SCADA system capabilities, with recommendations.

Phase 3: Program Dev & Implementation

Implementation of the Water Efficiency Program, manifested through a series of monthly Water Efficiency Team Meetings, at which time we prioritize, execute and evaluate the improvement measures identified in Phase two, document and communicate results to the leadership, and recommend improvements.

Water Audit – Establish Baseline Volumes of Real Loss

Macon Water Authority

WATER SYSTEM KEY PERFORMANCE INDICATORS

Audit Year (AY 11)

Jul-10_Jun-11

System Input Volume

9,567 MG / year

Data Validity: 68

Annual Operating Cost (Water Only)

12,016,745 \$ / year

(out of 100)

Operational Indicators

Non-Revenue Water

1,755 MG / year

18.3%

Water Loss

1,585 MG / year

16.6%

Current Annual Apparent Loss (CAAL)

321 MG / year

3.4%

Current Annual Real Loss (CARL)

1,264 MG / year

13.2%

Apparent Losses per service connection per day

14 gal/conn/day

Real Losses per service connection per day

54 gal/conn/day

Real Losses per service connection per day per psi

1 gal/conn/day/psi

Unbilled Consumption

171 MG / year

1.8%

Unavoidable Annual Real Loss (UARL)

570 MG / year

6.0%

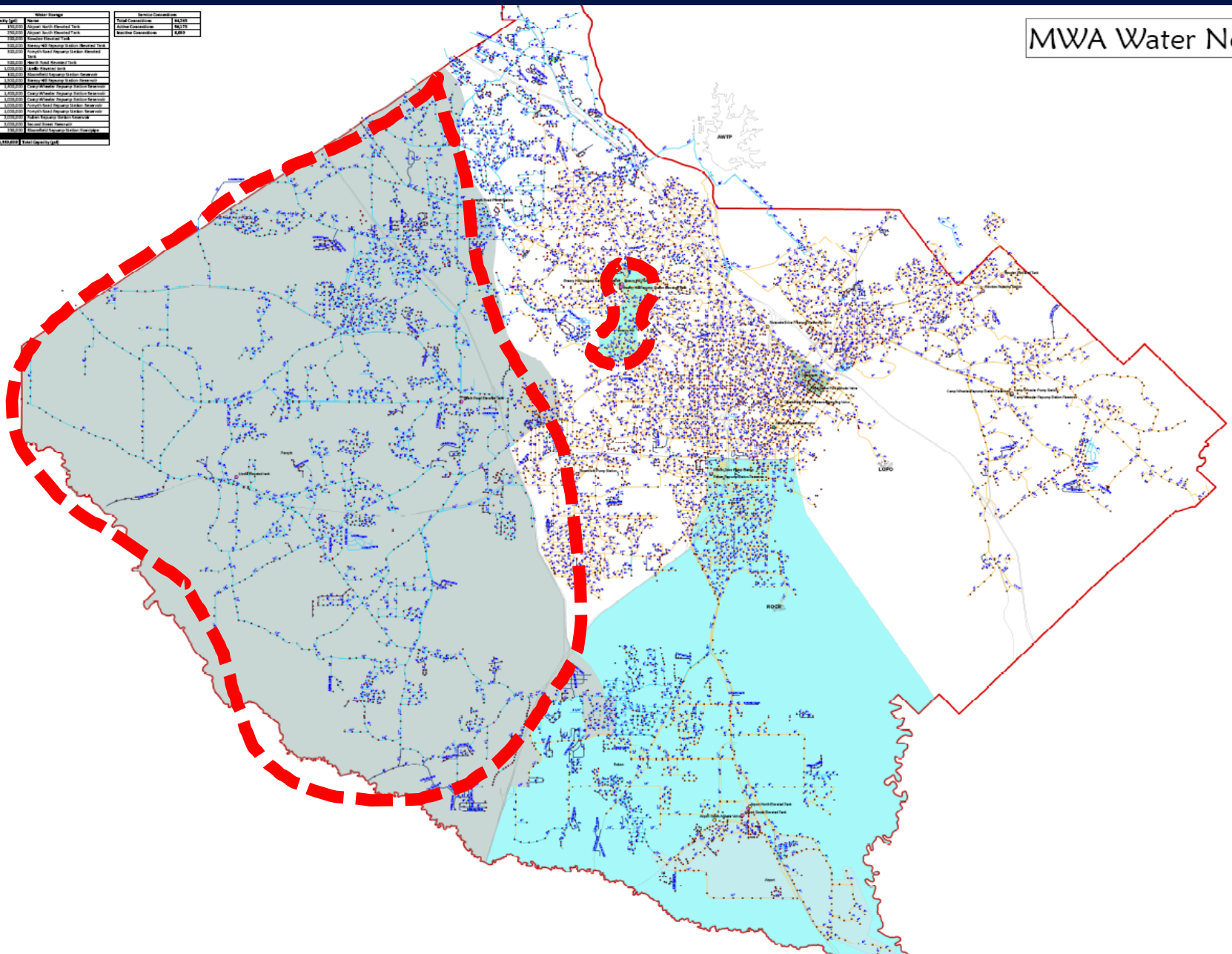
Infrastructure Leakage Index (ILI) :

