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# Improved Water System Management and Efficiency

## The AWWA Water Audit Standard



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*Presented by:*

*Cavanaugh & Associates P.A.*

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**04.07.10**

**"STEWARDSHIP THROUGH INNOVATION"**

# Presentation Overview



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- Purpose
  - Definitions
    - Benchmarking System Efficiency (today)
    - Managing System Efficiency (ongoing)
  - Water Loss Control Team

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# Water Audit Purpose



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1. Establish Benchmarks for **Water Loss**, in **gallons** and **dollars**.
2. Develop **Key Performance Indicators (KPIs)** for ongoing monthly performance tracking.
3. Develop **Strategies** to:
  - a. Control **Water Loss**
  - b. Recover **Water Revenue**
  - c. Improve **Data Confidence**

# Water Audit Definitions

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## REAL LOSS (RL)

*“Physical” Losses, largely leakage from mains, valves, service lines and overflows*

*Valued at marginal production cost*

## APPARENT LOSS (AL)

*“Paper Losses”, inaccuracies associated with customer metering, systematic data handling errors and theft*

*Valued at customer retail rate*

## UNAVOIDABLE REAL LOSS (URL)

*Theoretical low limit of leakage*

## RECOVERABLE REAL LOSS (RRL)

*Difference between Real Loss and Unavoidable Real Loss*

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# Profile of Authorized Consumption

**\*Metered\***



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Customer Class	# of Active Metered Accounts
Residential	76,000
Commercial	5,800
Industrial	10
PWC	47
City of Fayetteville	194
Sprinklers/Irrigation	6,600

- *PCS Billing Software*
- *~95,000 total accounts*
  - ~87,197 active (metered)
  - ~3,435 inactive (meter in place)
  - ~3,068 inactive (meter removed)
- *21 Cycles*
- *Meter reading / Billing*
  - 6 meter readers
  - 65-68K are radio read (Kent, Hersey, AMCO); remainder are manual read (hand-held key-in)
  - ITRON software
  - Readings downloaded to billing, exceptions report is run, re-reads dispatched following day
  - Meter readings and billings are continuous throughout the month
  - Actual bill generation and mailings are outsourced
- *Wastewater Lift Stations*
  - Not read on same cycle as customer accounts; readings sent to Billing
- *4 Bulk Metered Connections (# of connections):*  
Hoke County (2), Fort Bragg (2), Stedman (1), Spring Lake (1) and Aqua (4)

# Profile of Authorized Consumption

**\*Unmetered \***



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## Distribution/Collection (Jeff M)

- Flushing – UDF Program (ongoing, “everyday”)
- 2” manual blow offs (Tina to give the count from the GIS of this)
- Auto Flushers (10-12 total)
- Reactive Complaint Flushing
- Sewer jetting (fill trucks from hydrants, Mon-Fri, as needed on weekend)
- Repair Flushing
- New Construction – extension flushing
- Hydrant Flow Tests
- Water Quality Flushing March (disinfectant switch)
- Tank Cleaning
- New Lift Station Installation Testing
- Temporary water for New Construction

## Engineering

- Developer Construction Flushing

## Fire Department(s) (Mike)

- Hydrant Testing (City, Hope Mills, 6 County Volunteer Fire Departments)
- Fire Suppression (City & Hope Mills report usage to Dee Bowles)

## System Protection (Chad)

- Tank Truck Filling (Bulk Payment / Flat Rate, a few that report usage – 67 reported users)

## Other

- Special Events at Festival Park (need to verify if any unmetered connections for this)

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# AWWA Water Balance



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Own Sources	System Input	Water Exported	Authorized Consumption	Billed Authorized Consumption	Revenue Water	Billed Water Exported
		Water Supplied		Unbilled Authorized Consumption		Apparent Losses
Billed Unmetered Consumption						
Water Losses	Real Losses		Non-Revenue Water	Unbilled Metered Consumption		
				Unbilled Unmetered Consumption		
	Unauthorized Consumption					
	Customer Metering Inaccuracies					
Water Imported	(Allow For Known Errors)					Leakage on Mains
						Leakage and Overflows at Storages
				Leakage on Service Connections up to point of Customer Metering		

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# Operational Key Performance Indicators (KPIs)



