2013 Water Management Workshop Series

Metropolitan Planning Council

Chicago Metropolitan Agency for Planning

Regulations and Ordinances– June 26, 2013

Course ID 7254

DuPage Water Commission is Preserving Every Drop

Workshop series overview

Give conservation coordinators tools to educate and encourage customers to conserve water by emphasizing the importance of conservation and the role it plays in utility management, regulations and ordinances, water and revenues.

1. **May 29: Utility planning and asset management**
2. **June 26: Regulations and ordinances**
3. **July 31: Indoor and outdoor water use**
4. **August 28: Water rates and revenue**

Key takeaways

1. **Understand the role of regulations and ordinances on effective water supply management.**

2. **Recognize the barriers to successful implementation of water conservation ordinances and identify strategies to reduce them.**

3. **Become familiar with upcoming regulatory changes and how they will affect local water supply operations, including encouraging water conservation.**

Ordinances

Integrating and Implementing Water Conservation Ordinances

Abby Crisostomo, Metropolitan Planning Council

Bill Balling, WRB, LLC

Existing model ordinances in NE Illinois

Abby Crisostomo, Metropolitan Planning Council, @AbbyMPC

DuPage Water Commission, June 26, 2013

Role of water conservation ordinances

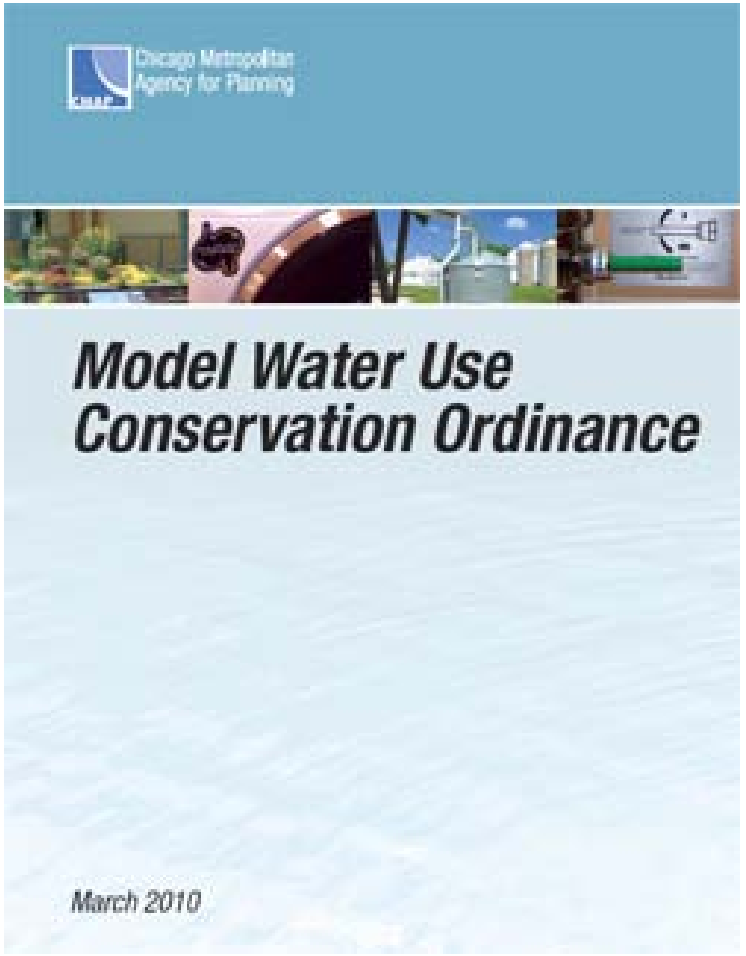
- Carrots and sticks
- Working with municipal staff
- Integrating with other ordinances

Role of water conservation ordinances

- Lawn watering restrictions
- New sod restrictions
- Other watering restrictions
- Municipal operations
- Water rates
- Water meters
- Water billing
- Water charge
- Well setback zones
- Groundwater protection overlays
- Watershed protection
- Landscaping
- Native plants
- Nuisance weeds
- Plumbing code
- Water-efficient fixtures
- Drought

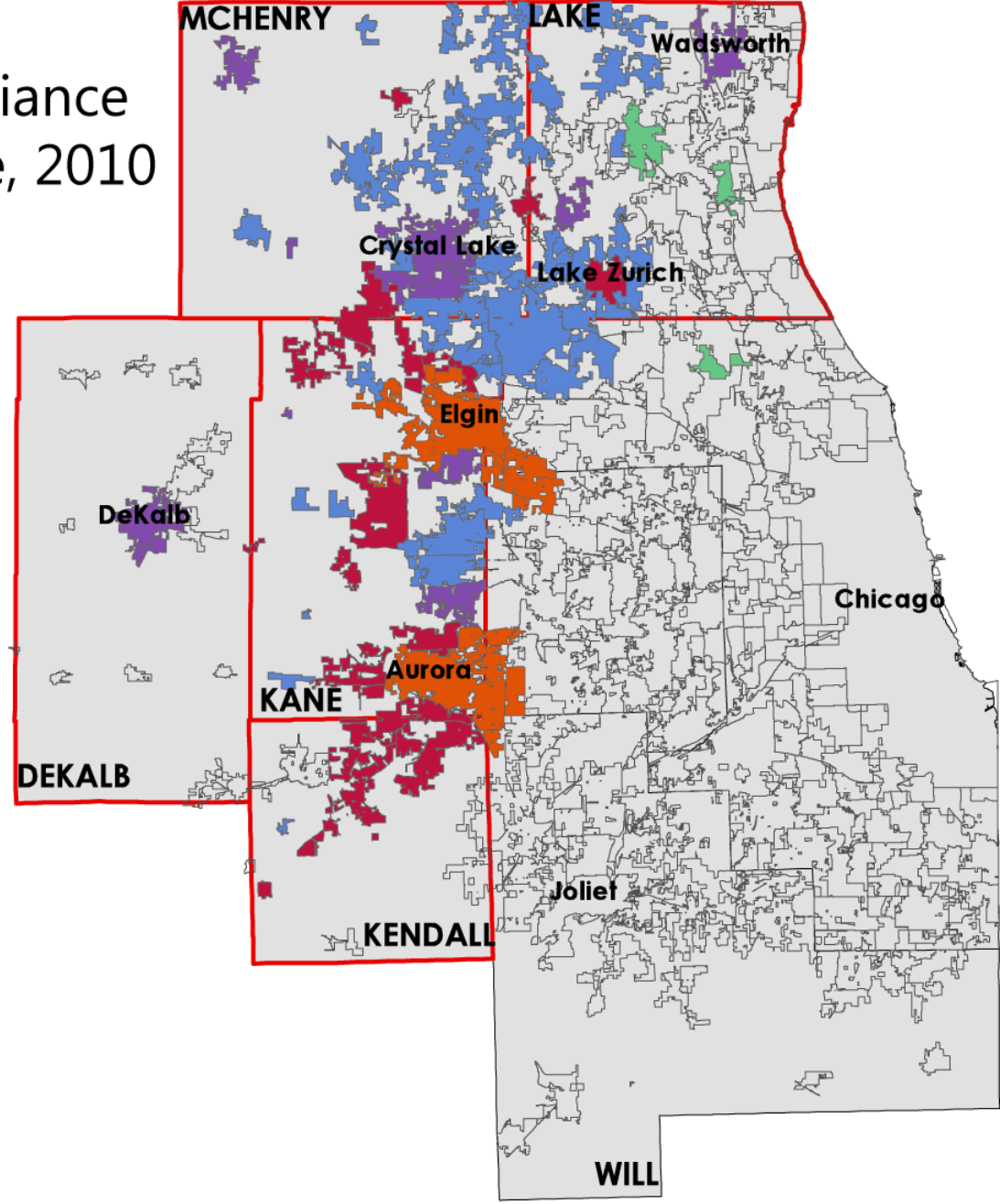
Existing model ordinances: CMAP

- Residential – indoors and outdoors
- ICI – indoors and outdoors
- Rainwater harvesting
- Water waste
- Pricing
- Information and outreach
- Violations and enforcement



Existing model ordinances: NWPA

Northwest Water Planning Alliance Communities by Water Source, 2010



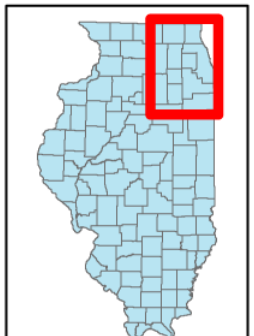
Northwest Water Planning Alliance Communities

- NWPA Counties
- Non-NWPA Municipalities

NWPA Municipalities by Water Source

- Deep Aquifer
- Deep Aquifer and River
- Deep and Shallow Aquifer
- Lake
- Shallow Aquifer

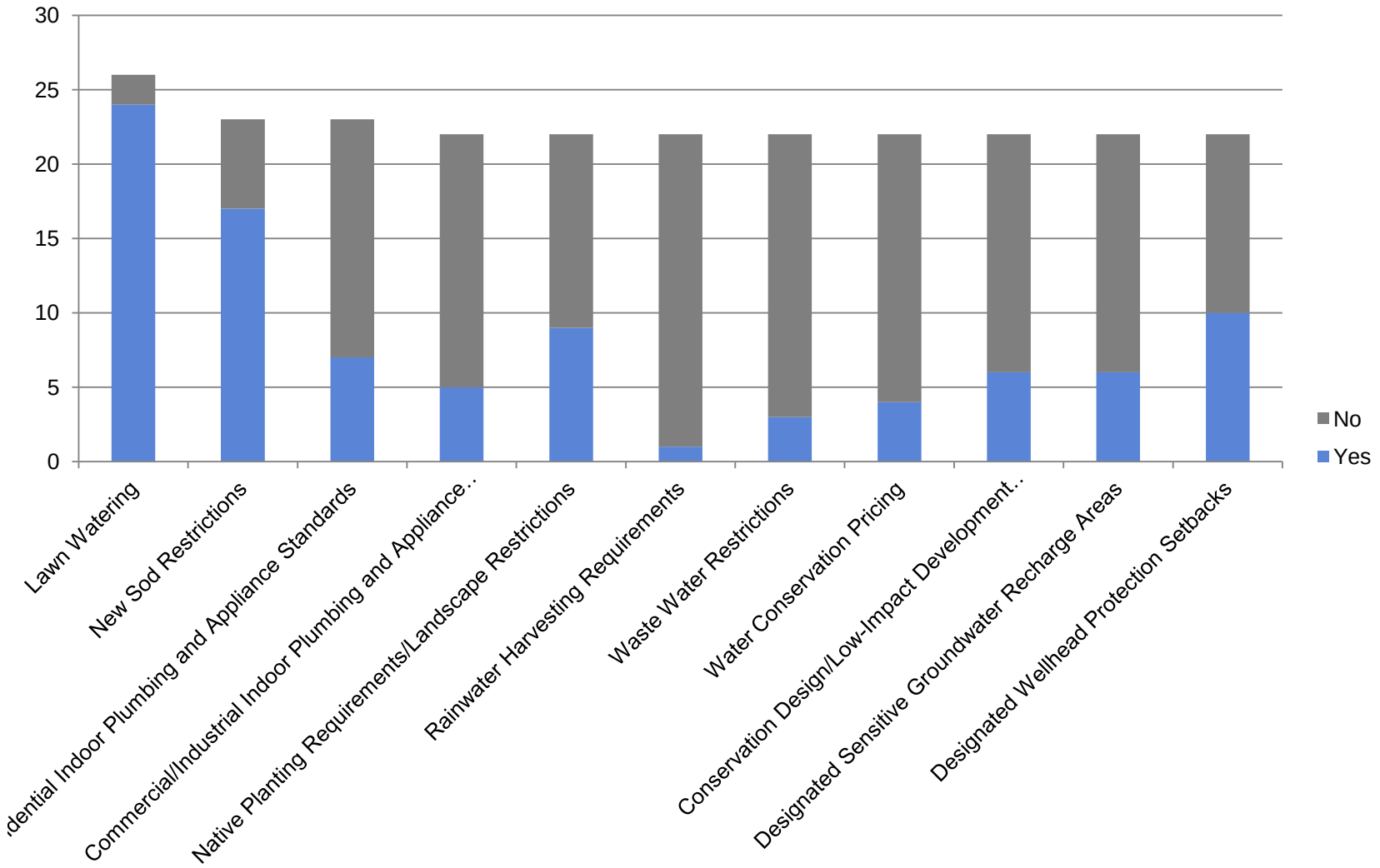
Illinois



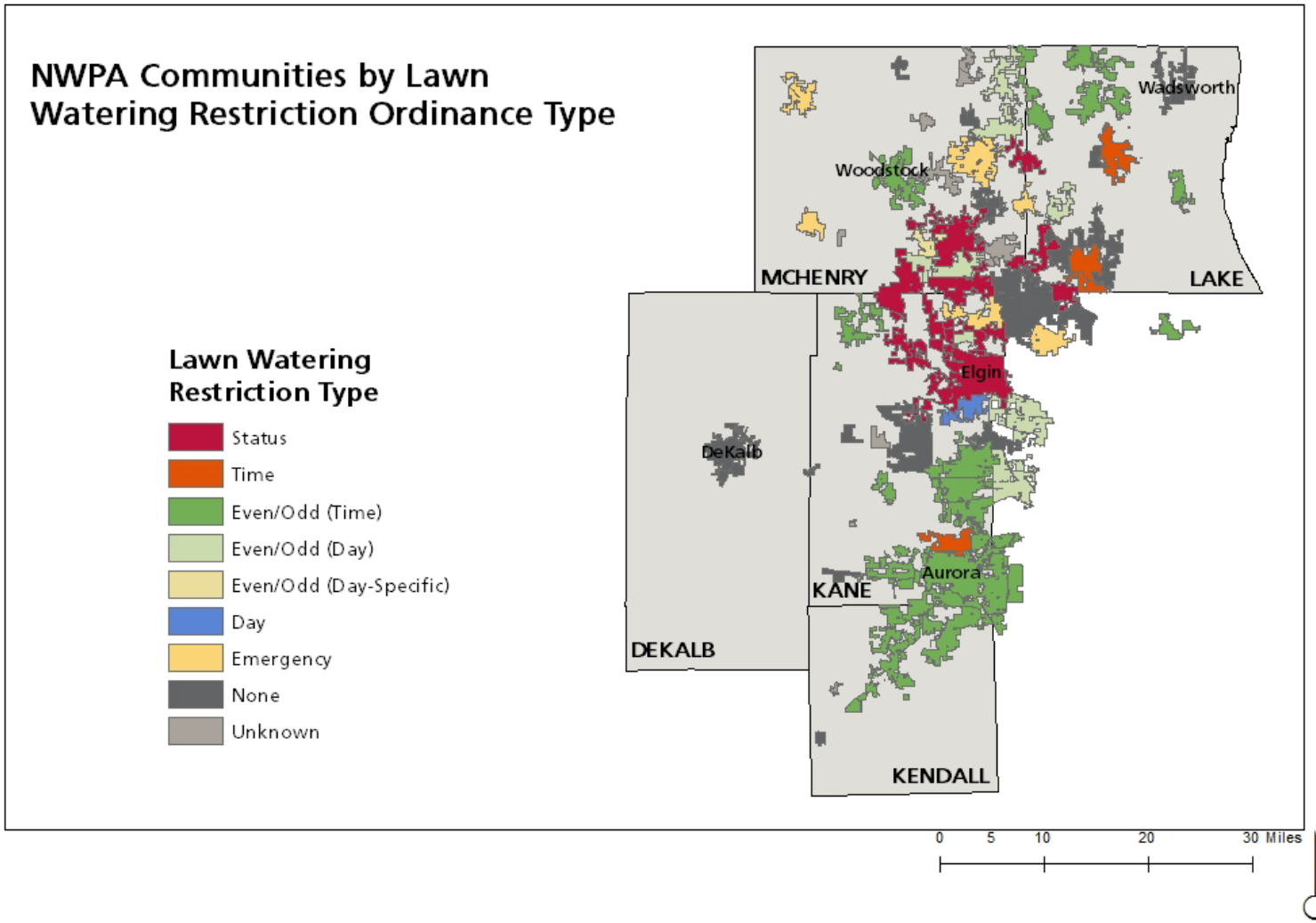
Sources:
Municipalities, water sources, and Northwest Water Planning Alliance from Metropolitan Planning Council;
counties from Illinois State Geological Survey

Map prepared by Abby Crisostomo
26 April 2012

Existing model ordinances: NWPA



Existing model ordinances: NWPA



Existing model ordinances: NWPA

Year–Round Conservation Ordinance:

Even/odd, sprinklers allowed 6am-9am and 6pm-9pm

- 18 or 24 hours available
- Non-potable water and handheld watering devices can be used any day or time
- Could be the “Green” in a color-coded system

Existing model ordinances: NWPA

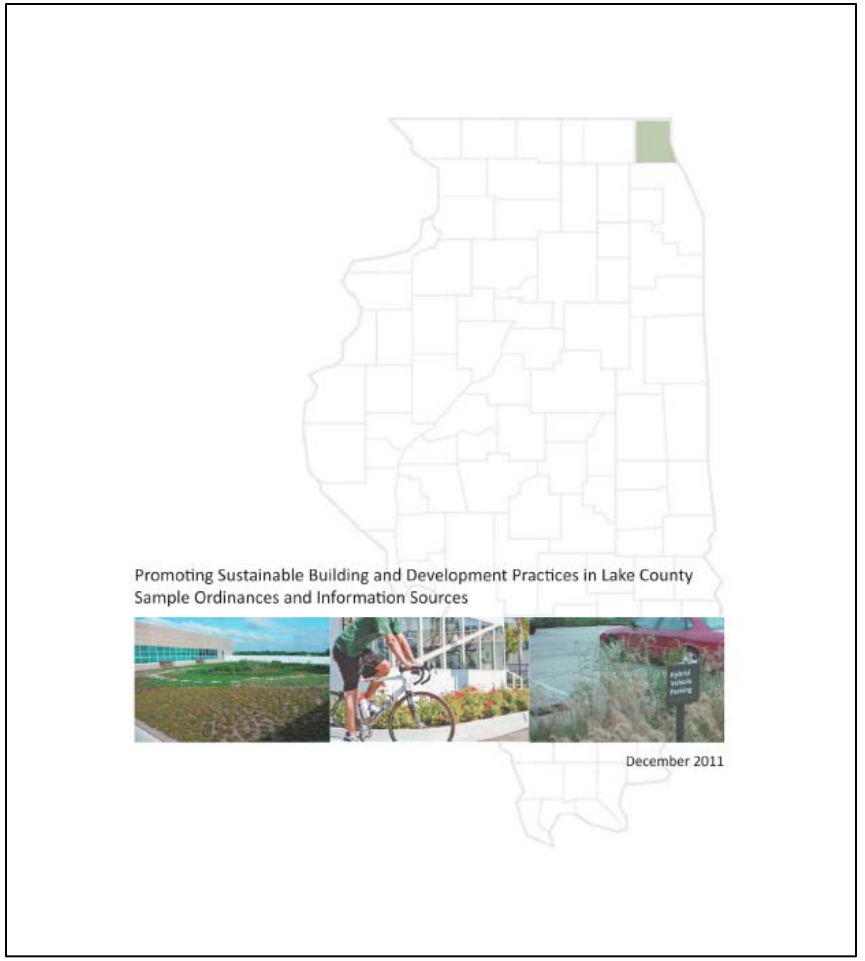
Drought Provisions

- **Drought Provision:** Sprinkler system use prohibited
  - Outdoor use of water allowed only with non-potable water or handheld watering devices
  - Could be the “Yellow” in a color-coded system

- **Extreme Drought Provision:** Total ban on outdoor watering
  - Could be the “Red” in a color-coded system

Existing model ordinances: Lake County

- Energy conservation and renewables
- Land use, transportation and mobility
- Open space and natural resources
- Water quality and quantity
- Stormwater management
- Redevelopment, waste minimization and material reuse
- Construction-phase pollution control
- Outdoor lighting
- Indoor environmental quality
- Food supply
- Incentive-based approaches to promoting sustainability



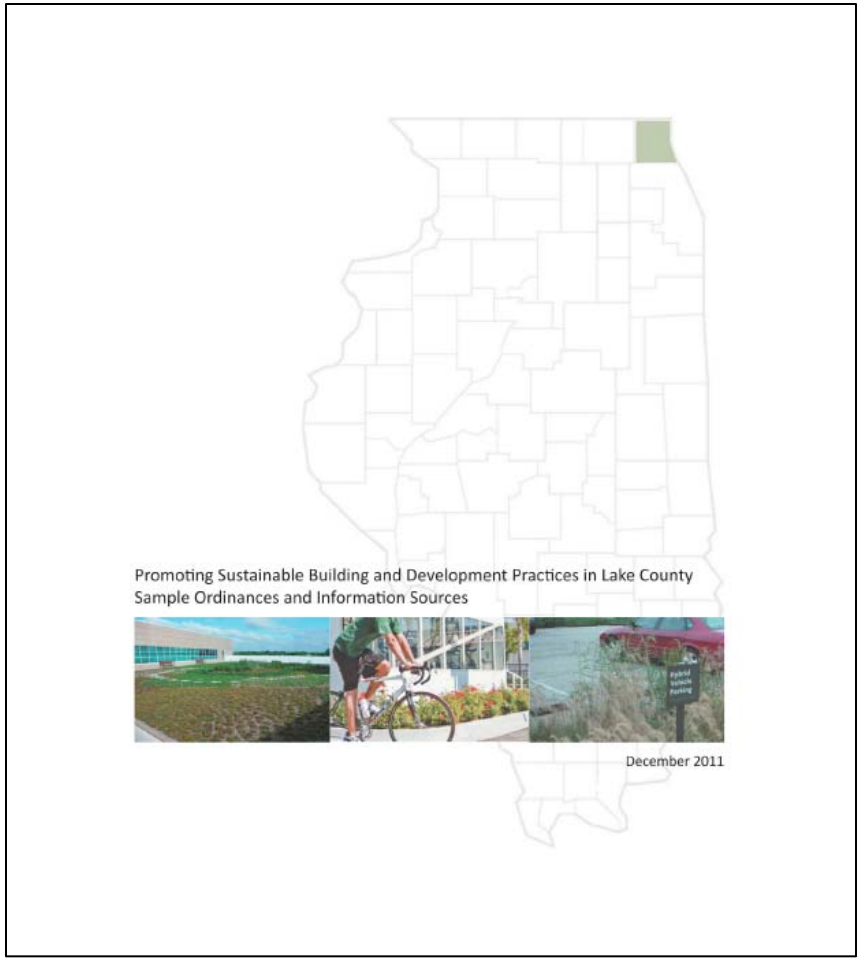
Existing model ordinances: Lake County

Open space and natural resources

- Native plants

Water quality and quantity

- Rainwater harvesting/reuse
- High-efficiency plumbing fixtures
- Low water use landscaping
- Efficient irrigation systems
- Turf area management
- Individual metering



Contact Us:

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Lake County Water Supply Advisory Committee (WSAC) Annual Report

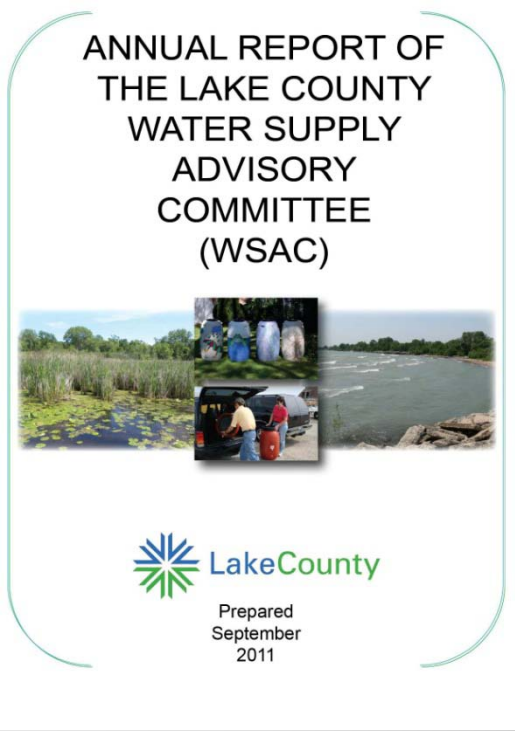
LakeCounty

Water Supply Advisory Committee

With our region's population projected to grow as much as 38% over the next 40 years, we must plan for our future water supply.