2.22 [CARL / UARL]

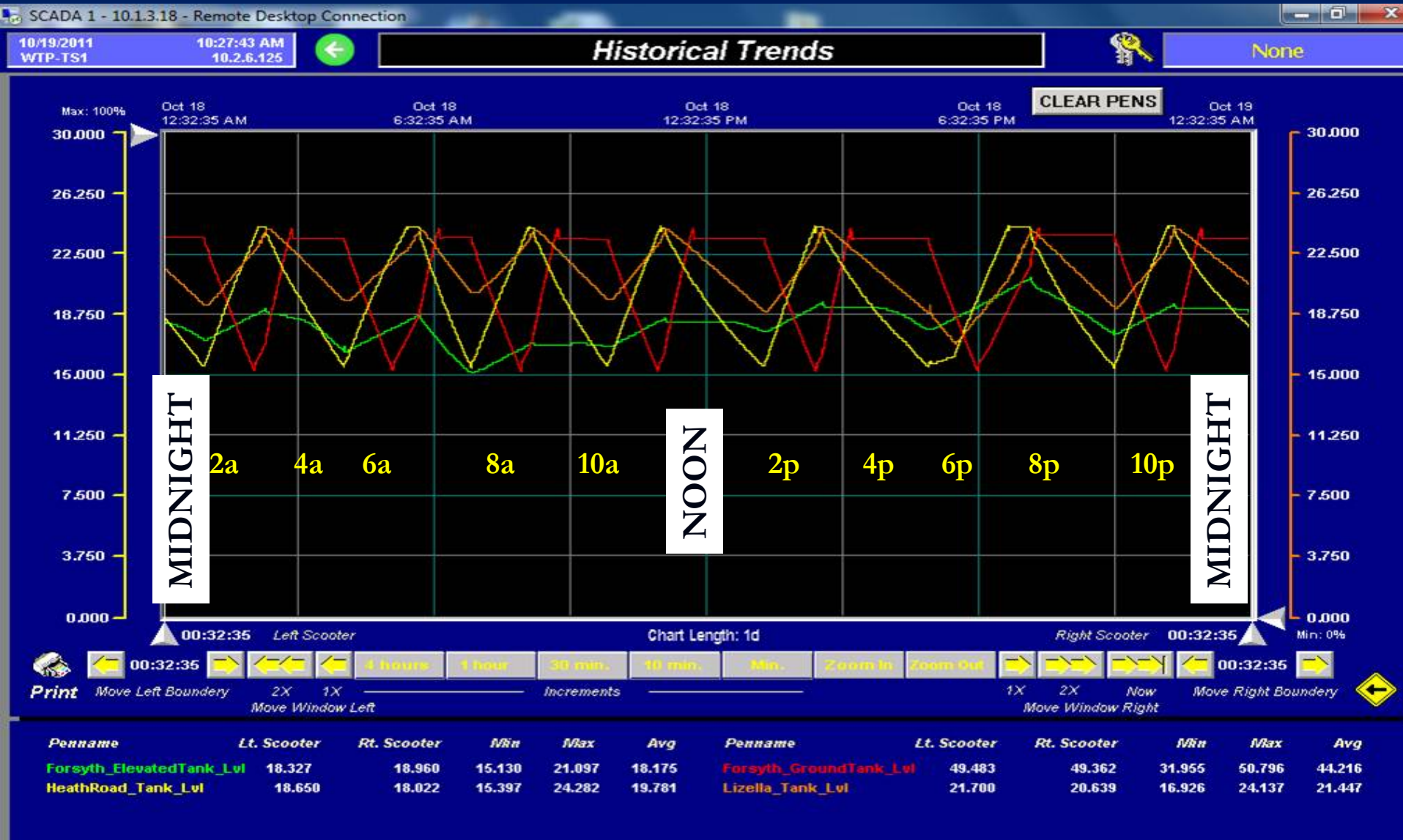
Identify Pilot District Metered Areas

Water Meter		Water Storage		Service Connection	
Connection ID	Length (ft)	Capacity (gal)	Name	Final Connection	Final Connection
1	1000.00	1000.00	Water Meter	1000.00	1000.00
2	1000.00	1000.00	Water Meter	1000.00	1000.00
3	1000.00	1000.00	Water Meter	1000.00	1000.00
4	1000.00	1000.00	Water Meter	1000.00	1000.00
5	1000.00	1000.00	Water Meter	1000.00	1000.00
6	1000.00	1000.00	Water Meter	1000.00	1000.00
7	1000.00	1000.00	Water Meter	1000.00	1000.00
8	1000.00	1000.00	Water Meter	1000.00	1000.00
9	1000.00	1000.00	Water Meter	1000.00	1000.00
10	1000.00	1000.00	Water Meter	1000.00	1000.00
11	1000.00	1000.00	Water Meter	1000.00	1000.00
12	1000.00	1000.00	Water Meter	1000.00	1000.00
13	1000.00	1000.00	Water Meter	1000.00	1000.00
14	1000.00	1000.00	Water Meter	1000.00	1000.00
15	1000.00	1000.00	Water Meter	1000.00	1000.00
16	1000.00	1000.00	Water Meter	1000.00	1000.00
17	1000.00	1000.00	Water Meter	1000.00	1000.00
18	1000.00	1000.00	Water Meter	1000.00	1000.00
19	1000.00	1000.00	Water Meter	1000.00	1000.00
20	1000.00	1000.00	Water Meter	1000.00	1000.00
21	1000.00	1000.00	Water Meter	1000.00	1000.00
22	1000.00	1000.00	Water Meter	1000.00	1000.00
23	1000.00	1000.00	Water Meter	1000.00	1000.00
24	1000.00	1000.00	Water Meter	1000.00	1000.00
25	1000.00	1000.00	Water Meter	1000.00	1000.00
26	1000.00	1000.00	Water Meter	1000.00	1000.00
27	1000.00	1000.00	Water Meter	1000.00	1000.00
28	1000.00	1000.00	Water Meter	1000.00	1000.00
29	1000.00	1000.00	Water Meter	1000.00	1000.00
30	1000.00	1000.00	Water Meter	1000.00	1000.00