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Benchmark Year FY 09		Data Confidence: <b>75</b> (out of 100)	
Annual System Input Volume		1,000.00	MG / year
<u>Operational Efficiency Indicators</u>		% of System Input Volume	
Total Non-Revenue Water	170.00	MG / year	17.0%
Total Water Loss	160.00	MG / year	16.0%
Apparent Loss	28.17	MG / year	2.8%
Real Loss	131.83	MG / year	13.2%
Unbilled Consumption	10.00	MG / year	1.0%
Unavoidable Real Loss	40.92	MG / year	4.1%
Recoverable Real Loss	90.91	MG / year	9.1%
Infrastructure Leakage Index (ILI) [Real Losses/URL]:	3.2		

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# Financial Key Performance Indicators (KPIs)



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<b>Annual System Input Volume</b>	<b>1,000.00</b>	<b>MG / year</b>	<b>Data Confidence: 75</b>
<u>Financial Indicators</u>			<b>(out of 100)</b>
<b>Annual Water Value of Apparent Loss:</b>	<b>\$84,510</b>		
<b>Annual Sewer Value of Apparent Loss:</b>	<b>\$84,510</b>		
<b>Annual Value of Real Loss:</b>	<b>\$98,872</b>		
<b>Annual Value of Unbilled Consumption:</b>	<b>\$7,500</b>		
<b>Annual Value of Non-Revenue Water:</b>	<b>\$190,883</b>	<b>excluding sewer</b>	<b>including sewer</b>
			<b>\$275,393</b>
<b>Annual Value of Recoverable Real Loss:</b>	<b>\$68,181</b>		
<b>Non-Revenue Water as percent by cost:</b>	<b>19.1%</b>		

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# Monthly Water Data



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Month	System Input					Authorized Consumption								Leakage			
	System	System	DC	Productio n Meter Accuracy	DC	Gross Billed Metered Consumption	DC	Hoffer WTF Service Connections	Unbilled Metered Consumption	DC	Customer Meter Accuracy	DC	Billed Unmetered Consumption	DC	Unbilled Unmetered Consumption	DC	Total Volume of Reported Leakage
	Input Vol (Hoffer) MGAL	Input Vol (Glenville) MGAL		%		MGAL		MGAL	MGAL		%		MGAL		MGAL		MG
J-08	428.1370	210.2210	5	99%	3	609.067000	4	2.869000	8.427000	4	99%	3	0.000000	1	11.111870	2	0.000000
F-08	379.7780	209.9110	5	99%	3	565.329000	4	2.390000	6.895200	4	99%	3	0.000000	1	9.109245	2	0.000000
M-08	476.8210	212.2050	5	99%	3	570.262000	4	2.467000	17.595300	4	99%	3	0.000000	1	23.098199	2	0.000000
A-08	503.2720	243.1090	5	99%	3	624.642000	4	2.845000	18.093600	4	99%	3	0.000000	1	23.749660	2	0.000000
M-08	525.2350	282.5870	5	99%	3	651.400000	4	2.003000	10.423200	4	99%	3	0.000000	1	13.721635	2	0.000000
J-08	710.3130	220.2740	5	99%	3	770.313000	4	2.739000	12.480300	4	99%	3	0.000000	1	16.411019	2	0.000000
J-08	758.6700	129.9810	5	99%	3	805.666000	4	3.246000	6.812000	4	99%	3	0.114000	1	12.205015	2	15.669417
A-08	706.7050	131.9510	5	99%	3	708.479000	4	3.636000	7.241000	4	99%	3	0.027000	1	16.194351	2	15.669417
S-08	522.3230	236.8610	5	99%	3	677.478000	4	3.839000	7.703000	4	99%	3	0.081000	1	17.341285	2	15.669417
O-08	513.3750	230.1320	5	99%	3	676.086000	4	4.371000	8.694000	4	99%	3	0.000000	1	14.611503	2	15.669417
N-08	443.1510	226.0800	5	99%	3	547.691750	4	2.752000	6.140250	4	99%	3	0.020000	1	10.721341	2	15.669417
D-08	409.8570	253.0270	5	99%	3	626.413000	4	3.184000	9.011100	4	99%	3	0.012000	1	11.875502	2	15.669417
J-09	452.0390	239.4730	5	99%	3	610.040000	4	2.870000	9.110700	4	99%	3	0.001000	1	12.169884	2	15.669417
F-09	405.4510	215.2860	5	99%	3	600.526000	4	3.322000	11.875200	4	99%	3	0.048000	1	15.594718	2	15.669417
M-09	417.8210	267.1690	5	99%	3	583.005000	4	3.226000	14.334900	4	99%	3	0.005000	1	18.878244	2	15.669417
A-09	473.8880	255.3650	5	99%	3	697.935000	4	3.094000	21.927300	4	99%	3	0.009000	1	28.790847	2	15.669417
M-09	489.9810	281.4390	5	99%	3	758.044000	4	3.114000	11.994300	4	99%	3	0.060000	1	15.892741	2	15.669417
J-09	580.3580	260.7380	5	99%	3	737.520000	4	3.179000	10.409100	4	99%	3	0.108000	1	13.757550	2	15.669417
J-09																	
A-09																	
S-09																	
O-09																	
N-09																	
D-09																	
J-10																	
F-10																	
M-10																	