Lake County, along with municipalities and professionals in both the private and public sector, formed the Water Supply Advisory Committee (WSAC). This group is working to establish sustainable policies and practices for our water supply. The WSAC annual report includes important information about best practices for:

- groundwater protection
- water conservation
- full cost water pricing



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Groundwater Protection

It's important that we protect groundwater from threats of contamination and preserve the quality of aquifers.

Some portions of Lake County are 100% dependent on groundwater to meet residential, commercial and municipal demands.

Both the ***quantity*** and ***quality*** of groundwater available in Lake County must be monitored and managed to assure that all future water needs of Lake County are met.

THREAT: ABANDONED WELLS

Wells that are no longer in use are no longer monitored. If one of these wells were to become contaminated it could easily and quickly contaminate nearby wells. Remediation would be extremely costly and nearly impossible.

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Water Conservation

Water Conservation is one of the most important ways that we can assure a long term reliable groundwater source.

The WSAC report recommends developing specific goals for reducing water consumption. A few of these are:

- Endorse the installation of water saving fixtures (faucets, showerheads)
- Endorse the installation high efficiency toilets and washers
- Install and replace water meters
- Promote rain barrel programs, rain gardens and native landscaping
- Promote high efficiency sprinkler and irrigation systems
- Develop programs for leak detection, leak survey and repair

LakeCounty

Full Cost Water Pricing

Full cost water pricing charges users for the full cost of water – including operational and maintenance expenses and capital improvements and replacement expenses.

To study this, it's important to consider:

- Customer classes (residential, commercial, industrial)
- Rate types (uniform block rates, decreasing block rates, increasing block rates, seasonal rates)
- Billing intervals (monthly, quarterly)
- Collections

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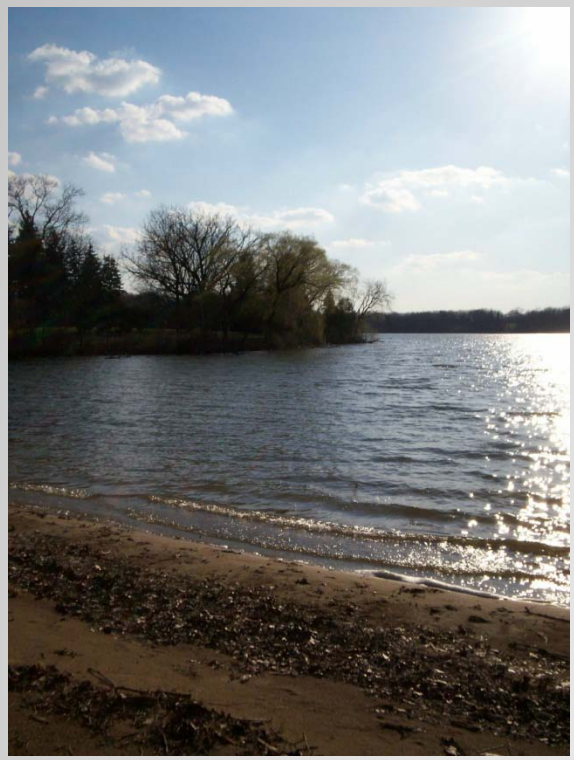
What's Next?



The next step for the committee will be to evaluate alternative water supplies, educate the public about water conservation and work with policy makers to create appropriate strategies to ensure Lake County residents have clean and safe water now and in the future.

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THANK YOU

www.lakecountyil.gov

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Discussion: Integrating and implementing water conservation ordinances

NEWS

All Sections

Home > Featured Articles > **Chicago**

Weed law in Chicago sends native plant gardeners to court

May 19, 2013 | Mary Schmich

Recommend 77 Tweet 24 6

Chicago's growing season is still young, and so far the alleged villain in Kathy Cummings' garden is only 2 inches tall.

By summer's peak, however, the accused will stand 4 gangly feet once again, and once again someone is sure to mistake it for a weed.

It's milkweed. That is not a weed.

Kathy Cummings in her West Side natural garden Wednesday, M...

Discussion: Integrating and implementing water conservation ordinances

- What water conservation ordinances do you use in your community?
- What barriers have you faced with implementing and enforcing ordinances?
- Bring your own questions about using water conservation ordinances

Regulations

Role of Water Reuse in Water Conservation and Changes to the State Plumbing Code

John Bauer, Wahaso

Josh Ellis, Metropolitan Planning Council

Water Harvesting

For Commercial & Institutional Buildings

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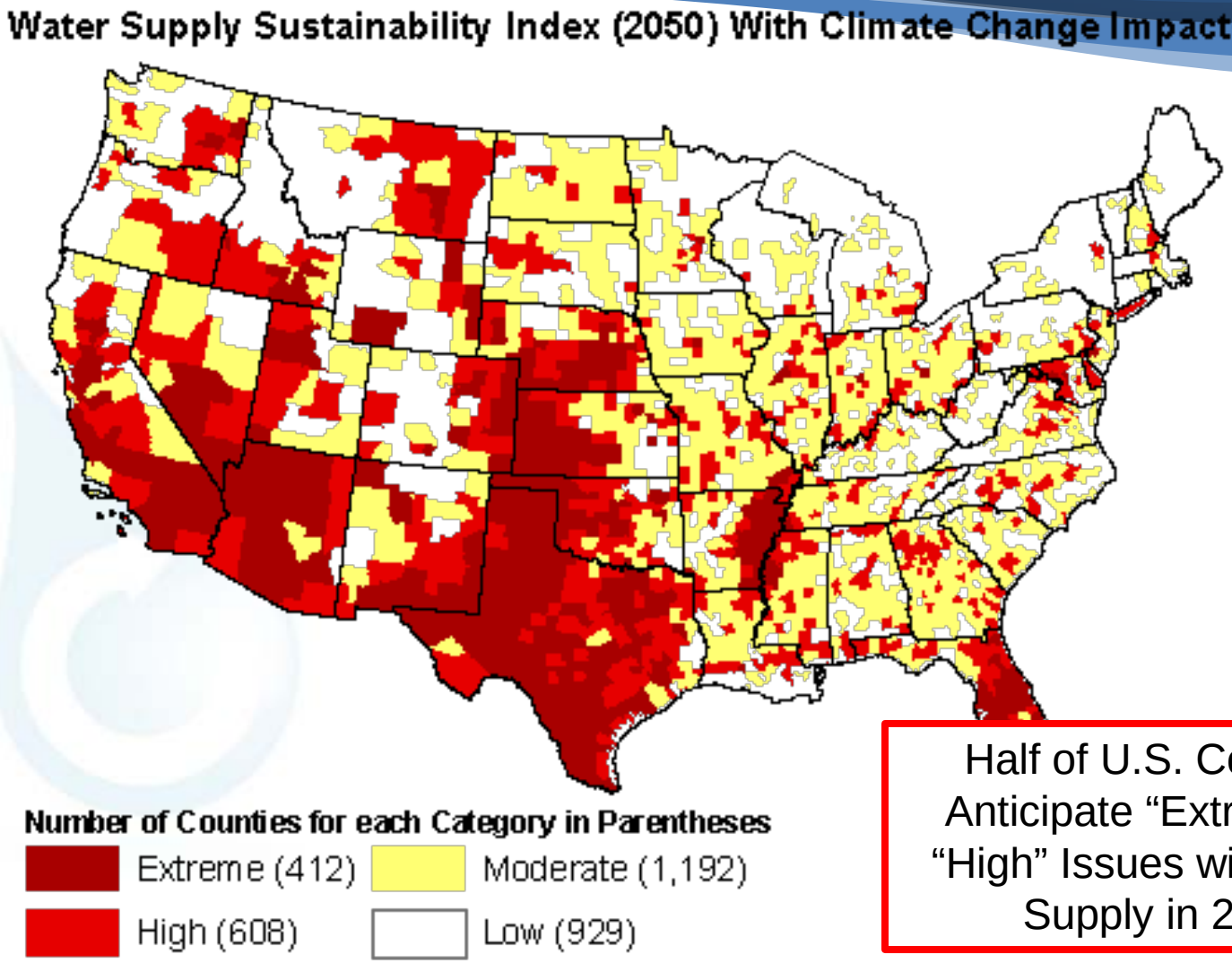
wahaso
WATER HARVESTING SOLUTIONS

A Water Crisis on the Horizon



Half of U.S. Counties Anticipate “Extreme” or “High” Issues with Water Supply in 2050

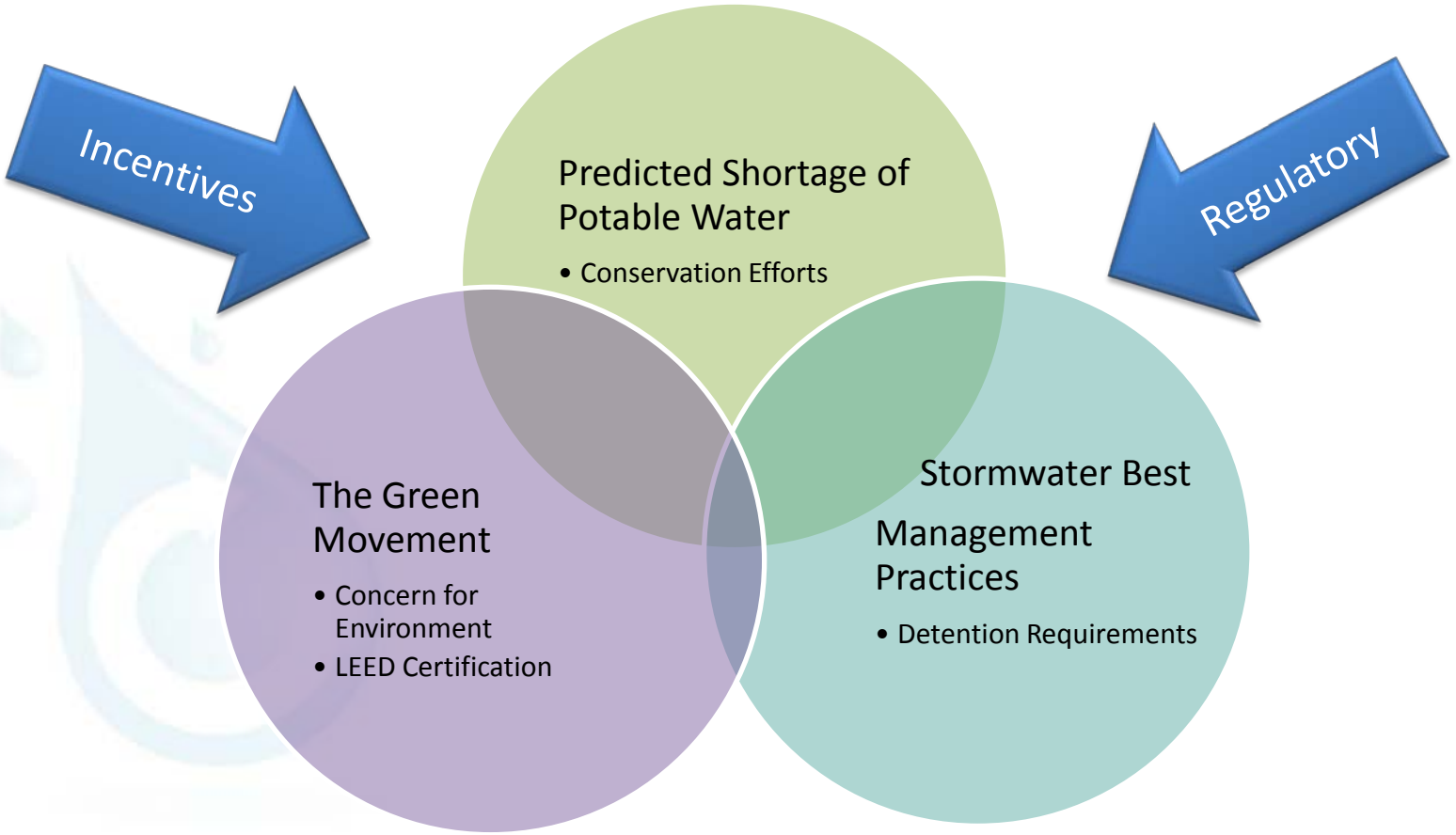
What is "Water Harvesting"?

Water Harvesting *is the collection, cleaning, storage and reuse of onsite water sources, to reduce the consumption of municipal potable water.*

TERMS

Rainwater	From roofs and above-ground collectors
Stormwater	From ground surfaces – Parking lots, run-off
Greywater, Gray Water	Untreated waste water “gently used” in showers, sinks, processes
Condensate	From cooling system blower units or steam systems
Groundwater	From below-grade sumps (around basements)
Reclaimed Water	Municipally-treated sewage for reuse
On-Site Treated Non-Potable Water	Processed water from any source ready for non-potable reuse

Megatrends Support Water Harvesting as One Conservation Effort

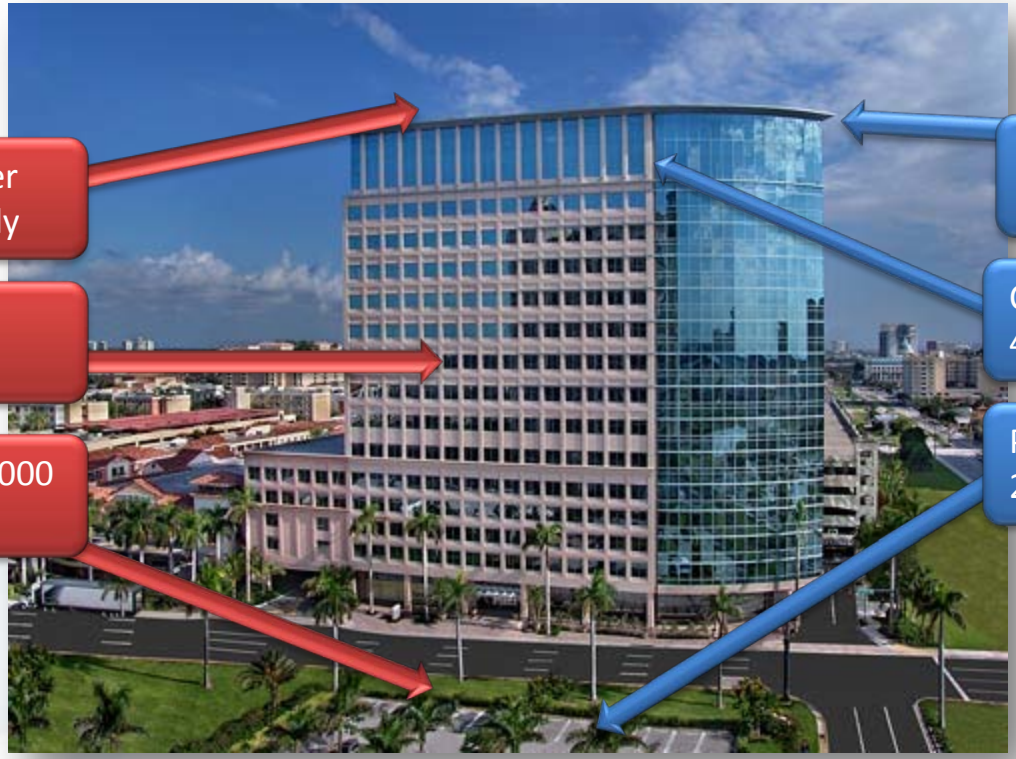


What's in it for Owners?

- Save money on municipal water and sewer charges
- Convert stormwater liability into an asset
- Protect the environment

- “Green” building certification
- Regulatory requirements, incentives
- Higher property resale value
- Good public relations

The Harvesting Opportunity in Commercial Properties



Evaporative Cooling Tower
1,500,000 gallons annually

Toilet flushing
500,000 gallons annually

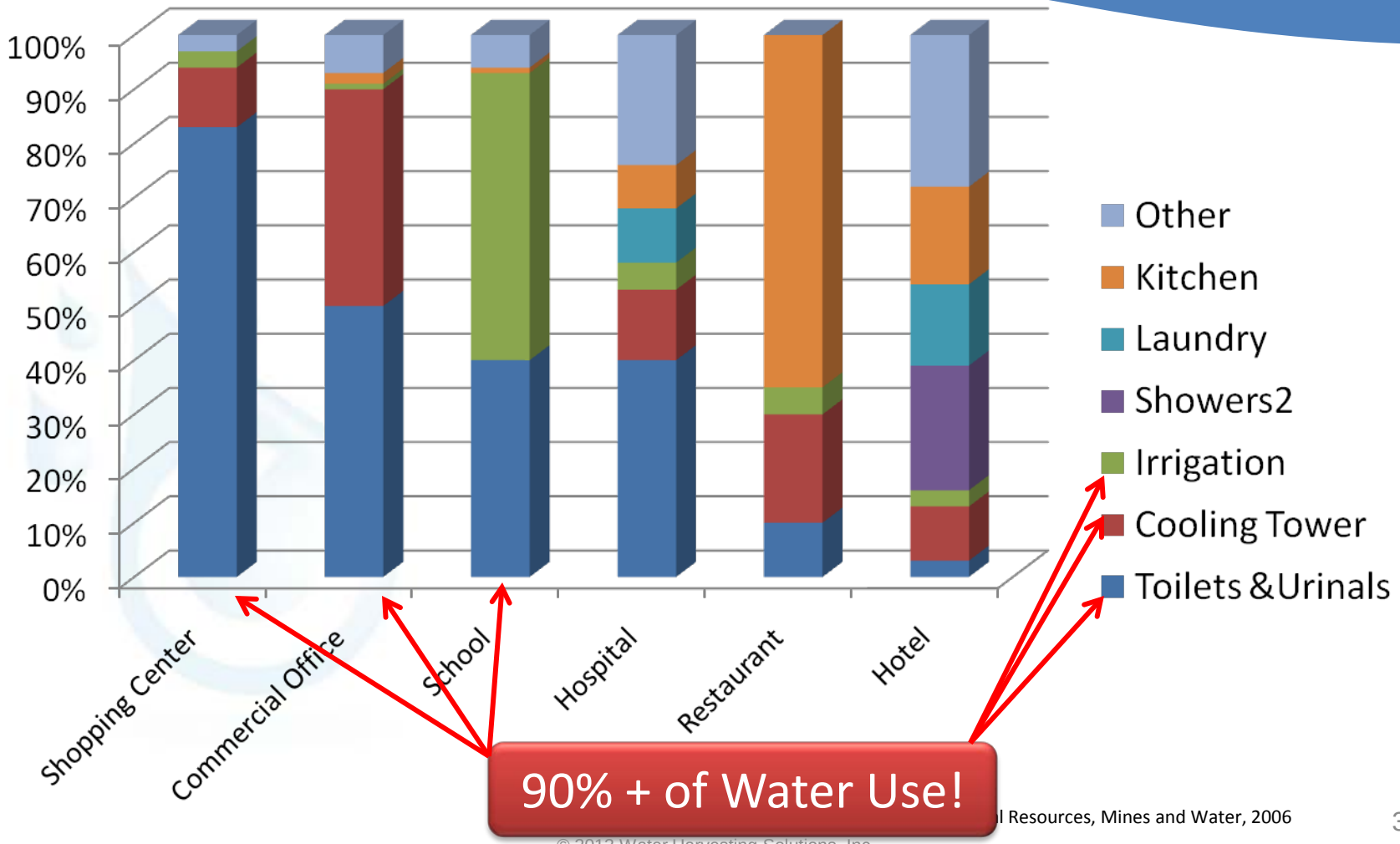
Landscape irrigation 750,000 gallons annually