31	1000.00	1000.00	Water Meter	1000.00	1000.00
32	1000.00	1000.00	Water Meter	1000.00	1000.00
33	1000.00	1000.00	Water Meter	1000.00	1000.00
34	1000.00	1000.00	Water Meter	1000.00	1000.00
35	1000.00	1000.00	Water Meter	1000.00	1000.00
36	1000.00	1000.00	Water Meter	1000.00	1000.00
37	1000.00	1000.00	Water Meter	1000.00	1000.00
38	1000.00	1000.00	Water Meter	1000.00	1000.00
39	1000.00	1000.00	Water Meter	1000.00	1000.00
40	1000.00	1000.00	Water Meter	1000.00	1000.00
41	1000.00	1000.00	Water Meter	1000.00	1000.00
42	1000.00	1000.00	Water Meter	1000.00	1000.00
43	1000.00	1000.00	Water Meter	1000.00	1000.00
44	1000.00	1000.00	Water Meter	1000.00	1000.00
45	1000.00	1000.00	Water Meter	1000.00	1000.00
46	1000.00	1000.00	Water Meter	1000.00	1000.00
47	1000.00	1000.00	Water Meter	1000.00	1000.00
48	1000.00	1000.00	Water Meter	1000.00	1000.00
49	1000.00	1000.00	Water Meter	1000.00	1000.00
50	1000.00	1000.00	Water Meter	1000.00	1000.00
51	1000.00	1000.00	Water Meter	1000.00	1000.00
52	1000.00	1000.00	Water Meter	1000.00	1000.00
53	1000.00	1000.00	Water Meter	1000.00	1000.00
54	1000.00	1000.00	Water Meter	1000.00	1000.00
55	1000.00	1000.00	Water Meter	1000.00	1000.00
56	1000.00	1000.00	Water Meter	1000.00	1000.00
57	1000.00	1000.00	Water Meter	1000.00	1000.00
58	1000.00	1000.00	Water Meter	1000.00	1000.00
59	1000.00	1000.00	Water Meter	1000.00	1000.00
60	1000.00	1000.00	Water Meter	1000.00	1000.00
61	1000.00	1000.00	Water Meter	1000.00	1000.00
62	1000.00	1000.00	Water Meter	1000.00	1000.00
63	1000.00	1000.00	Water Meter	1000.00	1000.00
64	1000.00	1000.00	Water Meter	1000.00	1000.00
65	1000.00	1000.00	Water Meter	1000.00	1000.00