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# Monthly KPI Tracker (%)

## [Trailing 12 month average]



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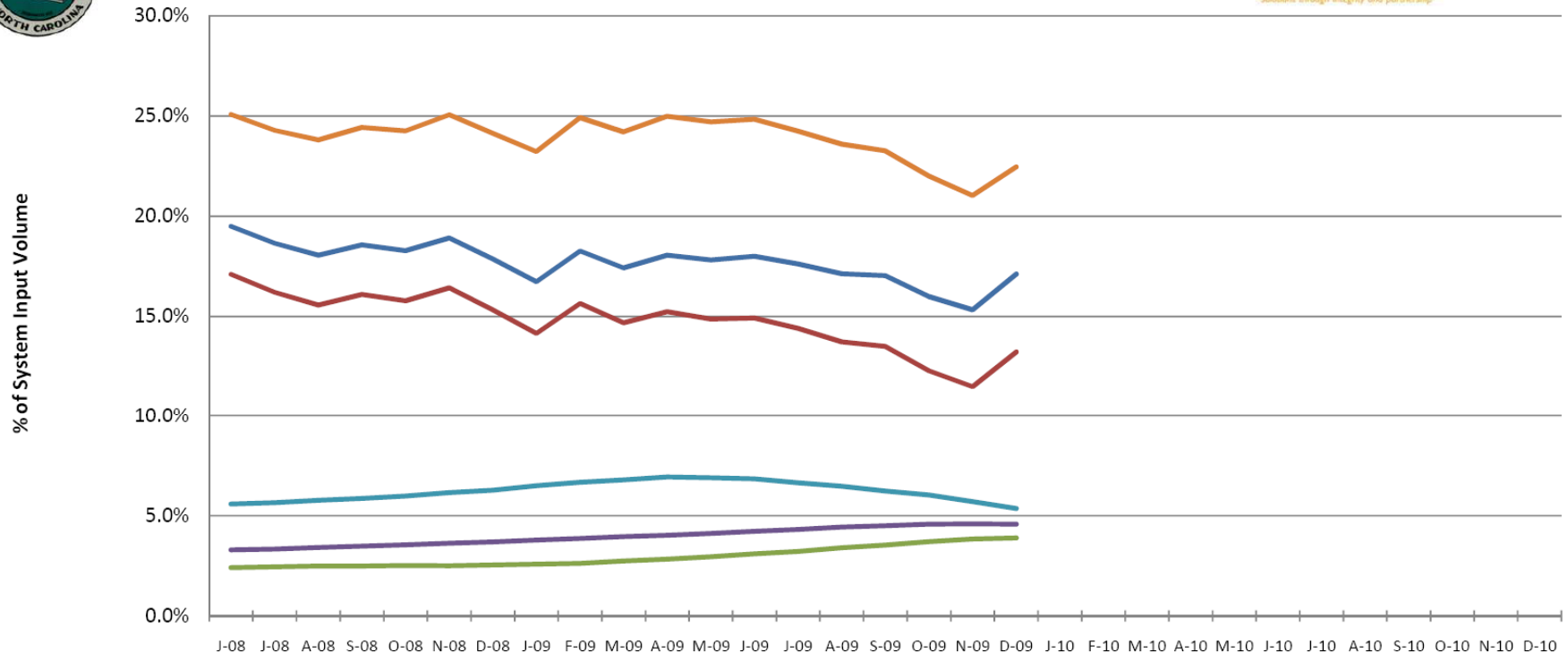