Rooftop rainwater 500,000 gallons annually

Cooling coil condensation
400,000 gallons annually

Parking lot rainwater
2,000,000 gallons annually

Most Water Use in Commercial Buildings can be Replaced with Harvested Rainwater and Stormwater



l Resources, Mines and Water, 2006

Issue: Plumbing Design Affects Options for Life of Building

2013

2015

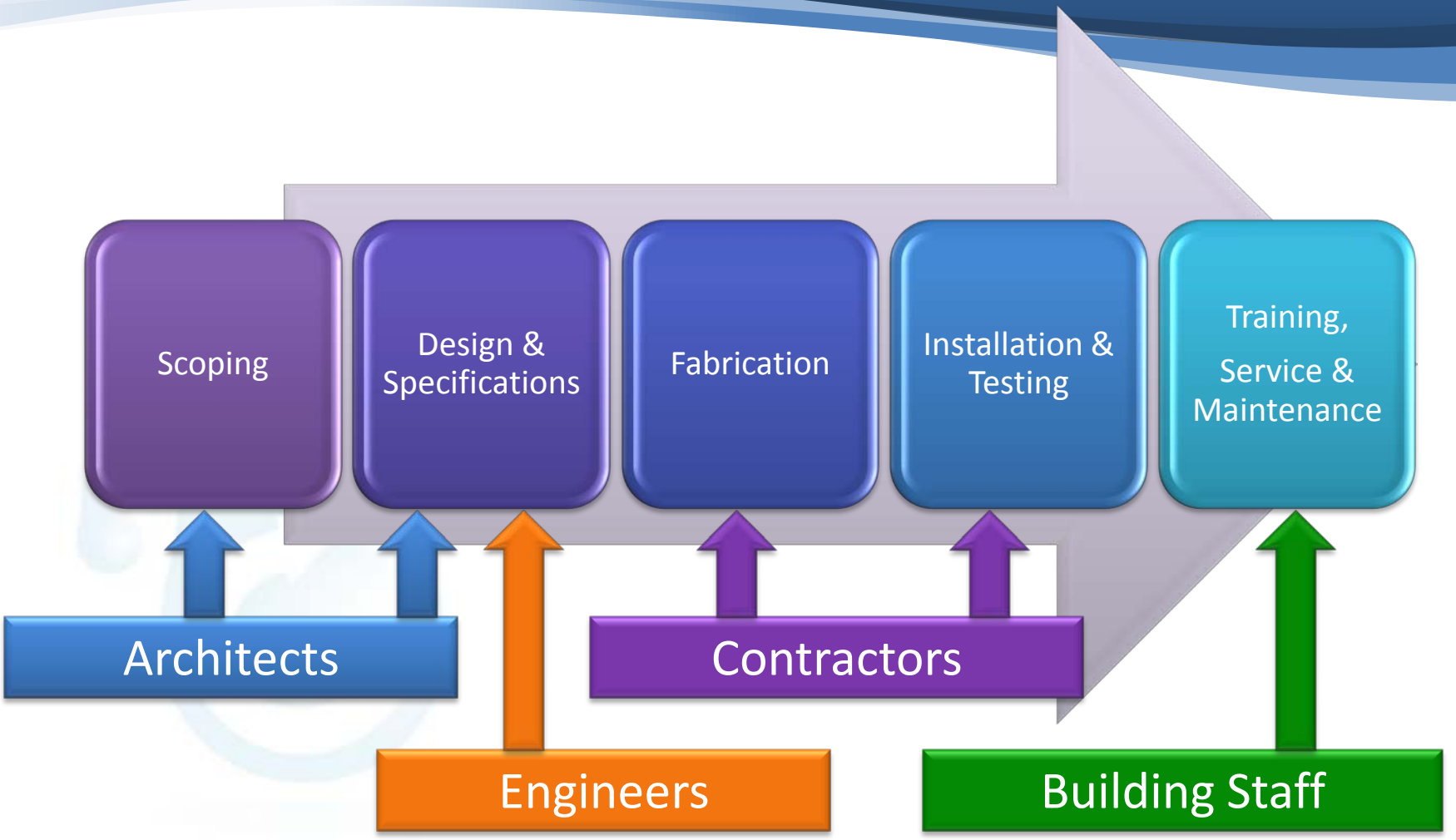
2055?

Ability to capture and harvest greywater

Ability to flush toilets with non-potable water

- *20 million gallons of savings over life of building!*

Development Process Touches Multiple Customers



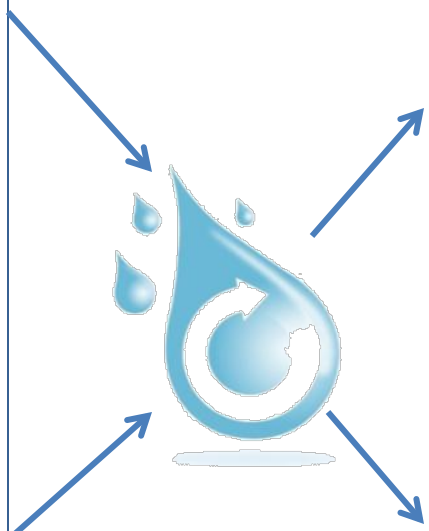
System Design Objectives

- Make a significant and meaningful impact on reducing the amount of municipal water use
- Match a system to meet the unique characteristics of the building
  - Location, use, opportunities, local codes
- Ensure that the water is safe for storage & application
- Keep the system as simple as possible
  - Complexity adds up-front cost, maintenance, risk
- Keep the system cost-per-gallon saved as low as possible

Scoping: Evaluating Water Sources & Applications

Potential Sources

- Rooftop rainwater
- Surface stormwater
- Greywater from showers, sinks, washers
- Cooling condensate
- Steam condensate
- Groundwater ejectors
- Cooling tower “blow down”
- Process wastewater



Potential Uses

- Landscape irrigation
- Toilet flushing
- Cooling tower “make-up”
- Green roof irrigation
- Boiler “make-up”
- Truck washing
- Washing machines

Scoping: Matching Supply to Demand

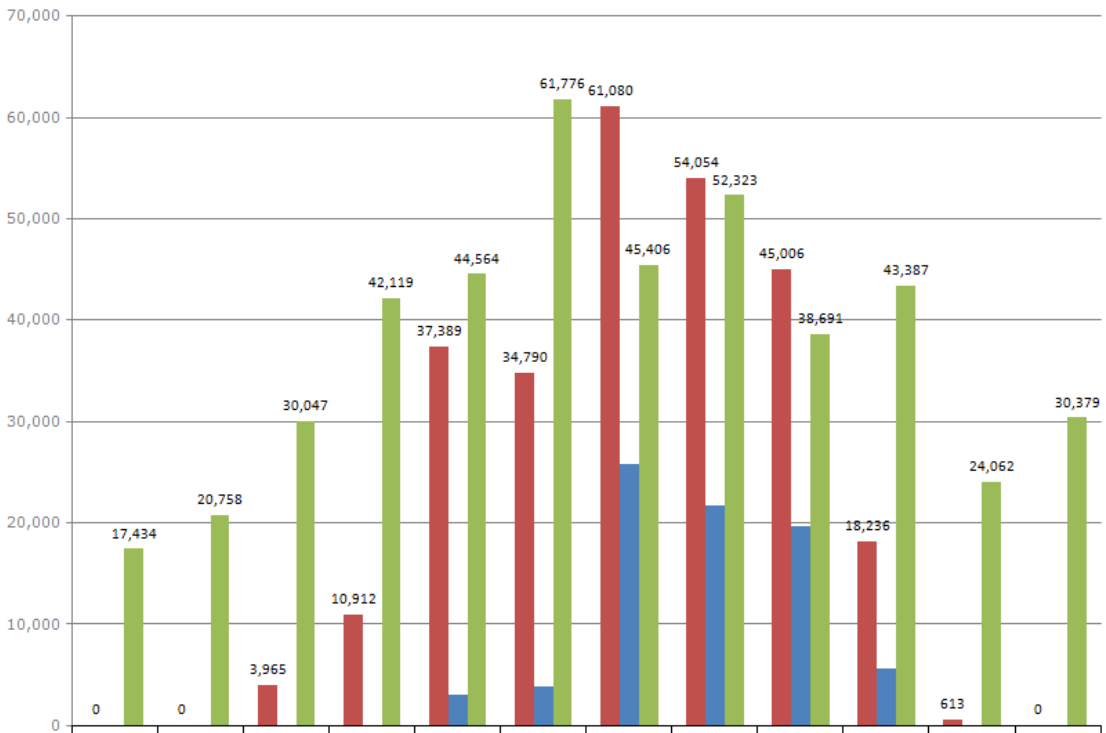
System Effectiveness Based on Recommended 20K Gallon Cistern

Projected Annual Averages Based On Past Six Years of Actual Daily Rainfall

Total Supply	Total Demand	Harvested Gallons Used	Municipal Gallons Used	Total Days Requiring Municipal Make-Up
450,947	266,043	186,300	79,743	42

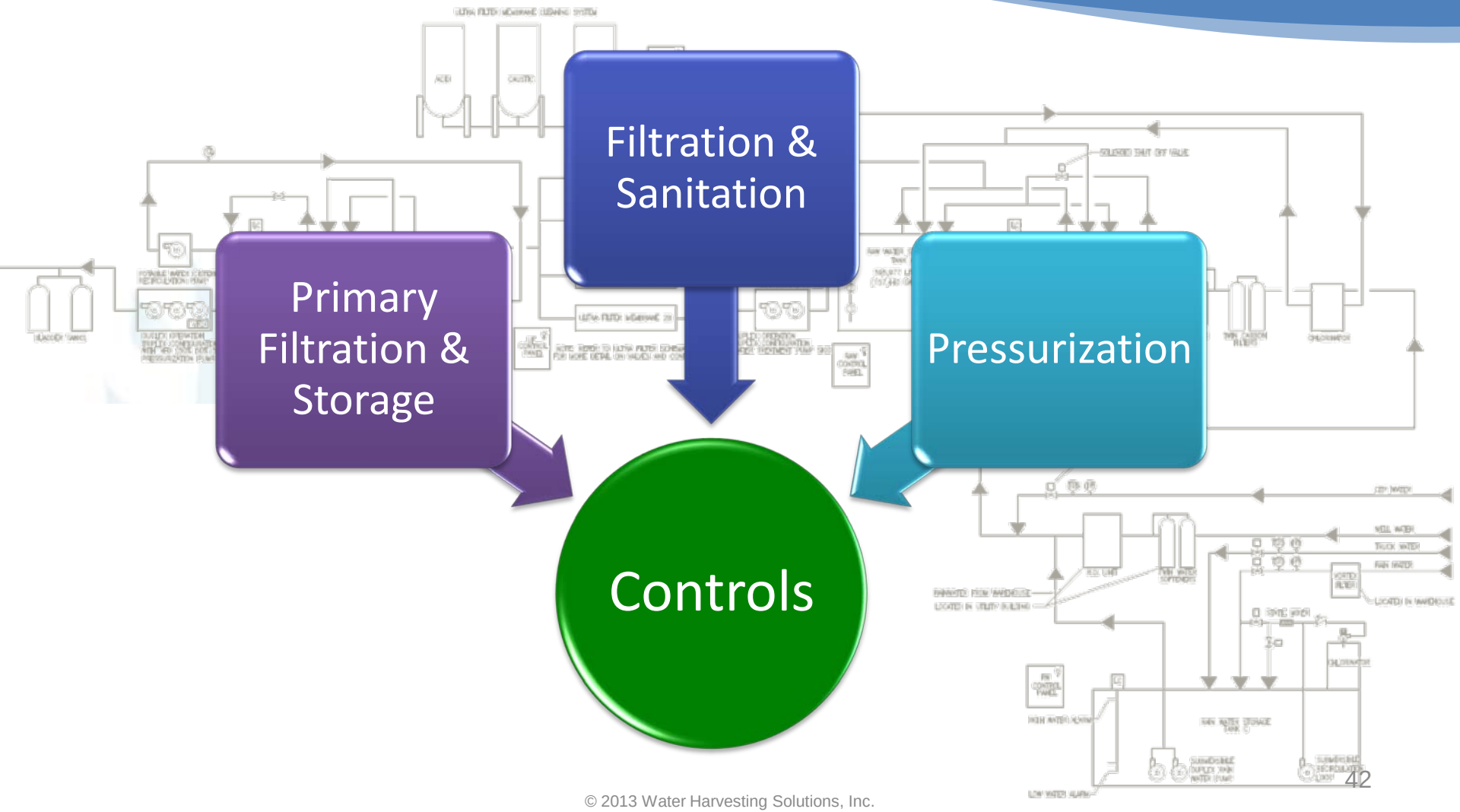
Projected Monthly Supply & Demand

Based on Historical 6-Year Daily Rainfall Amounts



	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
Estimated Average Demand	0	0	3,965	10,912	37,389	34,790	61,080	54,054	45,006	18,236	613	0
Estimated Municipal Make-up Required	0	0	0	0	3,009	3,853	25,858	21,765	19,652	5,607	0	0
Estimated Average Supply	17,434	20,758	30,047	42,119	44,564	61,776	45,406	52,323	38,691	43,387	24,062	30,379

System Components are Customized to Each Project



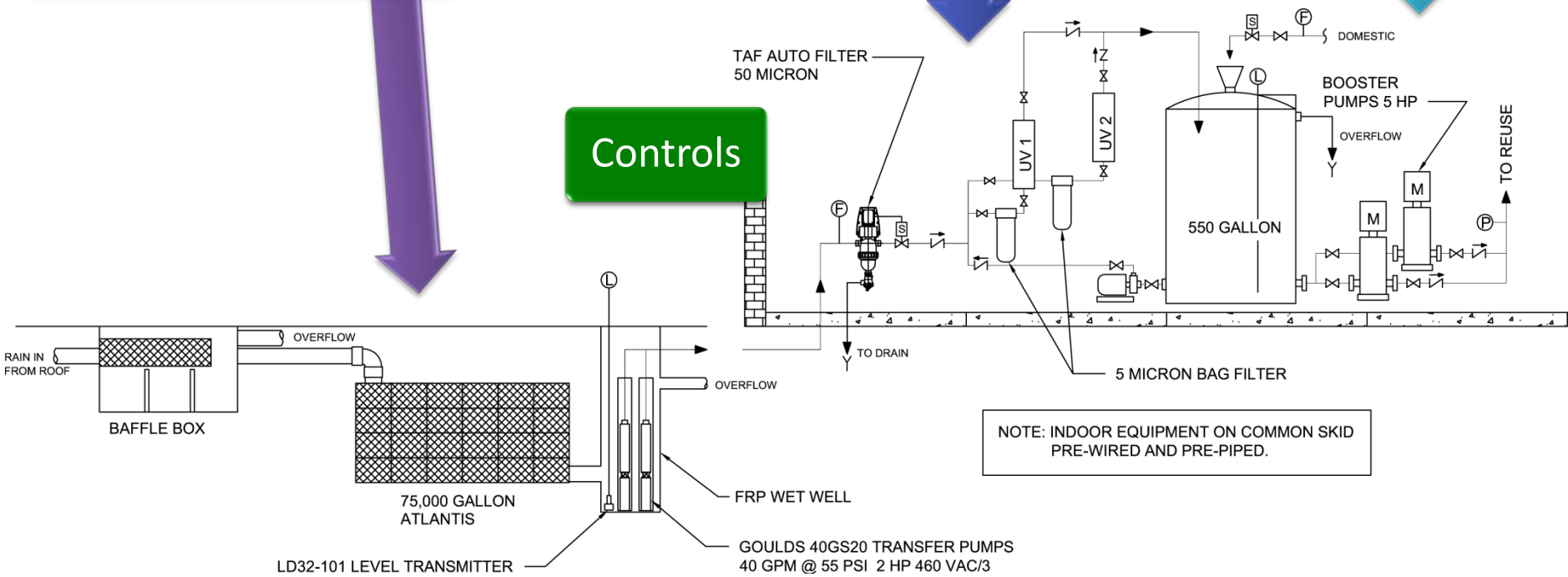
Typical System Design

Primary Filtration & Storage

Processing

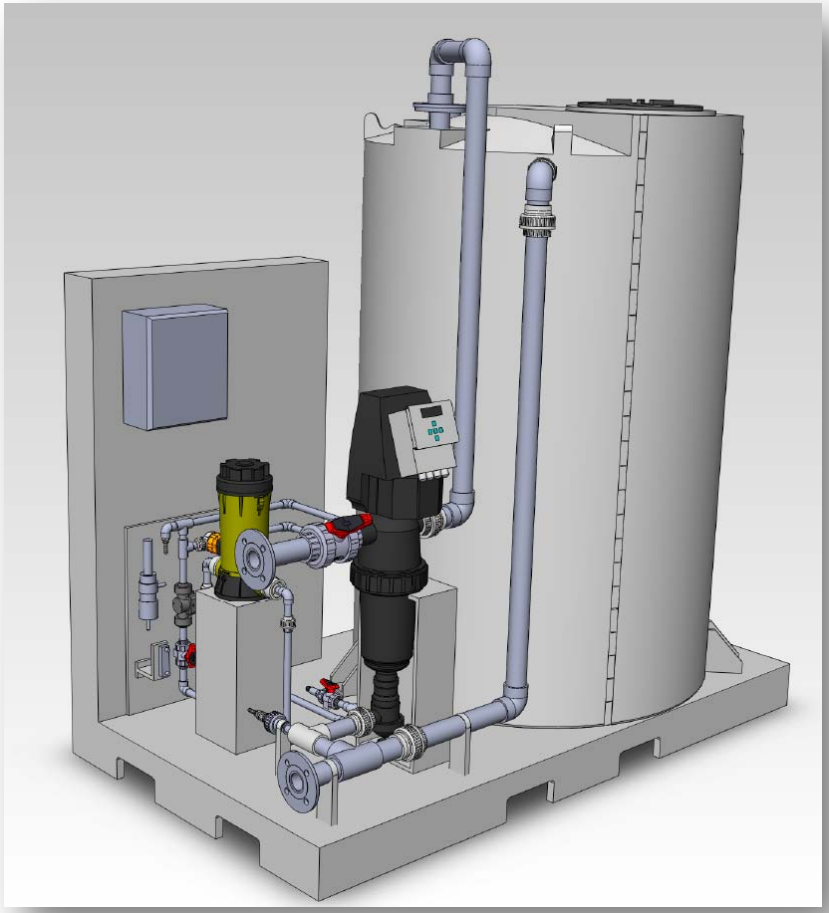
Pressurization

Controls



NOTE: INDOOR EQUIPMENT ON COMMON SKID
PRE-WIRED AND PRE-PIPED.