66	1000.00	1000.00	Water Meter	1000.00	1000.00
67	1000.00	1000.00	Water Meter	1000.00	1000.00
68	1000.00	1000.00	Water Meter	1000.00	1000.00
69	1000.00	1000.00	Water Meter	1000.00	1000.00
70	1000.00	1000.00	Water Meter	1000.00	1000.00
71	1000.00	1000.00	Water Meter	1000.00	1000.00
72	1000.00	1000.00	Water Meter	1000.00	1000.00
73	1000.00	1000.00	Water Meter	1000.00	1000.00
74	1000.00	1000.00	Water Meter	1000.00	1000.00
75	1000.00	1000.00	Water Meter	1000.00	1000.00
76	1000.00	1000.00	Water Meter	1000.00	1000.00
77	1000.00	1000.00	Water Meter	1000.00	1000.00
78	1000.00	1000.00	Water Meter	1000.00	1000.00
79	1000.00	1000.00	Water Meter	1000.00	1000.00
80	1000.00	1000.00	Water Meter	1000.00	1000.00
81	1000.00	1000.00	Water Meter	1000.00	1000.00
82	1000.00	1000.00	Water Meter	1000.00	1000.00
83	1000.00	1000.00	Water Meter	1000.00	1000.00
84	1000.00	1000.00	Water Meter	1000.00	1000.00
85	1000.00	1000.00	Water Meter	1000.00	1000.00
86	1000.00	1000.00	Water Meter	1000.00	1000.00
87	1000.00	1000.00	Water Meter	1000.00	1000.00
88	1000.00	1000.00	Water Meter	1000.00	1000.00
89	1000.00	1000.00	Water Meter	1000.00	1000.00
90	1000.00	1000.00	Water Meter	1000.00	1000.00
91	1000.00	1000.00	Water Meter	1000.00	1000.00
92	1000.00	1000.00	Water Meter	1000.00	1000.00
93	1000.00	1000.00	Water Meter	1000.00	1000.00
94	1000.00	1000.00	Water Meter	1000.00	1000.00
95	1000.00	1000.00	Water Meter	1000.00	1000.00
96	1000.00	1000.00	Water Meter	1000.00	1000.00
97	1000.00	1000.00	Water Meter	1000.00	1000.00
98	1000.00	1000.00	Water Meter	1000.00	1000.00
99	1000.00	1000.00	Water Meter	1000.00	1000.00
100	1000.00	1000.00	Water Meter	1000.00	1000.00