### Town of Valdese Water System Key Performance Indicators



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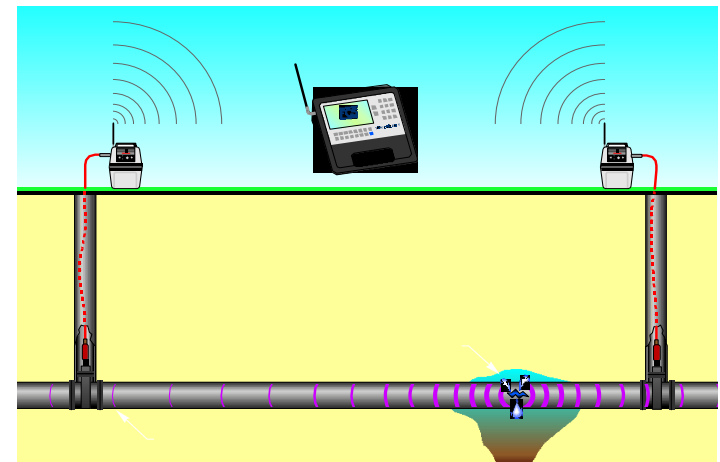
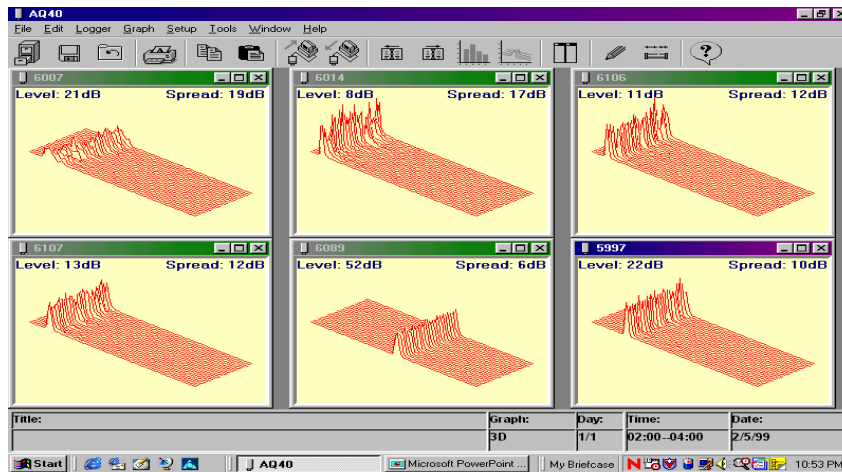
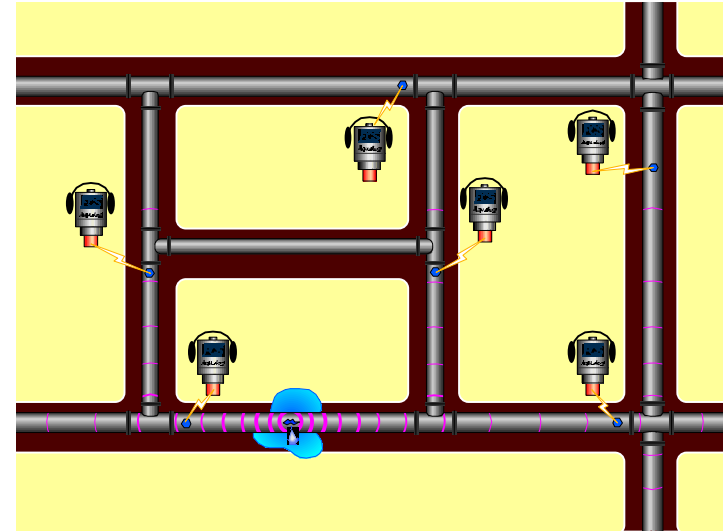
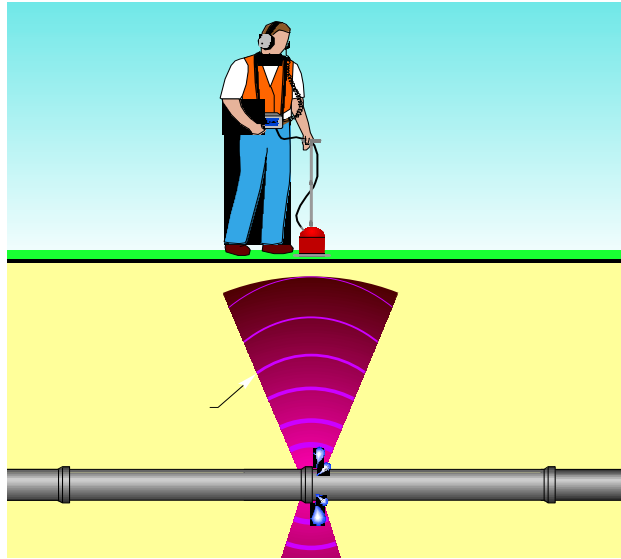
	J-08	J-08	A-08	S-08	O-08	N-08	D-08	J-09	F-09	M-09	A-09	M-09	J-09	J-09	A-09	S-09	O-09	N-09	D-09	J-10	F-10	M-10	A-10	M-10	J-10	J-10	A-10	S-10	O-10	N-10	D-10	
Total Water Loss	19.5%	18.6%	18.1%	18.6%	18.3%	18.9%	17.9%	16.7%	18.3%	17.4%	18.1%	17.8%	18.0%	17.6%	17.1%	17.0%	16.0%	15.3%	17.1%													