Engineered Designs are Transformed into Functional Systems

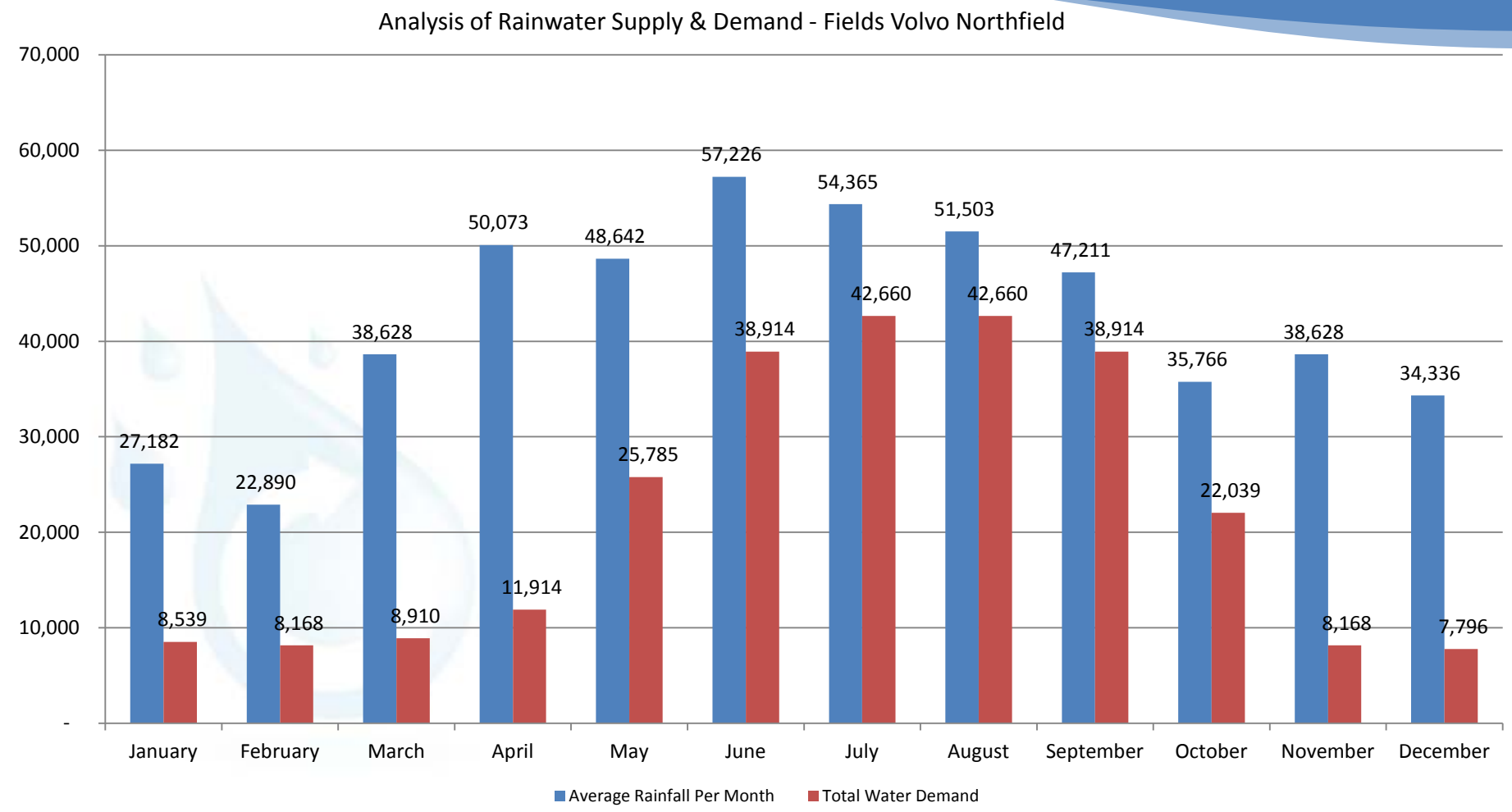


Eample: Fields Volvo
“World’s Greenest Volvo Dealership”

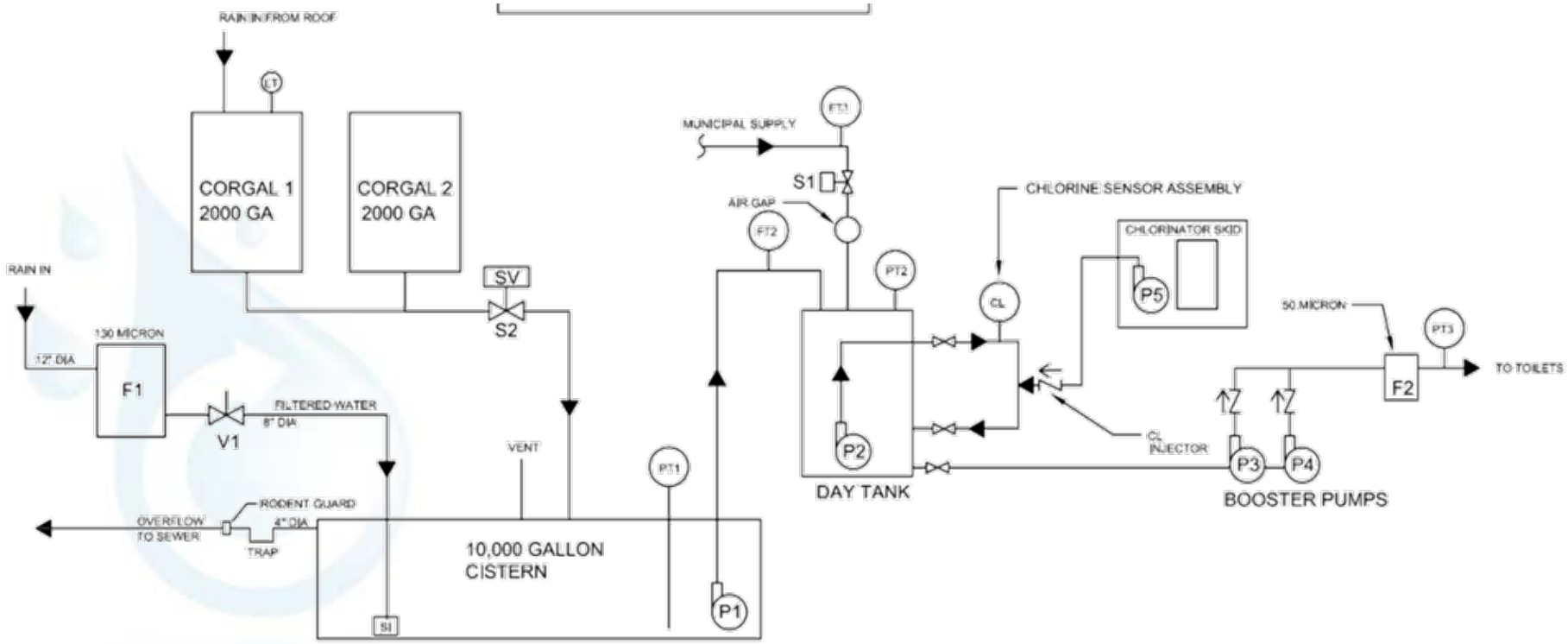
Fields Volvo

Project:	Field's Volvo
Location:	Northfield, IL.
Customer:	Dan Fields
Engineers:	JDR Engineering, Madison, WI
System Type:	Rooftop rainwater for irrigation and toilet flushing
Considerations:	Marketing value as "World's Greenest Volvo Dealership, " LEED Silver
Storage:	10,000 gallon Atlantis Raintank 4,400 gallon CorGal steel tanks
Sanitation:	Chlorine (Calcium Hypochlorite)
Projected Annual Water Savings:	265,000 gallons
Commissioning Date:	February 1, 2011

Supply & Demand



System Schematic



Atlantis Rain Tank Installation

All Tank Sections Installed

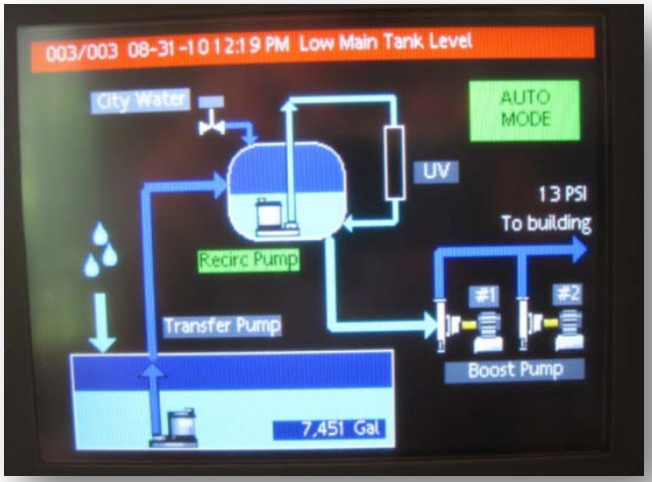
Compacted Sand Layer Between Tanks and Rubber Liner

Site Restored To Grade Level With Dirt Top Layer

Two 2,000 Gallon CorGal Tanks Installed

Processing Skid

Control Panel Monitors and Controls 24/7



Chicago Parks District

Valley Forge Field House

Project:	Valley Forge Field House
Location:	Chicago, IL
Customer:	Chicago Parks District
Engineers:	Building Systems Engineering L.L.C.
System Type:	Rooftop rainwater for toilet flushing
Considerations:	Minimize stormwater run-off
Storage:	4,200 gallon Atlantis Raintank
Sanitation:	Chlorine (Calcium Hypochlorite)
Projected Annual Water Savings:	65,000 gallons
Commissioning Date:	November, 2010

Demand Analysis

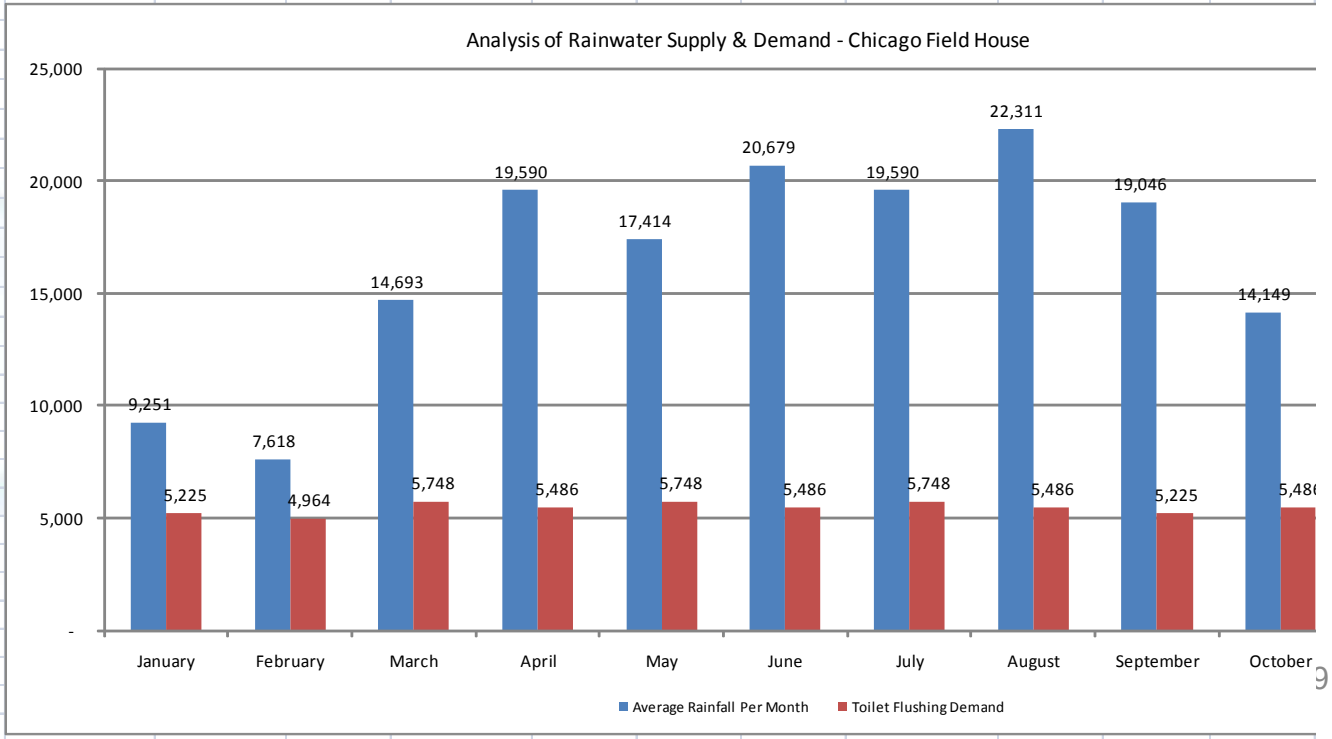
Toilet Demand	Persons	Flushes	Occupants
Flushes Per Person Per Day			
Staff	5	4	20.0
Visitors	170	1	170.0
Total Flushes Per Day			190.0
Number of Persons			71.0
Percentage Male			50%
Flushes Per Day Use			190.0
Male Urinal Use			75%
Flushes Per Week By Fixture	Toilets	Urinals	Total
	119	71	190
GPF	1.6	1.0	
Total Gallons For Flushing Per Day of Use	190.00	71.25	261

Supply Analysis

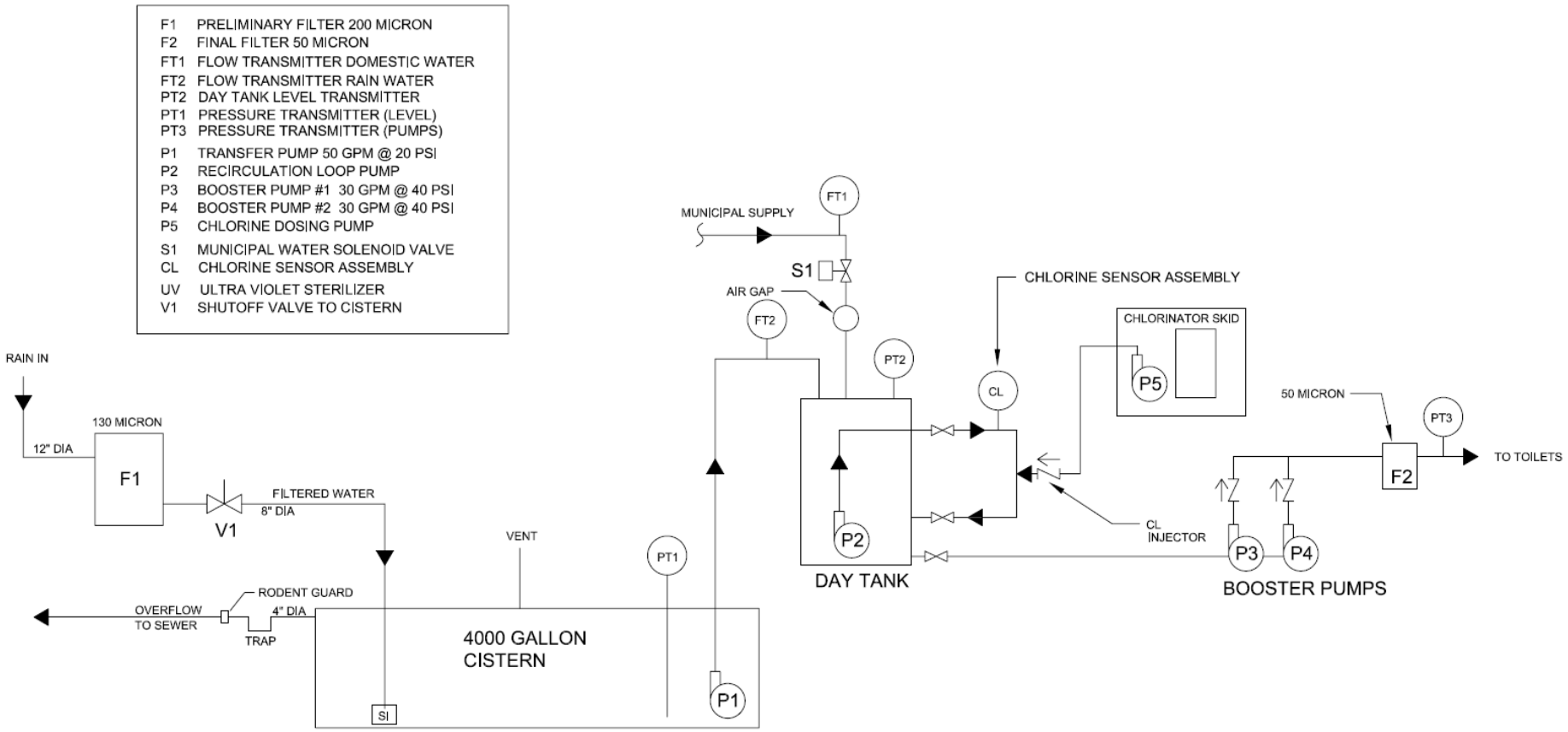
Rainwater Calculator - Chicago Field House

Supply & Demand Analysis

Rooftop Rainwater to Flush Toilets	Annual Average	January	February	March	April	May	June	July	August	September	October
Average precipitation for Chicago, IL	35.30	1.70	1.40	2.70	3.60	3.20	3.80	3.60	4.10	3.50	2.60
Building Use Days	250	20	19	22	21	22	21	22	21	20	21
Sub-Calculation - Area of roof in square feet	10,270	10,270	10,270	10,270	10,270	10,270	10,270	10,270	10,270	10,270	10,270
Gross Gallonage	225,993	10,884	8,963	17,286	23,047	20,487	24,328	23,047	26,249	22,407	16,645
Discount for Evaporation, system flush	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Rooftop Rainwater Available (In Gallons)	192,094	9,251	7,618	14,693	19,590	17,414	20,679	19,590	22,311	19,046	14,149
Rainfall Events	126	11	9	13	13	11	10	10	9	10	9
Rain Per Event	1,525	841	846	1,130	1,507	1,583	2,068	1,959	2,479	1,905	1,572
Demand for Toilet Flushing	65,313	5,225	4,964	5,748	5,486	5,748	5,486	5,748	5,486	5,225	5,486



System Schematic



Processing Skid

Controls

- System logs & reports
  - Water available in cistern
  - Total water saved, municipal water make-up required.
  - Pump status
  - Chlorine levels

Installed System

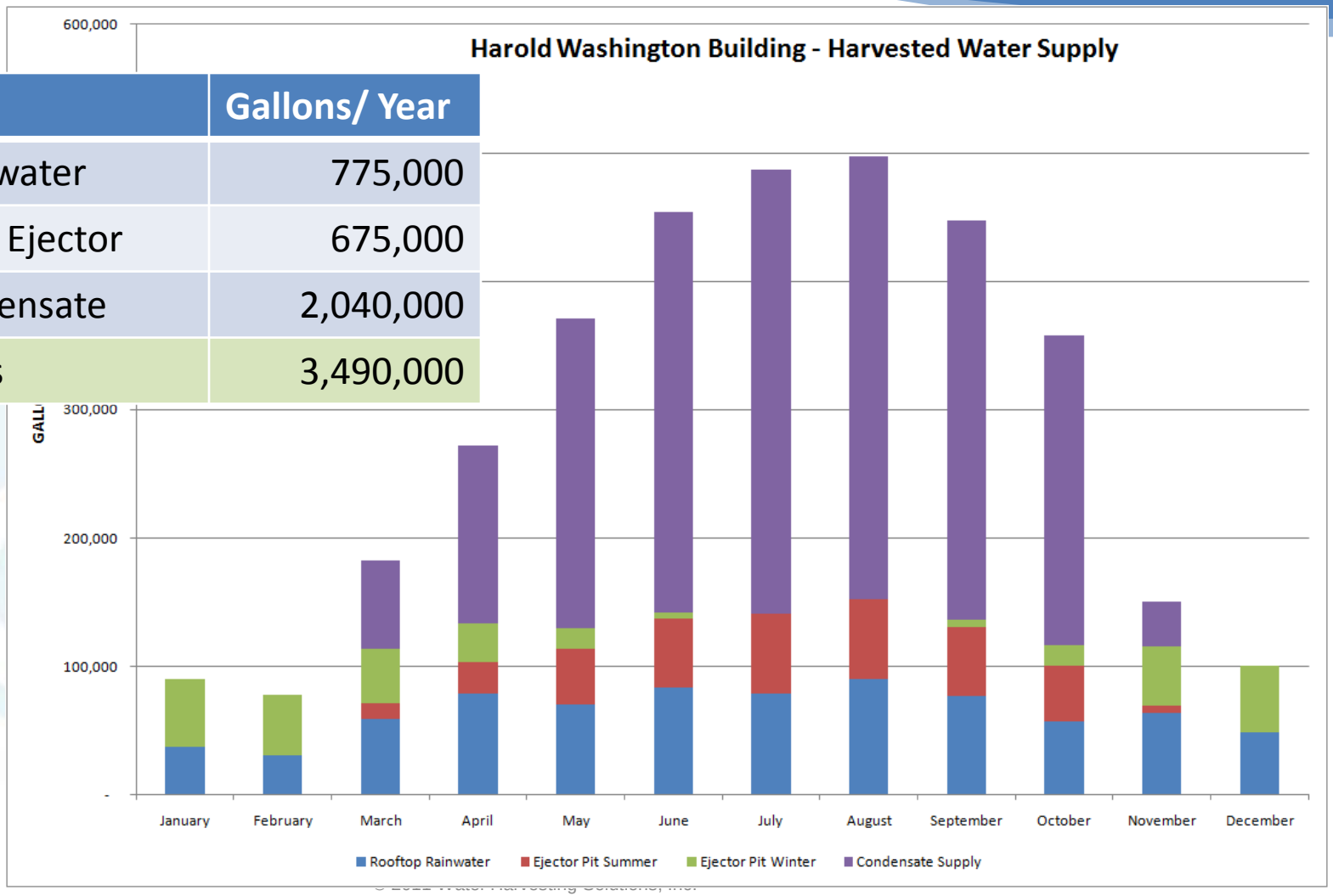
Harold Washington Social Security Building - Chicago

Harold Washington Social Security Building

Project:	Harold Washington Building
Location:	600 W. Madison Street, Chicago, IL
Customer:	Government Services Administration
Engineers:	
System Type:	Multi-Source, Multi-Use
Considerations:	Existing tanks, Utility floor access
Storage:	4 X 8,000 Gallon Re-Commissioned Steel Tanks
Sanitation:	Chlorine (Calcium Hypochlorite)
Projected Annual Water Savings:	3,220,000 gallons
Commissioning Date:	September, 2009