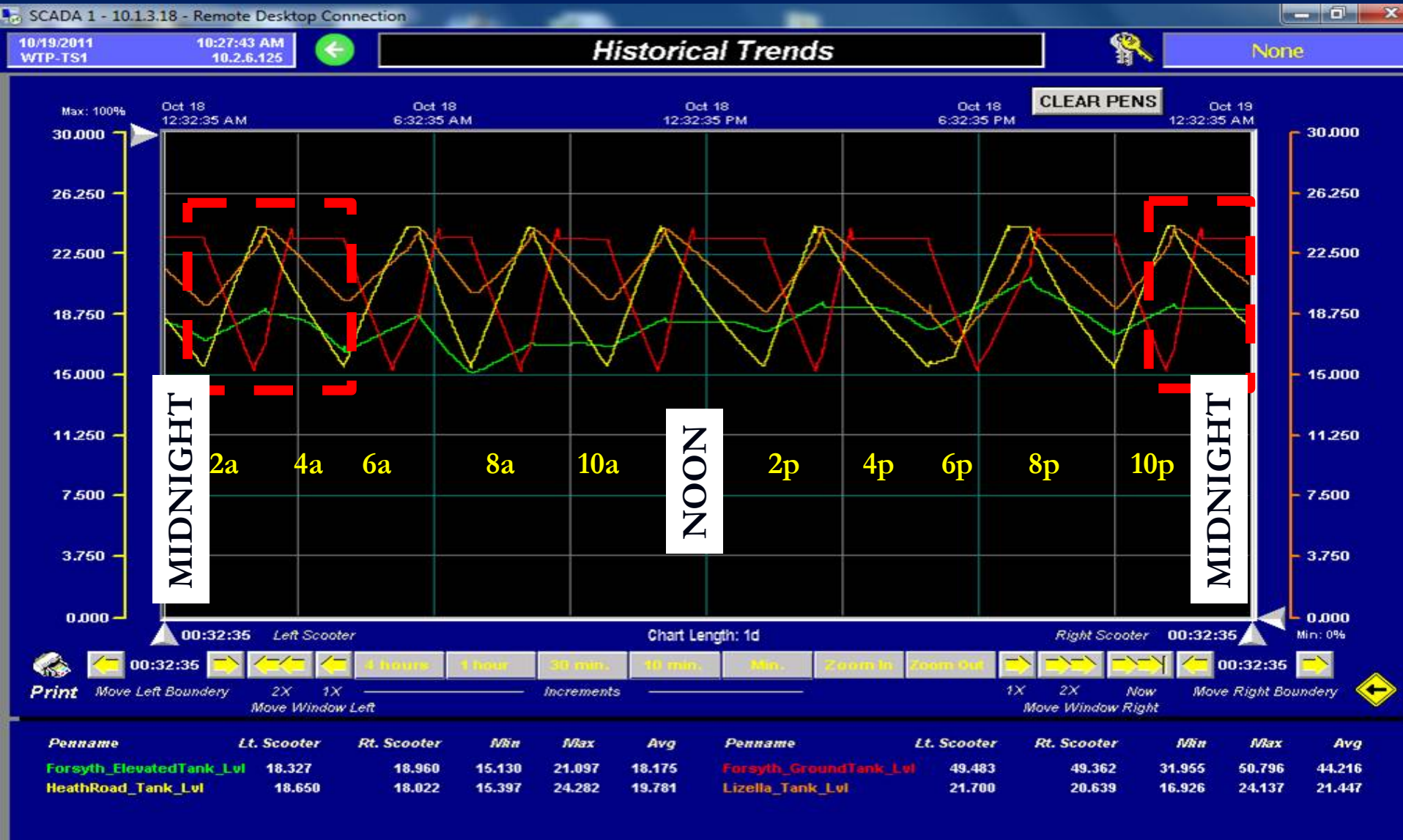
MWA Water Network



Analysis of Min-Hour Demand within Pilot DMAs



Analysis of Min-Hour Demand within Pilot DMAs



Analysis of Min-Hour Demand within Pilot DMA

SCADA 2 - 10.1.3.19 - Remote Desktop

10/13/2011
WTP-TS2

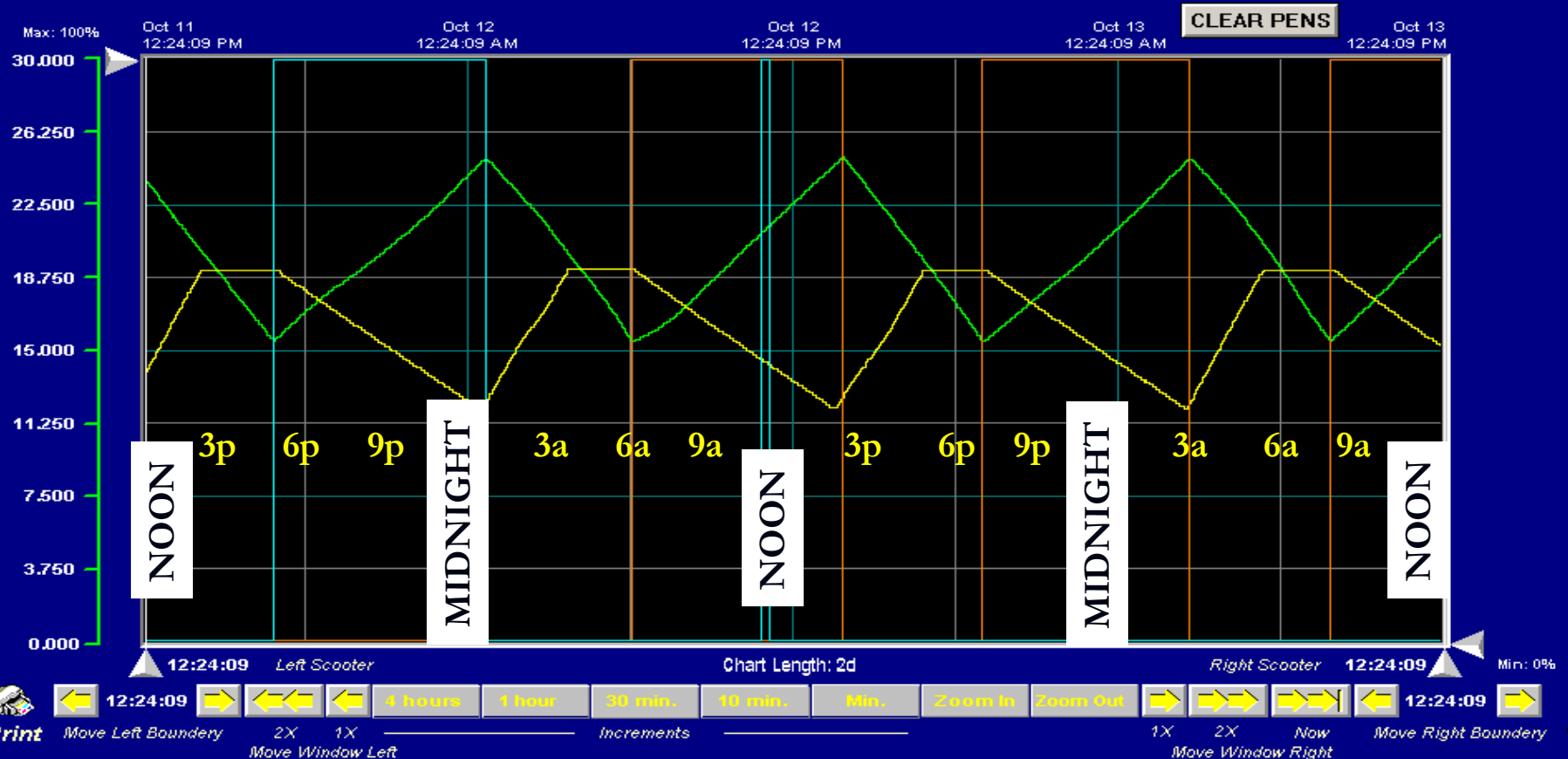
12:29:02 PM
10.2.6.119



Historical Trends



None



Penname	Lt. Scooter	Rt. Scooter	Min	Max	Avg	Penname	Lt. Scooter	Rt. Scooter	Min	Max	Avg
BreezyHill_ElevatedTank_Lvl	23.862	20.979	15.488	24.994	19.973	BreezyHill_pump1run	0.000	1.000	0.000	1.000	0.402
BreezyHill_GroundTank_Lvl	11.520	12.711	10.019	15.998	13.732						
BreezyHill_pump2run	0.000	0.000	0.000	1.000	0.171						