Real Loss	17.1%	16.2%	15.6%	16.1%	15.8%	16.4%	15.3%	14.2%	15.6%	14.7%	15.2%	14.9%	14.9%	14.4%	13.7%	13.5%	12.3%	11.5%	13.2%													
Apparent Loss	2.4%	2.4%	2.5%	2.5%	2.5%	2.5%	2.6%	2.6%	2.7%	2.8%	3.0%	3.1%	3.2%	3.4%	3.5%	3.7%	3.8%	3.9%														
Unavoidable Loss	3.3%	3.3%	3.4%	3.5%	3.5%	3.6%	3.7%	3.8%	3.9%	4.0%	4.0%	4.1%	4.2%	4.3%	4.4%	4.5%	4.6%	4.6%	4.6%													
Unmetered Unbilled (%)	5.6%	5.6%	5.8%	5.9%	6.0%	6.1%	6.3%	6.5%	6.7%	6.8%	6.9%	6.9%	6.8%	6.6%	6.5%	6.2%	6.0%	5.7%	5.4%													
Non-Revenue Water (%)	25.1%	24.3%	23.8%	24.4%	24.3%	25.1%	24.1%	23.2%	24.9%	24.2%	25.0%	24.7%	24.8%	24.2%	23.6%	23.3%	22.0%	21.0%	22.5%													