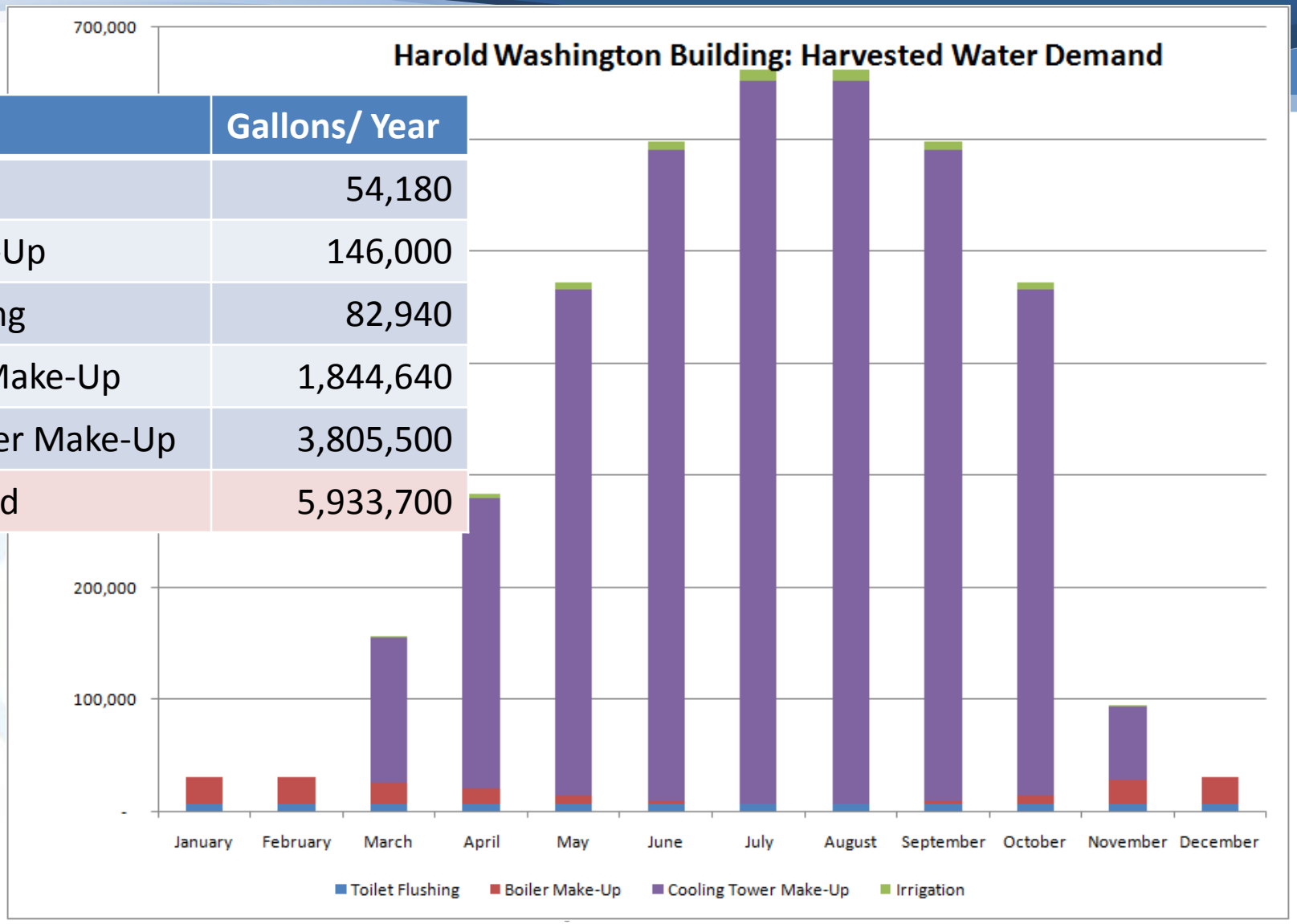
Multiple Supplies Identified - Condensate was the Driver

Supplies	Gallons/ Year
Rooftop Rainwater	775,000
Groundwater Ejector	675,000
Cooling Condensate	2,040,000
Total Supplies	3,490,000



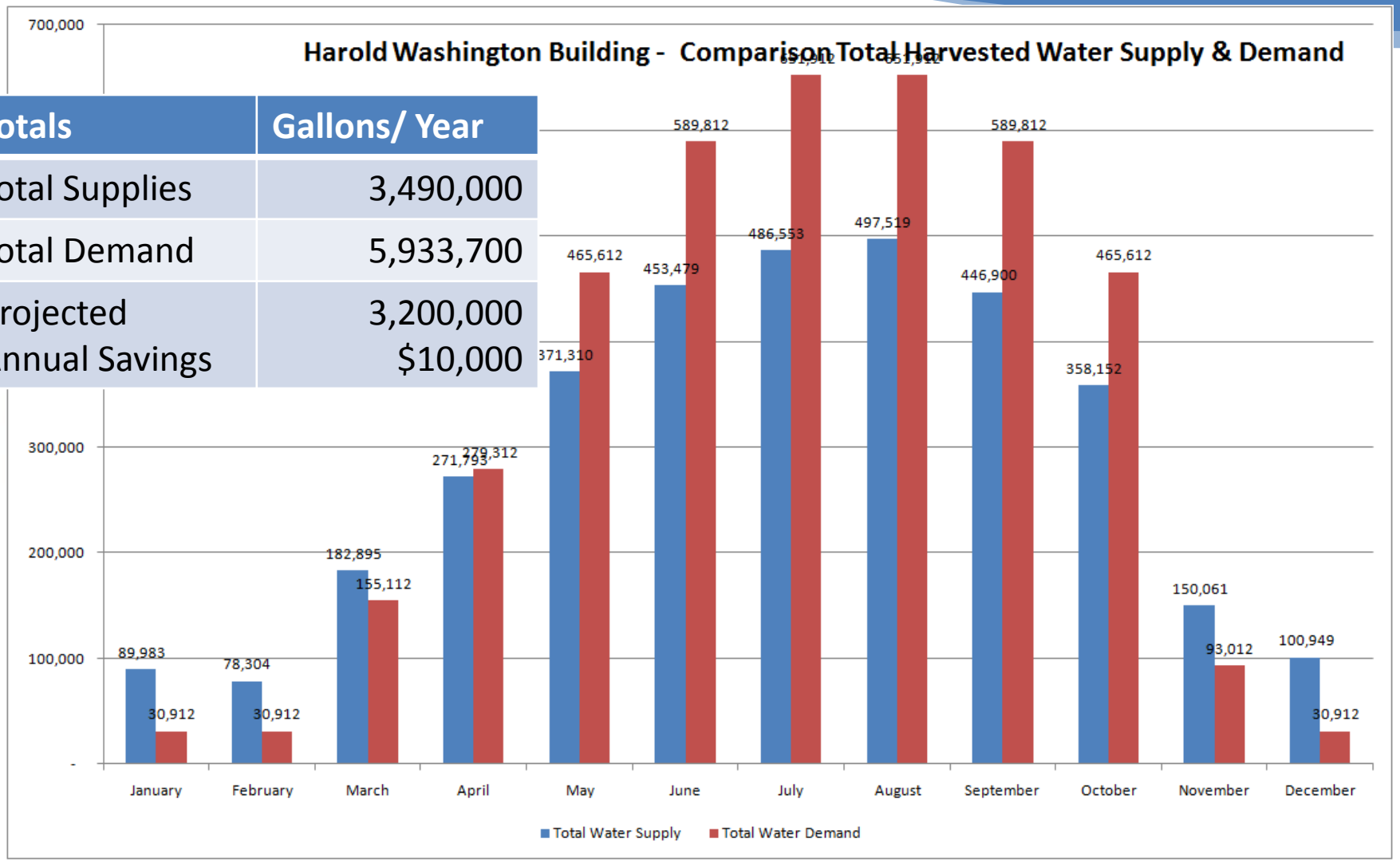
Cooling Towers Drove Demand

Demand	Gallons/ Year
Irrigation	54,180
Boiler Make-Up	146,000
Toilet Flushing	82,940
Humidifier Make-Up	1,844,640
Cooling Tower Make-Up	3,805,500
Total Demand	5,933,700

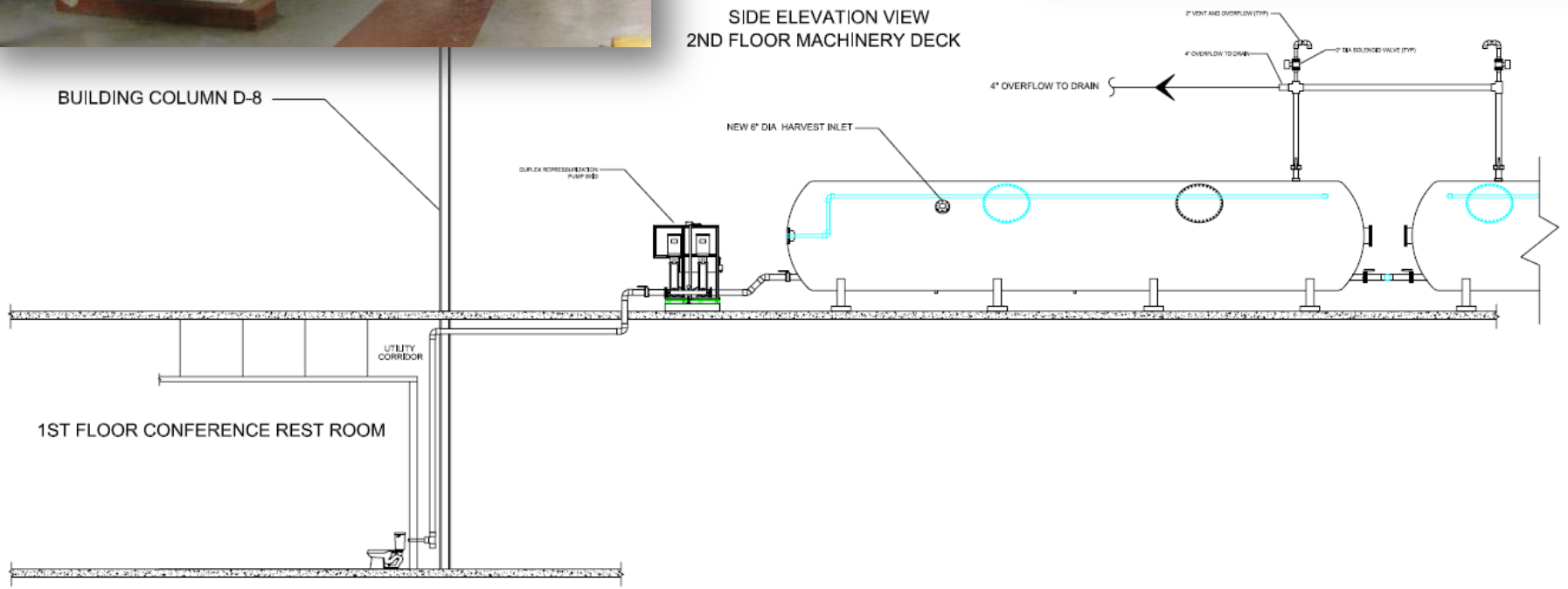


A Good Match of Supply & Demand

Totals	Gallons/ Year
Total Supplies	3,490,000
Total Demand	5,933,700
Projected Annual Savings	3,200,000 $10,000



Four 8,000 Gallon Decommissioned Tanks



Pressurization & Chlorinator

System Controls

Control system monitors all activities and tracks and displays water harvested and applied

Water Harvesting

For Commercial & Institutional Buildings

John R. Bauer
JohnB@Wahaso.com
630-235-2143

wahaso
WATER HARVESTING SOLUTIONS

Wahaso.com

Metropolitan Planning Council

Illinois Plumbing Code Revisions

Josh Ellis, Program Director

June 26, 2013

DuPage Water Commission

Adapting to Lake Michigan Water Loss Permit Condition Changes

Josh Ellis, Metropolitan Planning Council

John VanArsdel, AWWA

Changes to the Lake Michigan permit conditions

Josh Ellis, Program Director, Metropolitan Planning Council

June 26, 2013

DuPage Water Commission

Water Audits:

AWWA method compared to LM0-2

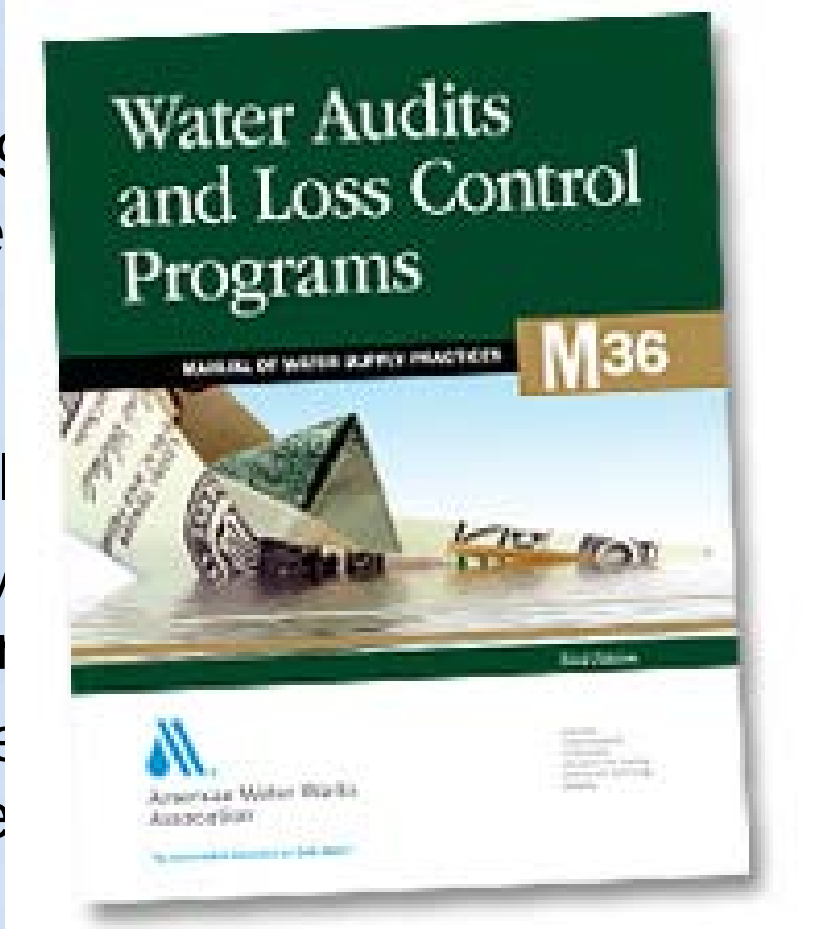
M.E. SIMPSON Co., Inc.

John H. Van Arsdel, Vice President

Water Audit Process: A Top Down Approach

- Advantage: quickly pulls together data and information that is readily available
- Disadvantage: for most water utilities, incomplete or inaccurate data limits the *validity* of the top-down water audit

Water Audit and M36 Publication



- In April, 200 edition of Manual 36 e s Control Programs
- Manual was e of the Water Loss Control
- Concurrently veloped water audit softwa
- The software n AWWA on their website

M36 3rd Edition Table of Contents

Chapter 1 – Introduction: Auditing Water Supply Operations and Controlling Losses

Chapter 2 – Conducting the Water Audit

Chapter 3 – Identifying and Controlling Apparent Losses

Chapter 4 – Understanding Real Losses: The Occurrence and Impacts of Leakage

Chapter 5 – Controlling Real Losses: Leakage and Pressure Management

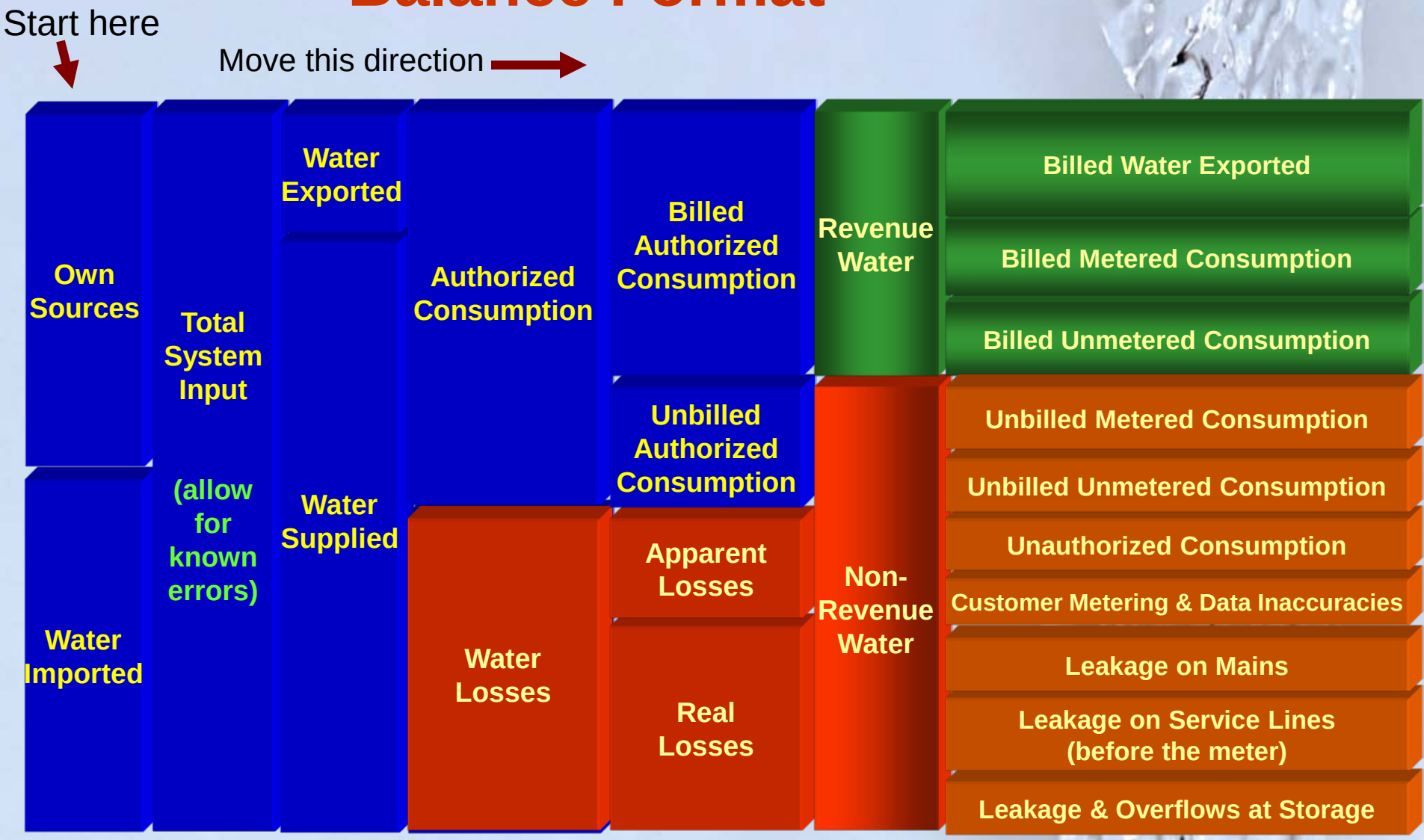
Chapter 6 – Planning and Sustaining the Water Loss Control Program

Chapter 7 – Considerations for Small Systems

Glossary of Terms and Definitions for Water Loss Control

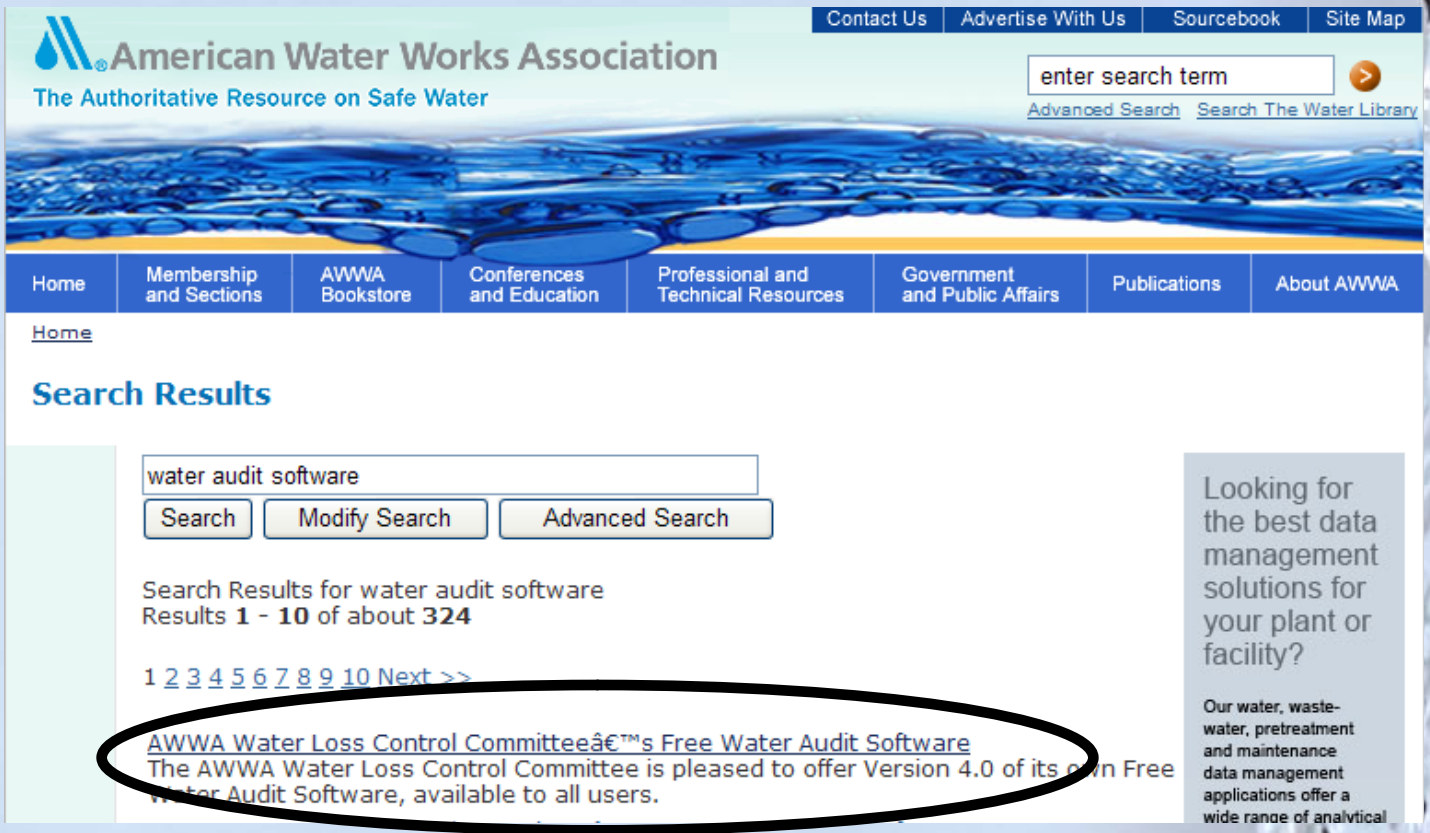
Appendix – Blank Forms, Assessing Water Resource Management, AWWA WLCC Free Water Audit Software, Case Studies