Analysis of Min-Hour Demand within Pilot DMA

SCADA 2 - 10.1.3.19 - Remote Desktop

10/13/2011
WTP-TS2

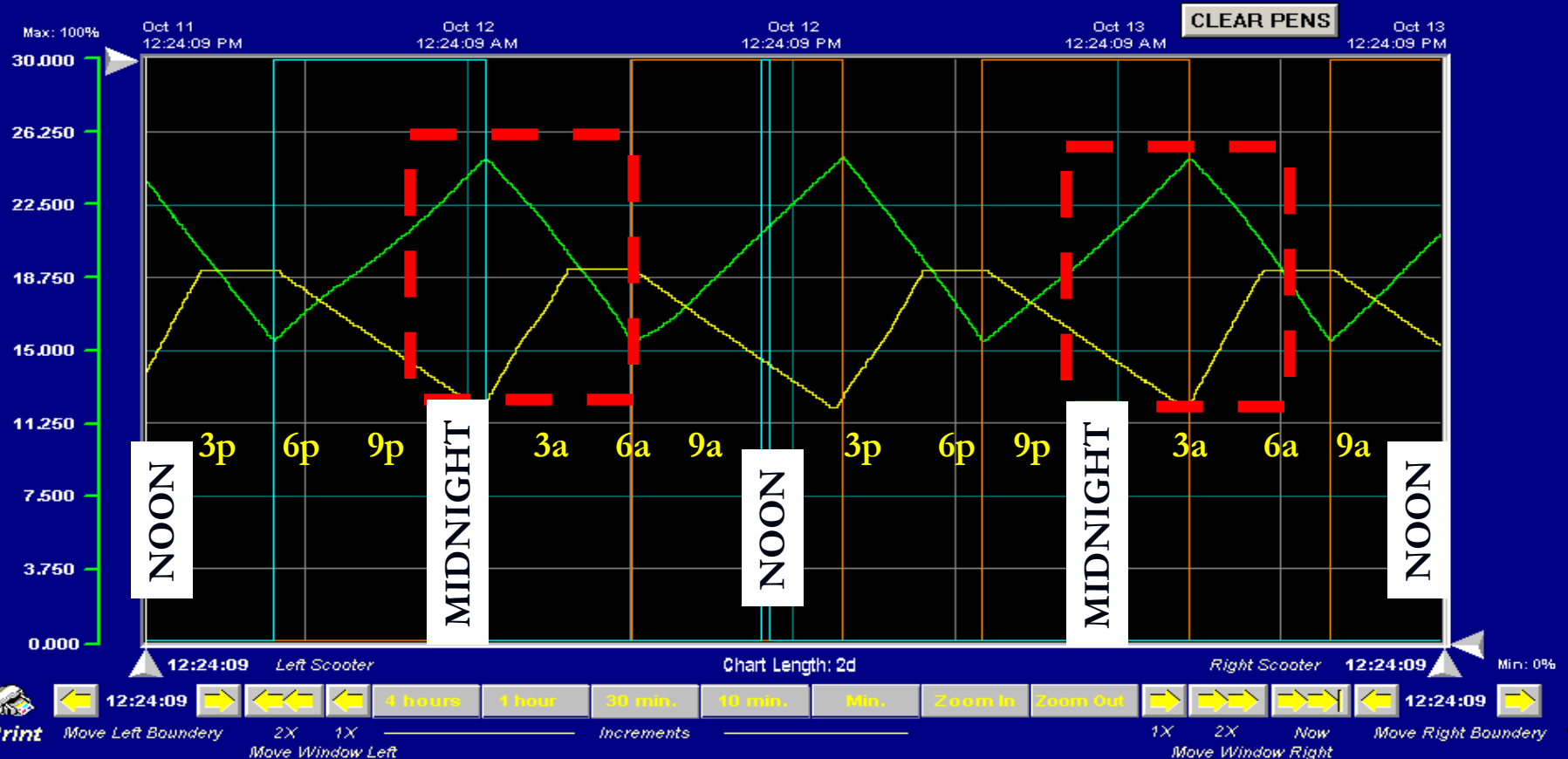
12:29:02 PM
10.2.6.119



Historical Trends



None



Penname	Lt. Scooter	Rt. Scooter	Min	Max	Avg	Penname	Lt. Scooter	Rt. Scooter	Min	Max	Avg
BreezyHill_ElevatedTank_Lvl	23.862	20.979	15.488	24.994	19.973	BreezyHill_pump1run	0.000	1.000	0.000	1.000	0.402
BreezyHill_GroundTank_Lvl	11.520	12.711	10.019	15.998	13.732						
BreezyHill_pump2run	0.000	0.000	0.000	1.000	0.171						

Analysis of Min-Hour Demand within Pilot DMAs

	length/mains (per GIS)	#/connections (per GIS)	average pressure (per model)	UARL
Zone	(mi)	(ea)	(psi)	(MG/yr)
Forsyth	333	10,495	112	138
Downtown	4	864	91	5
Breezy Hill	14	1,365	85	9
Airport	19	441	83	5
Amerson / Ruben	957	50,405	93	432
total	1,328	63,570	93	567

Analysis of Min-Hour Demand within Pilot DMA Forsyth Zone

	t	nighttime drop	tank vol	est tank diameter	est gal/ft	est rate of outflow	est rate of outflow		
tank	hr	ft	gal	ft	gal/ft	gpm	MG/year		
forsyth	1	1.0	300,000	41.26	8,000	133	70		
lizella	1	2.0	1,000,000	75.33	26,667	889	467		
heath rd	1	2.5	500,000	53.26	13,333	556	292		
total estimated min-hour tank outflow						1,578	829		
						gpm	MG/year		
estimated demand: Prison						50	26		
estimated demand: Monroe County						150	79		
estimated demand: Barrington Golf Course						30	16		