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# Active Leak Detection

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# Water Loss Calculator



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City of Burlington  
Water Loss Calculator

## Rectangular Break

Long Break

Length of break  in feet      PSI

Width of break  in inches

Leak Time  in hours      Area of Hole  sq. ft.



GPM water loss

Total Loss

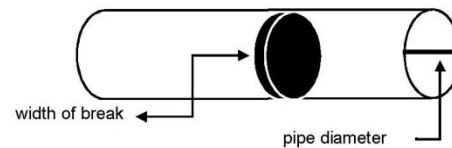
## Circular Break

around whole pipe

Pipe Size (Dia.)  in inches

Width of Break  in inches      Area of Hole  sq. ft.

Leak Time  in hours



PSI

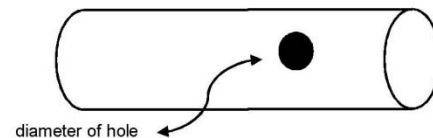
GPM

Total loss in gals

## Hole in Pipe

Dia. Of Hole  in inches      area of hole

Leak Time  in hours



PSI

GPM

Total Loss in gals

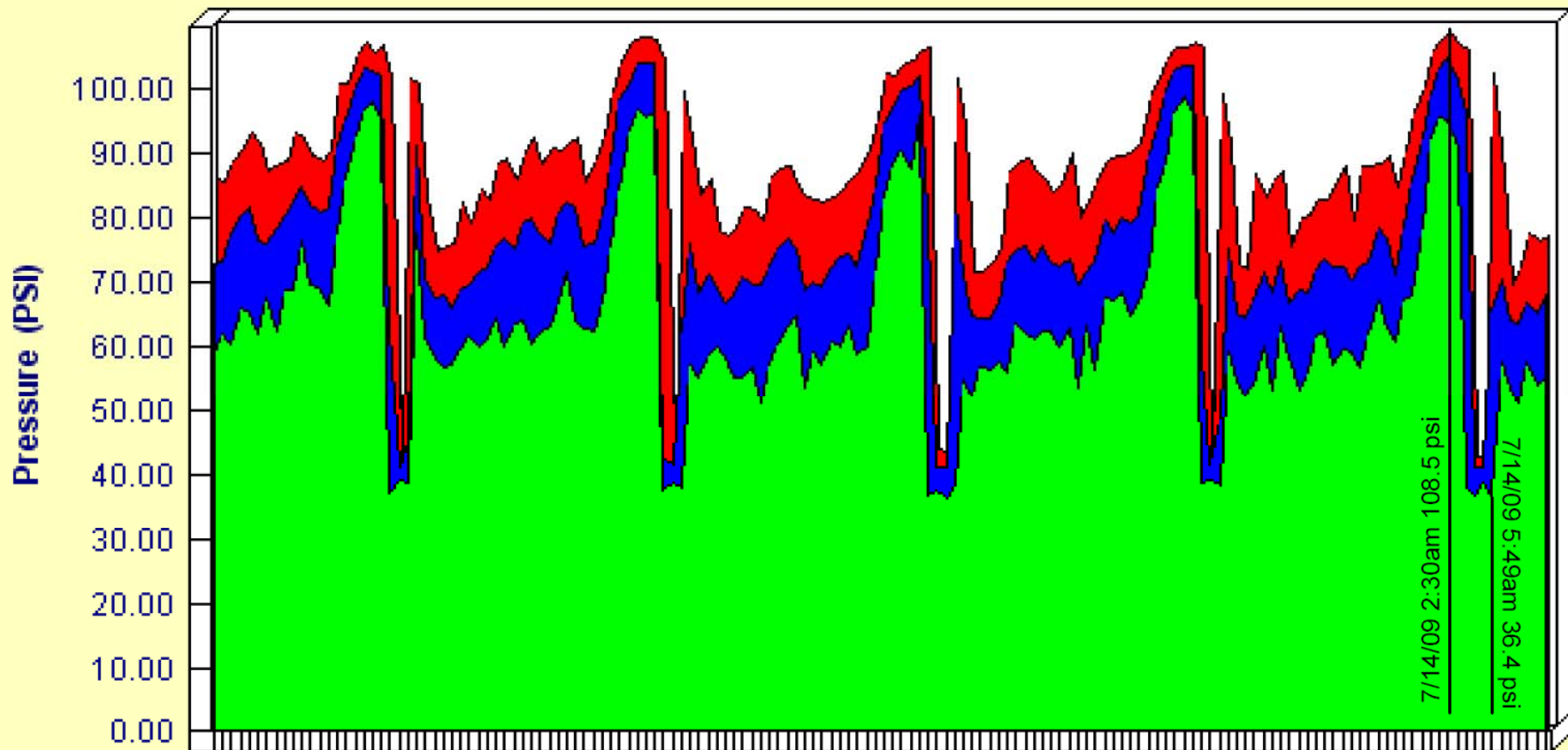
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# Pressure Management

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## Water Booster Station



7/9/2009 12:48:43 PM to 7/14/2009 11:05:43 AM

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# Water Loss Control Team



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- *Distribution/Collection*
- *Finance*
- *Public Works*
- *Water Treatment*
- *Wastewater Treatment*
- *Meter Reading / Testing*
- *Billing*
- *Fire Departments*
- *Parks & Recreation*
- *Leak Detection*
- *GIS / IT*
- *Administration*
- *Management*



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# Water Loss Control Team *Purpose*



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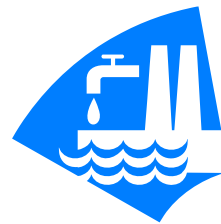
- 1. Track System KPIs**
- 2. Discussion and analysis of KPI trends**
- 3. Discuss strategies to control water loss**
- 4. Progress and next steps**



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**end**



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