Standard Water Balance Format



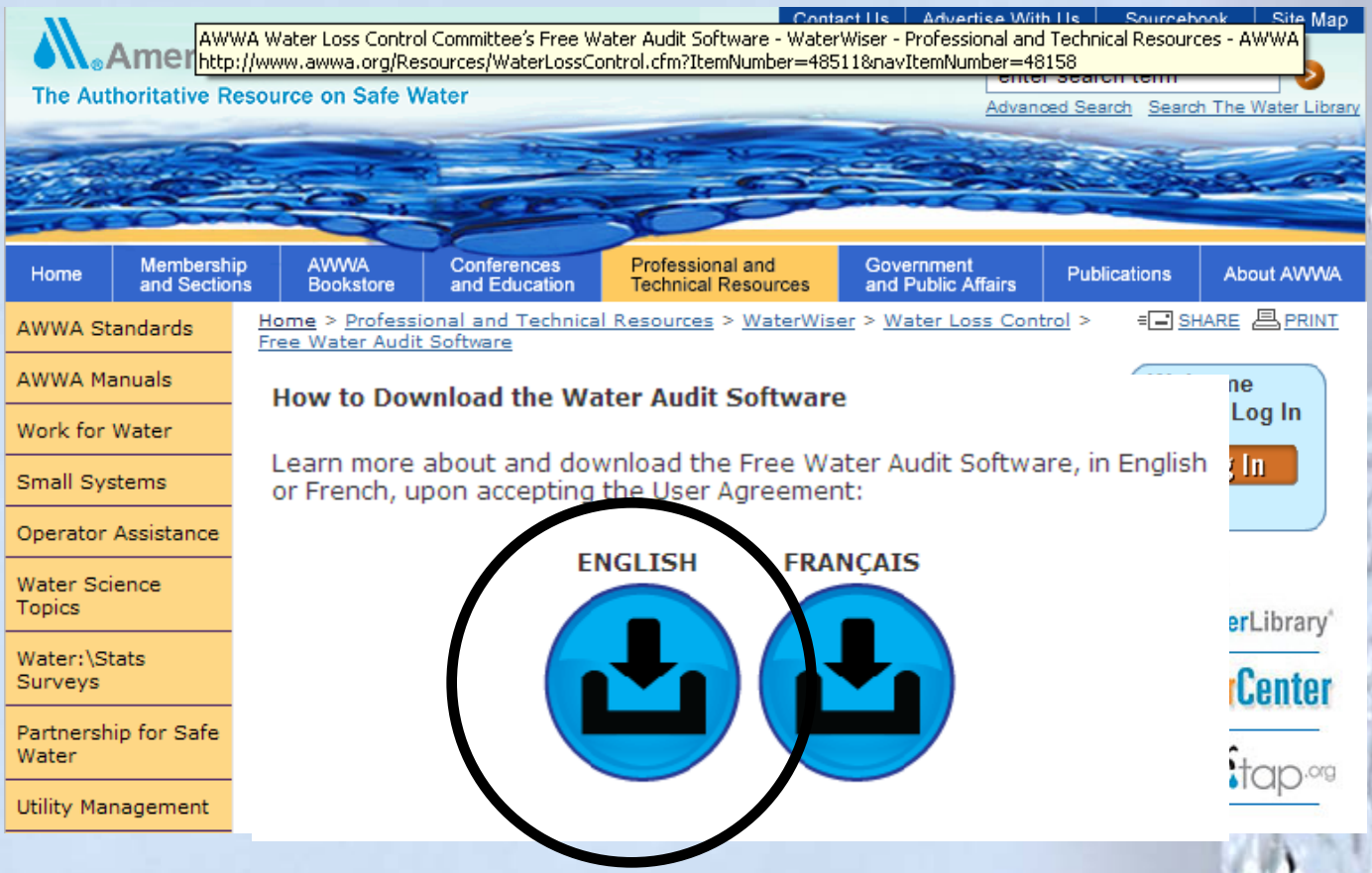
The Water Audit Process Roadmap

- Follow the search results



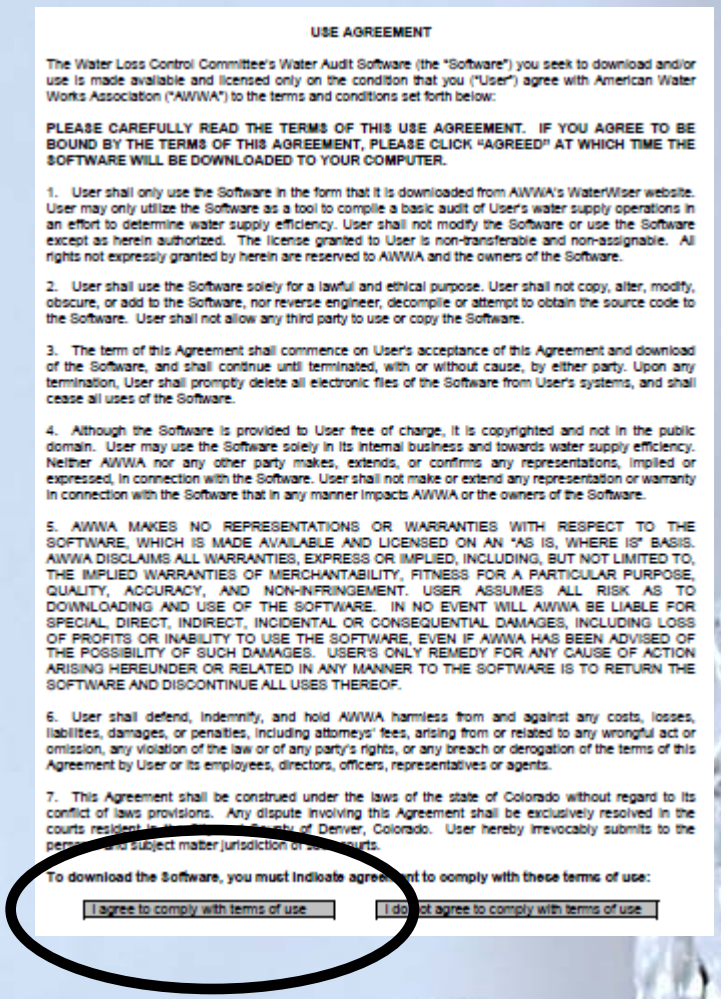
The Water Audit Process Roadmap

- Follow the link …..



The Water Audit Process Roadmap

- ….. and accept



USE AGREEMENT

The Water Loss Control Committee's Water Audit Software (the "Software") you seek to download and/or use is made available and licensed only on the condition that you ("User") agree with American Water Works Association ("AWWA") to the terms and conditions set forth below:

PLEASE CAREFULLY READ THE TERMS OF THIS USE AGREEMENT. IF YOU AGREE TO BE BOUND BY THE TERMS OF THIS AGREEMENT, PLEASE CLICK "AGREED" AT WHICH TIME THE SOFTWARE WILL BE DOWNLOADED TO YOUR COMPUTER.

1. User shall only use the Software in the form that it is downloaded from AWWA's WaterWiser website. User may only utilize the Software as a tool to compile a basic audit of User's water supply operations in an effort to determine water supply efficiency. User shall not modify the Software or use the Software except as herein authorized. The license granted to User is non-transferable and non-assignable. All rights not expressly granted by herein are reserved to AWWA and the owners of the Software.

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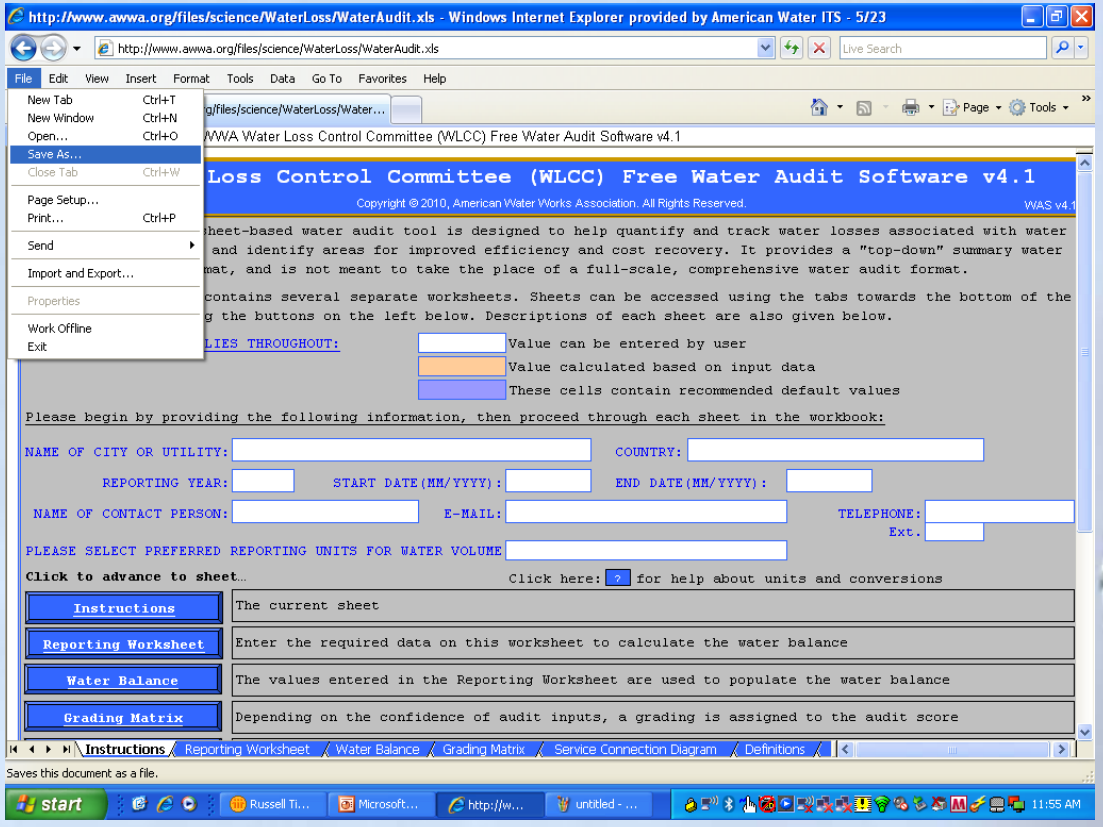
To download the Software, you must indicate agreement to comply with these terms of use:

I agree to comply with terms of use | I do not agree to comply with terms of use

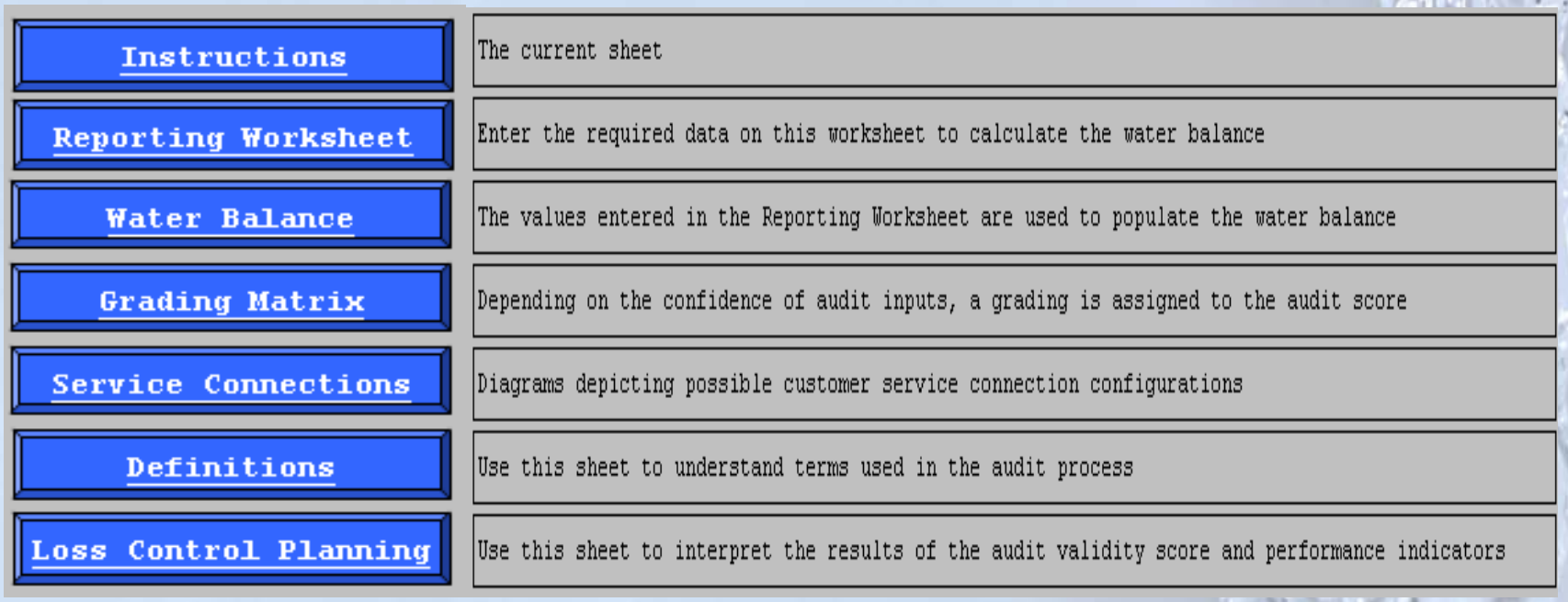
The Water Audit Process Roadmap

- ….. and “SAVE AS”



Completing Your First Water Audit

- Read the instructions provided in the software
- Follow the tabs



Title Page

THE FOLLOWING KEY APPLIES THROUGHOUT:

Value can be entered by user

Value calculated based on input data

These cells contain recommended default values

Please begin by providing the following information, then proceed through each sheet in the workbook:

NAME OF CITY OR UTILITY: COUNTRY:

REPORTING YEAR: START DATE(MM/YYYY): END DATE(MM/YYYY):

NAME OF CONTACT PERSON: E-MAIL: TELEPHONE: Ext.

PLEASE SELECT PREFERRED REPORTING UNITS FOR WATER VOLUME:

Click to advance to sheet…

Click here: ? for help about units and conversions

What data do I need?

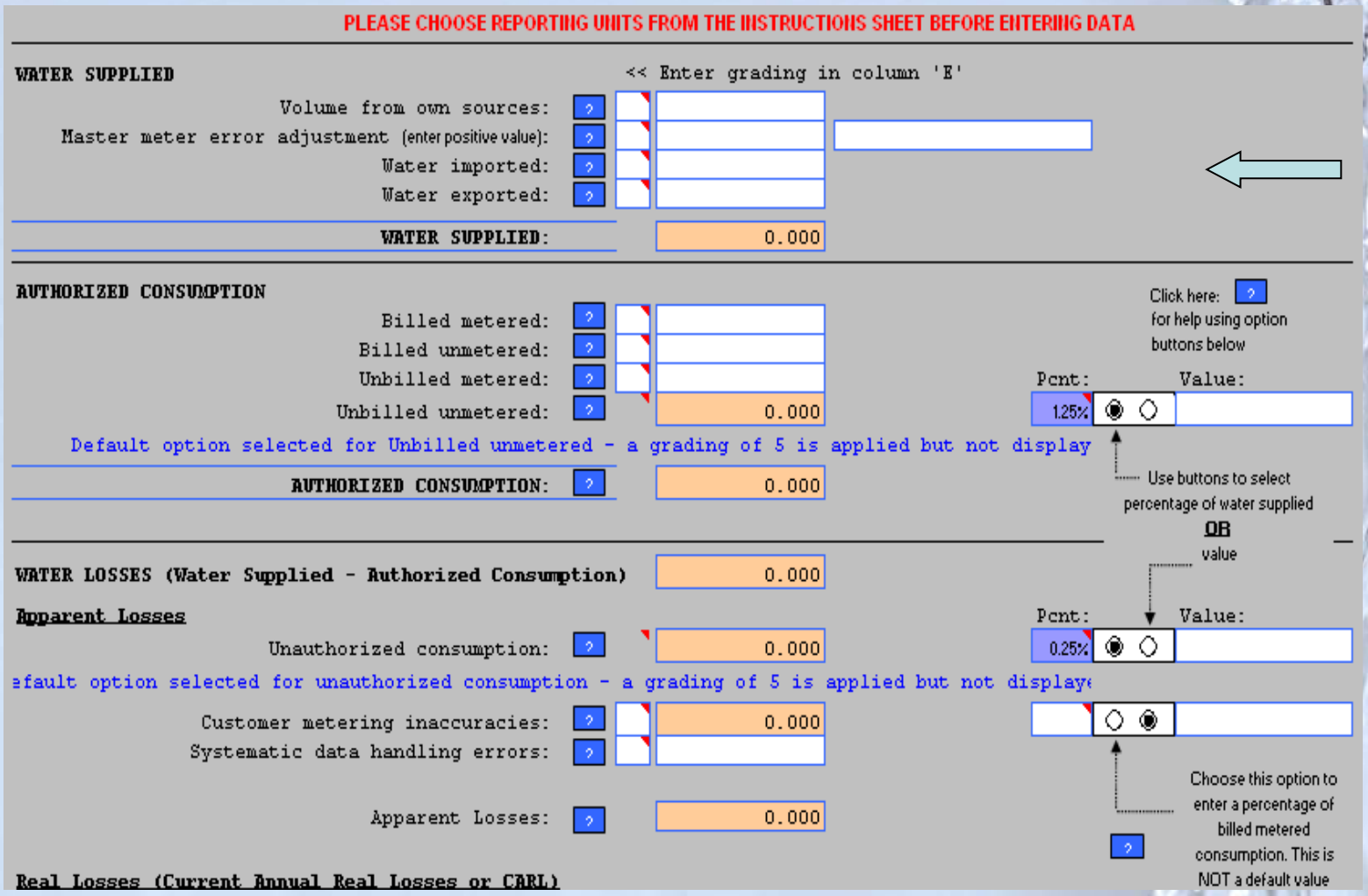
- System input including
  - Purchased water
  - Transferred water, imported and exported
- Sales
  - Metered, billed and unbilled
  - Unmetered, billed and unbilled
- Estimate of unauthorized consumption
- Estimate of meter error or inaccuracy
- Estimate of data handling errors

What data do I need?

- Physical parameters of the water system
  - Length of mains
  - Number of service connections
  - Average length of customer service line
  - Average system operating pressure
- Financial data on the system
  - Annual operating costs
  - Retail cost per unit
  - Marginal cost per unit

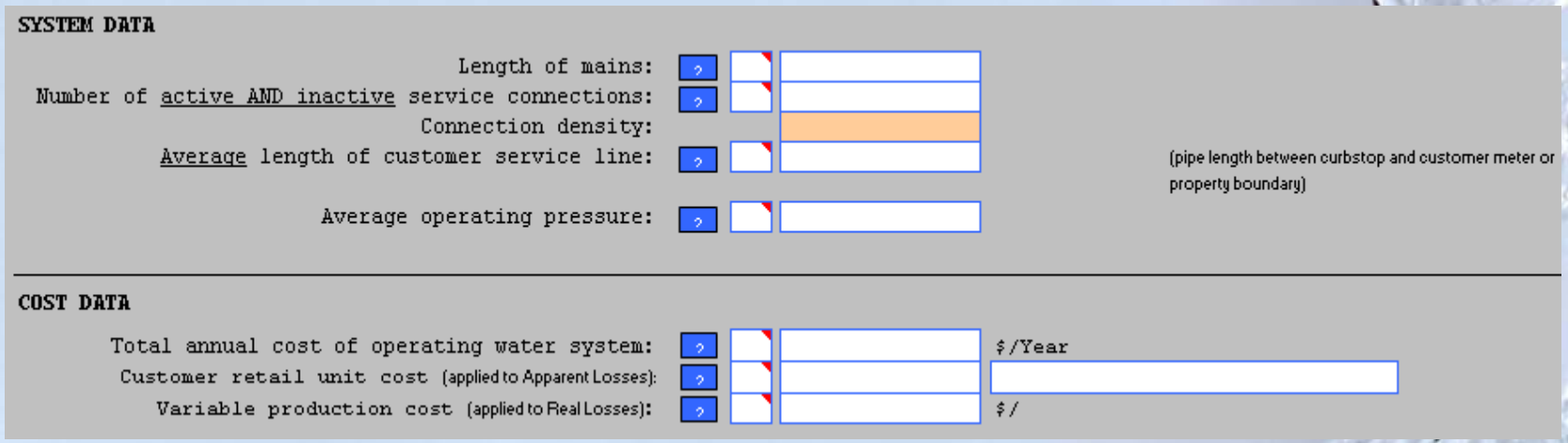
Where is the data entered?

- Look for the white boxes in the spreadsheet



Where is the data entered?

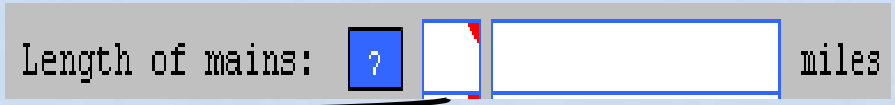
- Look for the white boxes in the spreadsheet



- That was easy, but what about those small white boxes?

Grading the data: an example

– How many miles of mains are in the system?



1. Poorly assembled and maintained paper as-built records of existing water main installations makes accurate determination of system pipe length impossible. Length of mains is guesstimated.

2. Paper records in poor condition (no annual tracking of installations & abandonments). Poor procedures to ensure that new water mains installed by developers are accurately documented.

3. Conditions between 2 and 4

4. Sound policy and procedures for permitting and documenting new water main installations, but gaps in management result in a uncertain degree of error in tabulation of mains length.

5. Conditions between 4 and 6

6. Sound policy and procedures exist for permitting and commissioning new water mains. Highly accurate paper records with regular field validation; or electronic records and asset management system in good condition. Includes system backup.

7. Conditions between 6 and 8

8. Sound policy and procedures exist for permitting and commissioning new water mains. Electronic recordkeeping and asset management system are used to store and manage data.

9. Conditions between 8 and 10

10. Sound policy exists for managing water mains extensions and replacements. Geographic Information System (GIS) data and asset management database agree and random field validation proves truth of databases.