estimated demand: Harrison Rd Hotels						100	53		
estimated demand: Macon State U						100	53		
estimated demand: Miscellaneous						100	53		
total estimated min-hour demand						530	279	est % of total system leakage	cost/year
total estimated leakage - Forsyth Zone						1,048	551	44%	\$ 572,190
UARL - Forsyth Zone							138	11%	\$ 143,313
Recoverable Real Loss- Forsyth Zone							413	33%	\$ 428,877

**within Pilot DMA
Breezy Hill Zone**

	t	nighttime drop	tank vol	est tank diameter	est gal/ft	est rate of outflow	est rate of outflow	% of total system leakage	
tank	hr	ft	gal	ft	gal/ft	gpm	MG/year		
breezy hill	3	5.0	500,000	53.26	16,667	463	243		
total estimated min-hour tank outflow						463	243		
estimated demand: Miscellaneous						50	26		
total estimated min-hour demand						50	26		
total estimated leakage - Breezy Hill Zone						413	217	17%	\$ 225,518
UARL - Breezy Hill Zone							9	1%	\$ 9,125
Recoverable Real Loss - Breezy Hill Zone							208	16%	\$ 216,393

Key Points

Pilot DMAs identified

Top-Down leakage and recovery potential quantified

No Capital Costs

Discovery and analysis of total leakage relationship to zone leakage



Just Add Water:

Leveraging Existing Water System Data to Launch Pilot District Metered Areas for Advanced Leakage Management

By: Will J. Jernigan, P.E., LEED® AP



will.jernigan@cavanaugholutions.com



CAVANAUGH

Stewardship Through Innovation