Data Input

WATER SUPPLIED << Enter grading in column 'E'

Volume from own sources:		
Master meter error adjustment (enter positive value):		
Water imported:		
Water exported:		
WATER SUPPLIED:	0.000	

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

		Pcnt:	Value:
Billed metered:			
Billed unmetered:			
Unbilled metered:			
Unbilled unmetered:	0.000	1.25%	

Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed

AUTHORIZED CONSUMPTION:	0.000

Use buttons to select percentage of water supplied

OR

Data Input

WATER LOSSES (Water Supplied - Authorized Consumption)		0.000		
Apparent Losses			Pcnt:	Value:
Unauthorized consumption:	?	0.000	0.25%	
Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed				
Customer metering inaccuracies:	?	0.000		
Systematic data handling errors:	?			
Apparent Losses:	?	0.000		
Real Losses (Current Annual Real Losses or CARL)				
Real Losses = Water Losses - Apparent Losses:	?	0.000		
WATER LOSSES:		0.000		
NON-REVENUE WATER				
NON-REVENUE WATER:	?	0.000		
= Total Water Loss + Unbilled Metered + Unbilled Unmetered				

Enter a percentage less than 10% in the red cell (J42), or select 'Value' option

Data Input

SYSTEM DATA

Length of mains:	?			
Number of active AND inactive service connections:	?			
Connection density:				
Average length of customer service line:	?			(pipe length between curbstop and customer meter or property boundary)
Average operating pressure:	?			

COST DATA

Total annual cost of operating water system:	?		$/Year	
Customer retail unit cost (applied to Apparent Losses):	?			
Variable production cost (applied to Real Losses):	?		$/	

Calculated Performance Indicators

Financial Indicators

Non-revenue water as percent by volume of Water Supplied:	
Non-revenue water as percent by cost of operating system:	
Annual cost of Apparent Losses:	
Annual cost of Real Losses:	

Operational Efficiency Indicators

Apparent Losses per service connection per day:	
Real Losses per service connection per day*:	
Real Losses per length of main per day*:	
Real Losses per service connection per day per meter (head) pressure:	
? Unavoidable Annual Real Losses (UARL):	
From Above, Real Losses = Current Annual Real Losses (CARL):	
? Infrastructure Leakage Index (ILI) [CARL/UARL]:	

* only the most applicable of these two indicators will be calculated

Grading the data: an example

SYSTEM DATA			
Length of mains:	?	8	105.0
Number of active AND inactive service connections:	?	8	10,235
Connection density:			97
Average length of customer service line:	?	8	70.0
Average operating pressure:	?	8	65.0

1. Poorly assembled and maintained paper as-built records of existing water main installations makes accurate determination of system pipe length impossible. Length of mains is guesstimated.
2. Paper records in poor condition (no annual tracking of installations & abandonments). Poor procedures to ensure that new water mains installed by developers are accurately documented.
3. Conditions between 2 and 4
4. Sound policy and procedures for permitting and documenting new water main installations, but gaps in management result in a uncertain degree of error in tabulation of mains length.
5. Conditions between 4 and 6
6. Sound policy and procedures exist for permitting and commissioning new water mains. Highly accurate paper records with regular field validation; or electronic records and asset management system in good condition. Includes system backup.
7. Conditions between 6 and 8
8. Sound policy and procedures exist for permitting and commissioning new water mains. Electronic recordkeeping and asset management system are used to store and manage data.
9. Conditions between 8 and 10
10. Sound policy exists for managing water mains extensions and replacements. Geographic Information System (GIS) data and asset management database agree and random field validation proves truth of databases.

Audit Validity Score

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 71 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Billed metered

2: Unauthorized consumption

3: Systematic data handling errors

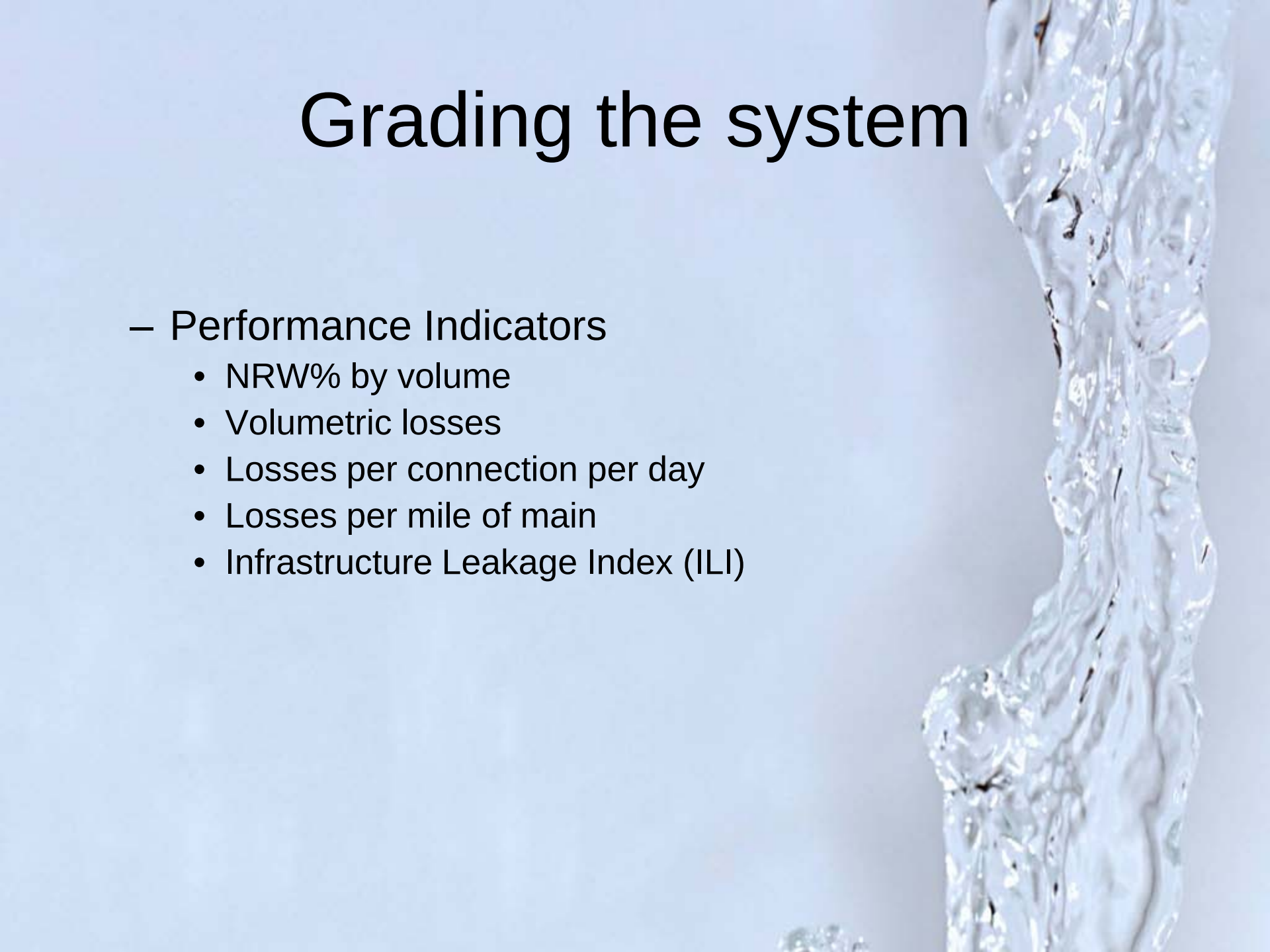
For more information, click here to see the Grading Matrix worksheet

Making the Grade

Water Loss Control Planning Guide					
	Water Audit Data Validity Level / Score				
Functional Focus Area	**Level I** (0-25)	**Level II** (26-50)	**Level III** (51-70)	**Level IV** (71-90)	**Level V** (91-100)
Audit Data Collection	Launch auditing and loss control team; address production metering deficiencies	Analyze business process for customer metering and billing functions and water supply operations. Identify data gaps.	Establish/revise policies and procedures for data collection	Refine data collection practices and establish as routine business process	Annual water audit is a reliable gauge of year-to-year water efficiency standing
Short-term loss control	Research information on leak detection programs. Begin flowcharting analysis of customer billing system	Conduct loss assessment investigations on a sample portion of the system: customer meter testing, leak survey, unauthorized consumption, etc.	Establish ongoing mechanisms for customer meter accuracy testing, active leakage control and infrastructure monitoring	Refine, enhance or expand ongoing programs based upon economic justification	Stay abreast of improvements in metering, meter reading, billing, leakage management and infrastructure rehabilitation
Long-term loss control		Begin to assess long-term needs requiring large expenditure: customer meter replacement, water main replacement program, new customer billing system or Automatic Meter Reading (AMR) system.	Begin to assemble economic business case for long-term needs based upon improved data becoming available through the water audit process.	Conduct detailed planning, budgeting and launch of comprehensive improvements for metering, billing or infrastructure management	Continue incremental improvements in short-term and long-term loss control interventions
Target-setting			Establish long-term apparent and real loss reduction goals (+10 year horizon)	Establish mid-range (5 year horizon) apparent and real loss reduction goals	Evaluate and refine loss control goals on a yearly basis
Benchmarking			Preliminary Comparisons - can begin to rely upon the Infrastructure Leakage Index (ILI) for performance comparisons for real losses (see below table)	Performance Benchmarking - ILI is meaningful in comparing real loss standing	Identify Best Practices/ Best in class - the ILI is very reliable as a real loss performance indicator for best in class service

Grading the system

- Performance Indicators
  - NRW% by volume
  - Volumetric losses
  - Losses per connection per day
  - Losses per mile of main
  - Infrastructure Leakage Index (ILI)



Grading the system

PERFORMANCE INDICATORS

Financial Indicators

Non-revenue water as percent by volume of Water Supplied:	
Non-revenue water as percent by cost of operating system:	
Annual cost of Apparent Losses:	
Annual cost of Real Losses:	

Operational Efficiency Indicators

Apparent Losses per service connection per day:	
Real Losses per service connection per day*:	
Real Losses per length of main per day*:	
Real Losses per service connection per day per meter (head) pressure:	
? Unavoidable Annual Real Losses (UARL):	
From Above, Real Losses = Current Annual Real Losses (CARL):	
? Infrastructure Leakage Index (ILI) [CARL/UARL]:	

ILI= CARL / UARL

CARL

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: ? 0.000

UARL

UARL (gallons/day)=(5.41Lm + 0.15Nc + 7.5Lc) xP,

or

UARL (litres/day)=(18.0Lm + 0.8Nc + 25.0Lc) xP

where:

Lm = length of mains (miles or kilometres)

Nc = number of service connections

Lc = total length of customer service lines (miles or km)

= Nc multiplied by the average distance of customer service line, Lp (miles or km)

P = Pressure (psi or metres)

Click to see Service Connection Diagram

Interpreting the Grades: **ILI**

General Guidelines for Setting a Target ILI (without doing a full economic analysis of leakage control options)			
Target ILI Range	**Financial Considerations**	**Operational Considerations**	**Water Resources Considerations**
1.0 - 3.0	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.	Operating with system leakage above this level would require expansion of existing infrastructure and/or additional water resources to meet the demand.	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.
>3.0 -5.0	Water resources can be developed or purchased at reasonable expense; periodic water rate increases can be feasibly imposed and are tolerated by the customer population.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long-term planning.
>5.0 - 8.0	Cost to purchase or obtain/treat water is low, as are rates charged to customers.	Superior reliability, capacity and integrity of the water supply infrastructure make it relatively immune to supply shortages.	Water resources are plentiful, reliable, and easily extracted.
Greater than 8.0	Although operational and financial considerations may allow a long-term ILI greater than 8.0, such a level of leakage is not an effective utilization of water as a resource. Setting a target level greater than 8.0 - other than as an incremental goal to a smaller long-term target - is discouraged.		
Less than 1.0	If the calculated Infrastructure Leakage Index (ILI) value for your system is 1.0 or less, two possibilities exist. a) you are maintaining your leakage at low levels in a class with the top worldwide performers in leakage control. b) A portion of your data may be flawed, causing your losses to be greatly understated. This is likely if you calculate a low ILI value but do not employ extensive leakage control practices in your operations. In such cases it is beneficial to validate the data by performing field measurements to confirm the accuracy of production and customer meters, or to identify any other potential sources of error in the data.		

UARL considerations

The UARL is a theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. It is a key variable in the calculation of the Infrastructure Leakage Index (ILI). It is not necessary that water utilities set this level as the target level of leakage, unless water is unusually expensive, scarce or both.

NOTE: The UARL calculation has not yet been fully proven as effective for very small, or low pressure water distribution systems. If,

in gallons per day:

(Lm x 32) + Nc < 3000 or

P <35psi

in litres per day:

(Lm x 20) + Nc < 3000 or

P < 25m

then the calculated UARL value may not be valid. The software does not display a value of UARL or ILI if either of these conditions is true.

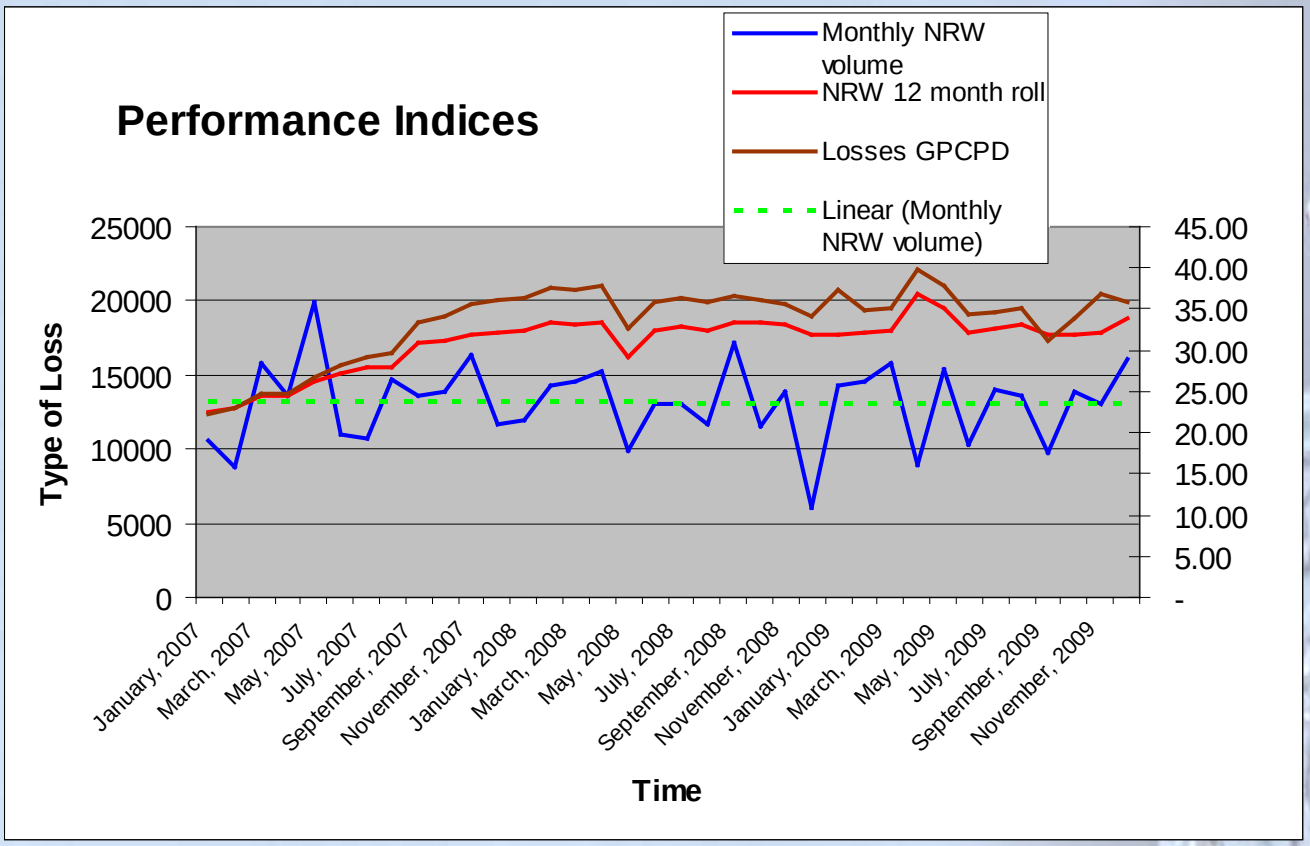
Smaller System Considerations

Operational Efficiency Indicators

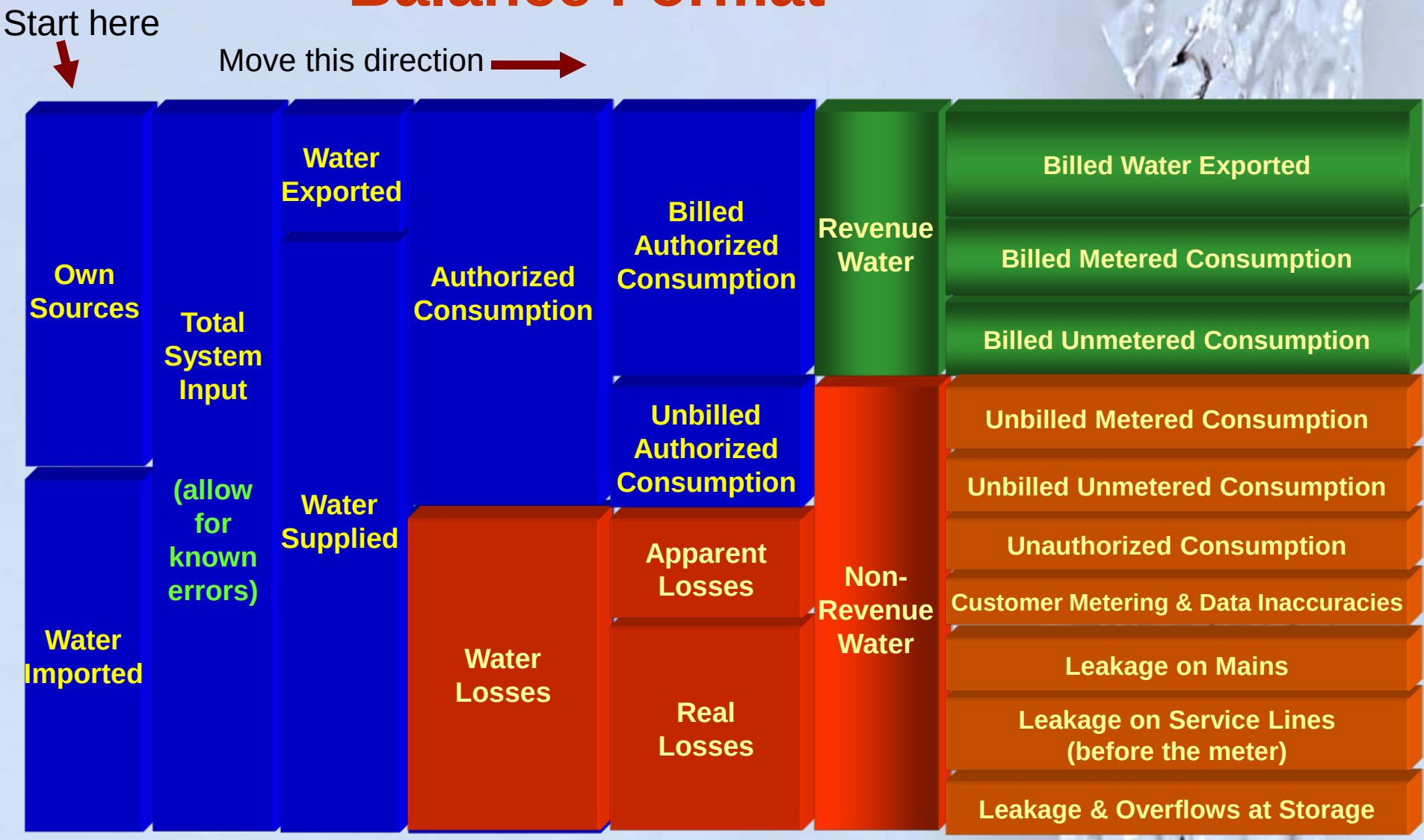
Apparent Losses per service connection per day:	
Real Losses per service connection per day*:	
Real Losses per length of main per day*:	
Real Losses per service connection per day per meter (head) pressure:	

Interpreting the Grades: NRW volume (mo & roll), NRW%

- Follow the trends



Standard Water Balance Format



Water Balance

AWWA WLCC Free Water Audit Software: Water Balance

WAS v4.2

Water Audit Report For:	Report Yr:
City of Lake Forest, Illinois	2010

Own Sources (Adjusted for known errors) 1,314.455	Water Exported 6.534	Authorized Consumption 1,118.911	Billed Authorized Consumption 1,089.691	Billed Metered Consumption (inc. water exported) 1,089.691	Revenue Water 1,089.691
				Billed Unmetered Consumption 0.000	
			Unbilled Authorized Consumption 29.220	Unbilled Metered Consumption 28.782	Non-Revenue Water (NRW) 218.230
				Unbilled Unmetered Consumption 0.438	
	Water Supplied 1,307.921	Water Losses 189.010	Apparent Losses 17.143	Unauthorized Consumption 0.100	
				Customer Metering Inaccuracies 17.033	
				Systematic Data Handling Errors 0.010	
Water Imported 0.000			Real Losses 171.867	Leakage on Transmission and/or Distribution Mains Not broken down	
				Leakage and Overflows at Utility's Storage Tanks Not broken down	
				Leakage on Service Connections Not broken down	

LMO2 Form

Illinois Department of
Natural Resources

One Natural Resources Way Springfield, Illinois 62702-1271
http://dnr.state.il.us

Pat Quinn, Governor
Marc Miller, Director

Office of Water Resources, Michael A. Bilandic Building, 160 N. LaSalle St., S-700, Chicago, IL 60601
Office: 312/793-3123 Fax: 312/793-5968

2011 Annual Water Use Audit Form (LMO-2)

This form must be completed by all Category IA and IIB Permittees for each annual water use accounting year running from October 1st through September 30th. This form must be submitted to the Department by January 9, 2012.

LMO2 Form

Section I - General Information

Name, address and phone number of Permittee:

_____

_____

_____

_____

_____

County: _____

Name, address and phone number of the contact person for the Permittee:

_____

_____

_____

_____

_____

e-mail address _____

Authorized Official _____

Title: _____

Date: _____

Please provide leak survey information and population estimates for the last year.

Population: _____ **Number of existing households:** _____

LMO2 Form

A. Pumpage Data

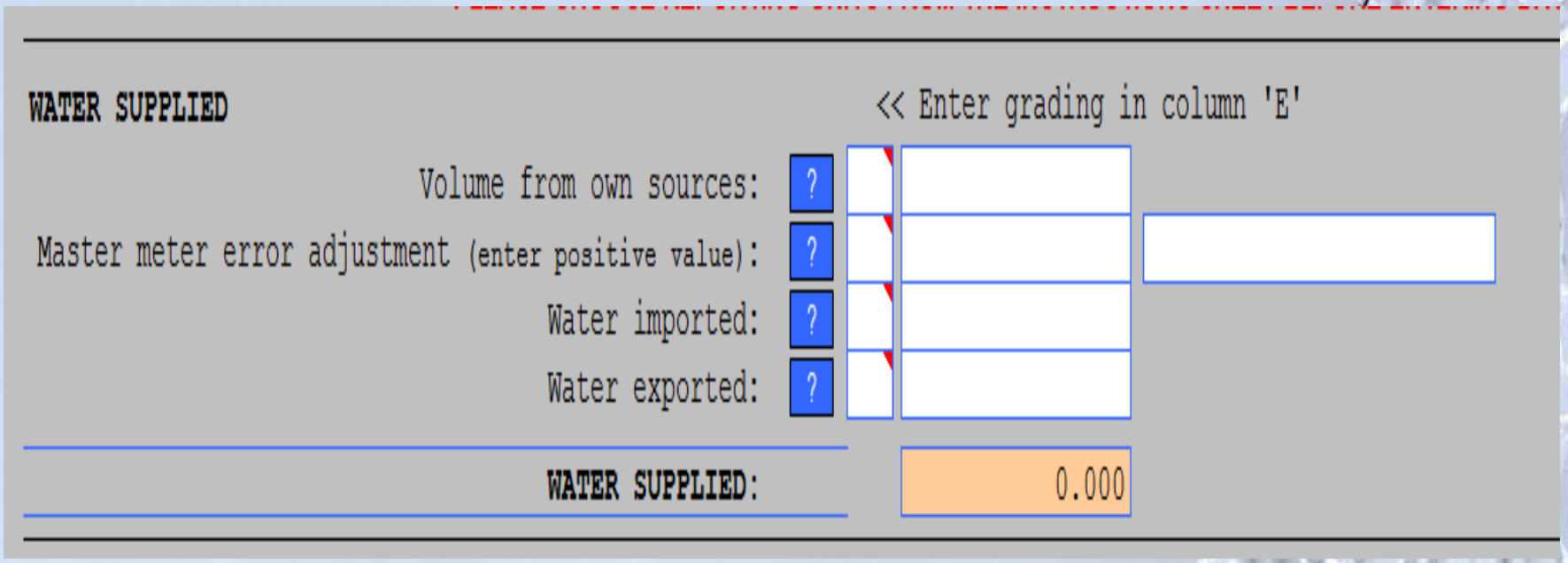
Water bought or received from the following distribution systems:

1. Lake Michigan Pumpage		**mgd**
2. Shallow Aquifer Pumpage		**mgd**
3. Deep Aquifer Pumpage		**mgd**
4. Total Pumpage (add lines 1, 2 & 3)	0.000	**mgd**
5. Water Treatment Use		**mgd**
6. Gross Annual Pumpage (subtract line 5 from line 4)	0.000	**mgd**

Water sold or provided to any other distribution systems (enter the name of each system and the amount sold or provided to that system on lines 7 through 12). If additional lines are required, attach an additional sheet listing each system and amount.

7		**mgd**
8		**mgd**
9		**mgd**
10		**mgd**
11		**mgd**
12		**mgd**
13. Total (add lines 7-12 and any additional amounts)	0.000	**mgd**
14. Net Annual Pumpage (subtract line 13 from line 6)	0.000	**mgd**

Volume inputs



LMO2 Form

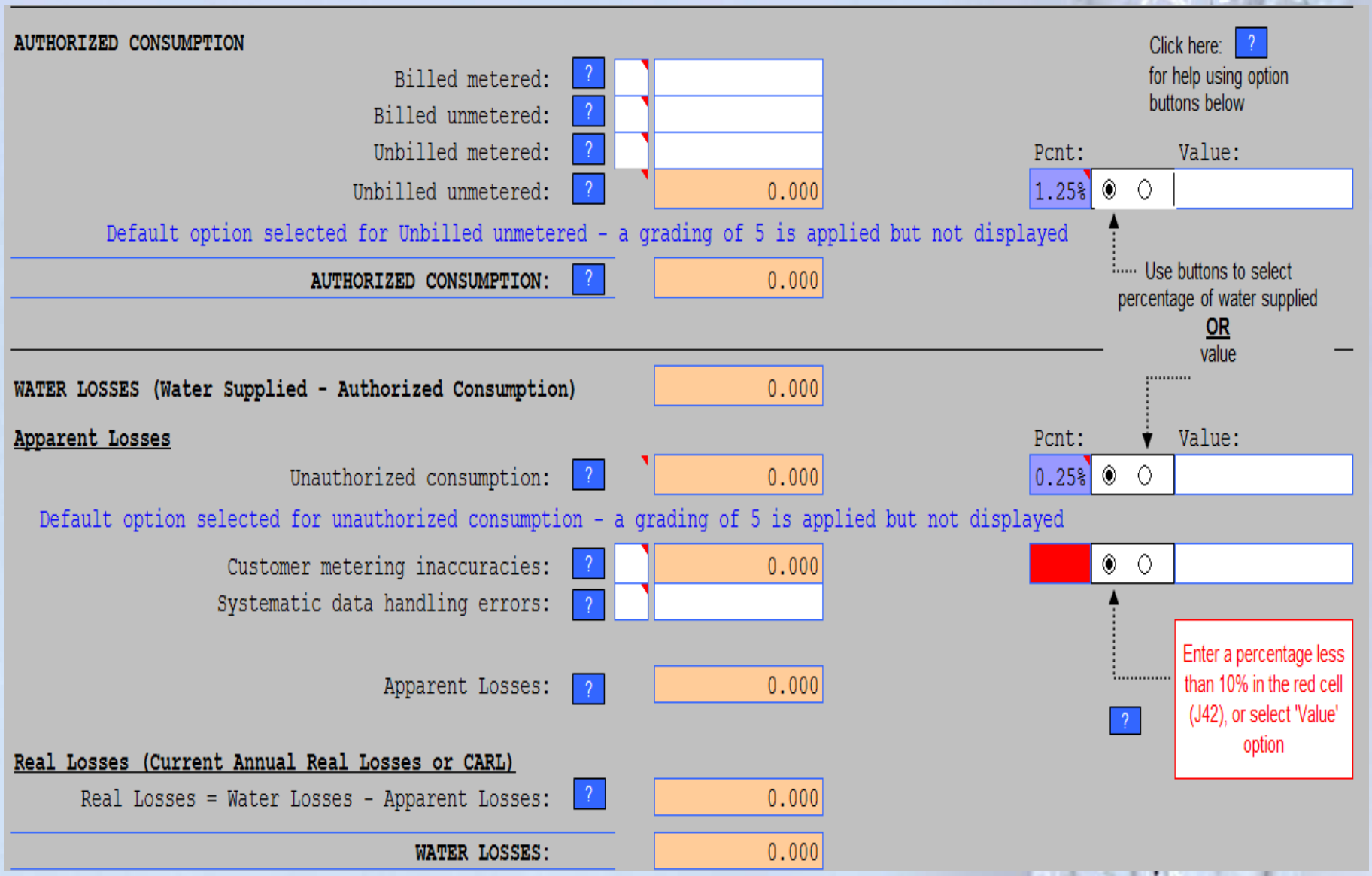
B. Uses	Metered	Unmetered	Total	
15. Residential			0.000	mgd
16. Commercial and Manufacturing			0.000	mgd
17. Municipal			0.000	mgd
18. Construction			0.000	mgd
19. Total Uses (add Total lines 15 through 18)	0.000	0.000	0.000	mgd
20. Percentage of Total Use to Net Annual Pumpage (divide line 19 by line 14 and multiply by 100)			#DIV/0!	%

C. Hydrant Uses		
21. Firefighting and Training		mgd
22. Water Main Flushing		mgd
23. Sewer Cleaning		mgd
24. Street Cleaning		mgd
25. Construction		mgd
26. Other (attach explanation)		mgd
27. Total Hydrant Use (add lines 21 through 26)	0.000	mgd

Section II - Water Use Audit (continued)

28. Percentage of Hydrant Use to Net Annual Pumpage (divide line 27 by line 14 and multiply by 100)	#DIV/0!	%
29. Department allowed maximum for Hydrant Use	1.0	%
30. Excessive hydrant use (subtract line 29 from line 28). If the percentage is greater than 0.0, attach an explanation. [see Rule 730.307 (e)]	#DIV/0!	%

Uses and Losses



LMO2 Reporting form

Complete the following calculations to determine your maximum unavoidable leakage.
Enter the appropriate amounts in the space provided.

A. Cast Iron Pipes With Lead Joints

Age of Pipes	Miles of Pipe	Leakage Rate	Maximum Unavoidable Leakage	
1. 60 yrs. or greater		x 3,000 g/d/mi =	0	g/d
2. 40-60 yrs.		x 2,500 g/d/mi =	0	g/d
3. 20-40 yrs.		x 2,000 g/d/mi =	0	g/d
4. 20 yrs. or less		x 1,500 g/d/mi =	0	g/d

B. All Other Types of Pipes and Joints

Age of Pipes	Miles of Pipe	Leakage Rate	Maximum Unavoidable Leakage	
5. 60 yrs. or greater		x 2,500 g/d/mi =	0	g/d
6. 40-60 yrs.		x 2,000 g/d/mi =	0	g/d
7. 20-40 yrs.		x 1,500 g/d/mi =	0	g/d
8. 20 yrs. or less		x 1,000 g/d/mi =	0	g/d
9. Total Miles	0.0	Total Leakage	0	g/d

10. Total Maximum Unavoidable Leakage, in mgd
(divide total leakage on line 9 by 1,000,000) ..... 0.000 **mgd**
(Enter this amount on line 31 of "Section II - Water Use Audit)

System Data and Cost Data

SYSTEM DATA

Length of mains:	?			
Number of active AND inactive service connections:	?			
Connection density:				
Average length of customer service line:	?			(pipe length between curbstop and customer meter or property boundary)
Average operating pressure:	?			

COST DATA

Total annual cost of operating water system:	?		$/Year	
Customer retail unit cost (applied to Apparent Losses):	?			
Variable production cost (applied to Real Losses):	?		$/	

LMO2 Form

D. Unavoidable Leakage and Unaccounted for Flow

31. Maximum Unavoidable Leakage (Do worksheet in Section III; enter amount from line 10 of the worksheet)	0.000 mgd
32. Percentage of Maximum Unavoidable Leakage to Net Annual Pumpage (divide line 31 by line 14 and multiply by 100)	#DIV/0! %
33. Total Accounted for Flow (add lines 19, 27 and 31)	0.000 mgd
34. Percentage of Total Accounted for Flow to Net Annual Pumpage (divide line 33 by line 14 and multiply by 100)	#DIV/0! %
35. Total Unaccounted for Flow (subtract amount on line 33 from line 14)	0.000 mgd
36. Percentage of Total Unaccounted for Flow to Net Annual Pumpage (divide line 35 by line 14 and multiply by 100)	#DIV/0! %

Please Check Your Calculations

The sum of lines 33 and 35 should equal line 14. If they do not equal, recheck your calculations.

The sum of lines 34 and 36 should equal approximately 100%. If not, check calculations.

ILI= CARL / UARL

CARL

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: ? 0.000

UARL

UARL (gallons/day)=(5.41Lm + 0.15Nc + 7.5Lc) xP,

or

UARL (litres/day)=(18.0Lm + 0.8Nc + 25.0Lc) xP

where:

Lm = length of mains (miles or kilometres)

Nc = number of service connections

Lc = total length of customer service lines (miles or km)

= Nc multiplied by the average distance of customer service line, Lp (miles or km)

P = Pressure (psi or metres)

Click to see Service Connection Diagram

Grading the system

PERFORMANCE INDICATORS

Financial Indicators

Non-revenue water as percent by volume of Water Supplied:	
Non-revenue water as percent by cost of operating system:	
Annual cost of Apparent Losses:	
Annual cost of Real Losses:	

Operational Efficiency Indicators

Apparent Losses per service connection per day:	
Real Losses per service connection per day*:	
Real Losses per length of main per day*:	
Real Losses per service connection per day per meter (head) pressure:	
? Unavoidable Annual Real Losses (UARL):	
From Above, Real Losses = Current Annual Real Losses (CARL):	
? Infrastructure Leakage Index (ILI) [CARL/UARL]:	

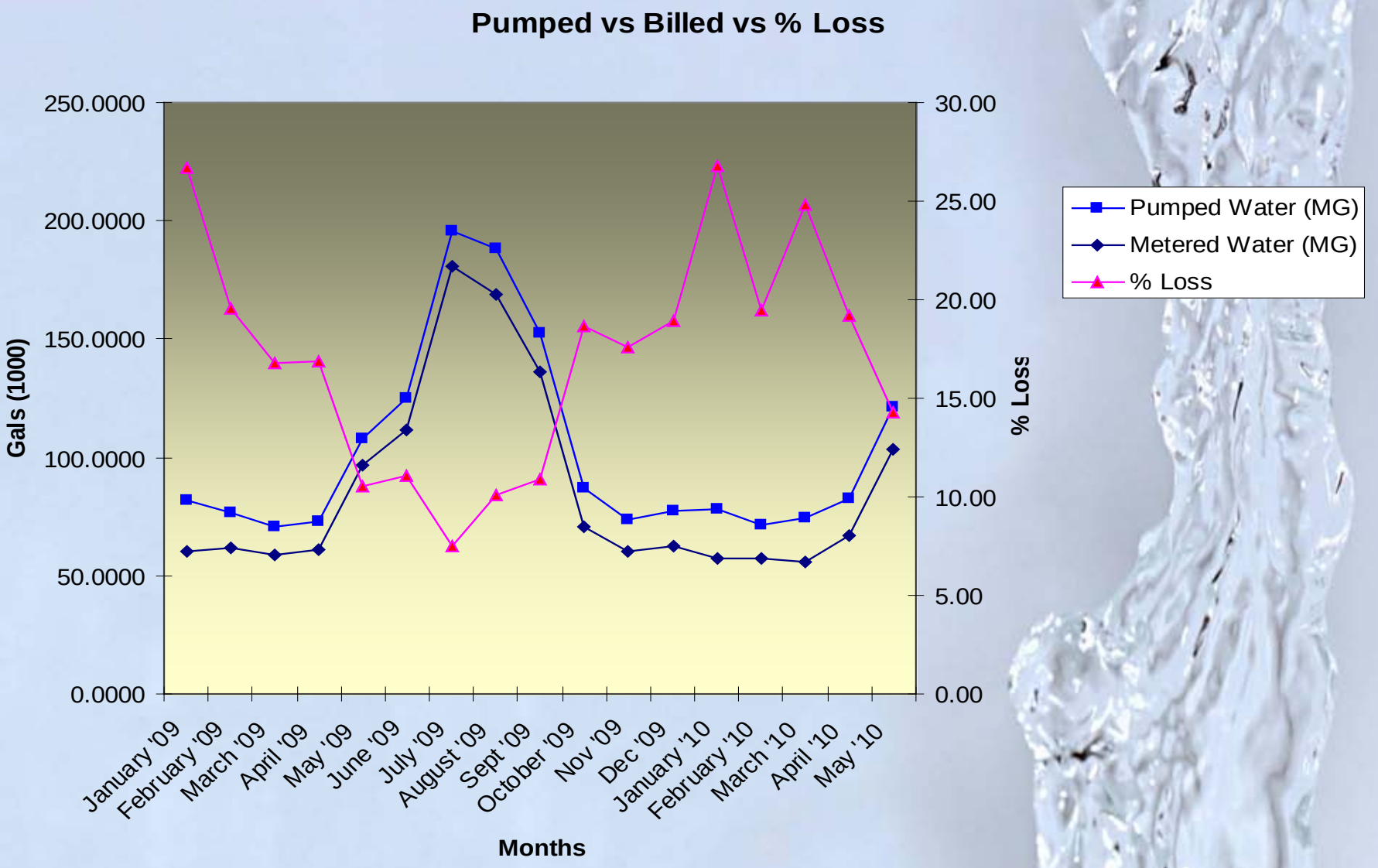
AWWA audit vs.LMO2 Form

- “Unaccounted for” water in LMO2 is ***identified*** in the Audit Spreadsheet.
- No “allowable leakage” based on type and age of pipe in the AWWA Audit.
- Validation grading scale used in the AWWA Audit to help with data issues.
- AWWA Audit results are based on lost revenue and help target remediation.
- AWWA Audit allows for corrections to be applied for meter inaccuracies (At production meters, customer meters).
- AWWA audit shows where water use and losses are in Balance Matrix.

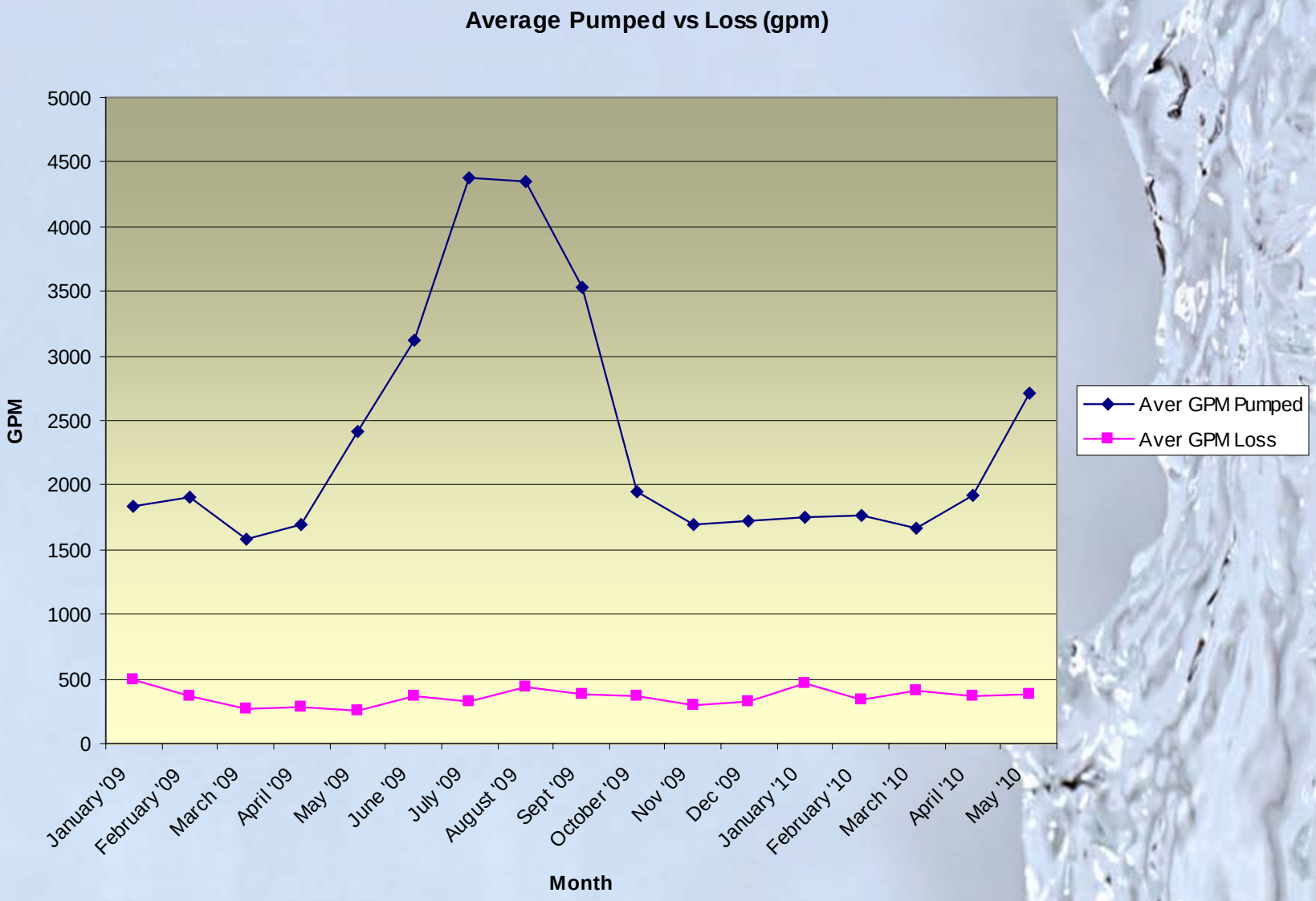
Developing Actions

- Monitor, Maintain and / or Manage
- Improve data
- Develop a “bottom up” audit
- Refer to M36 and other AWWA references
- Other publications, IWA and privately authored
- Review case studies
- Comments to wlc@awwa.org

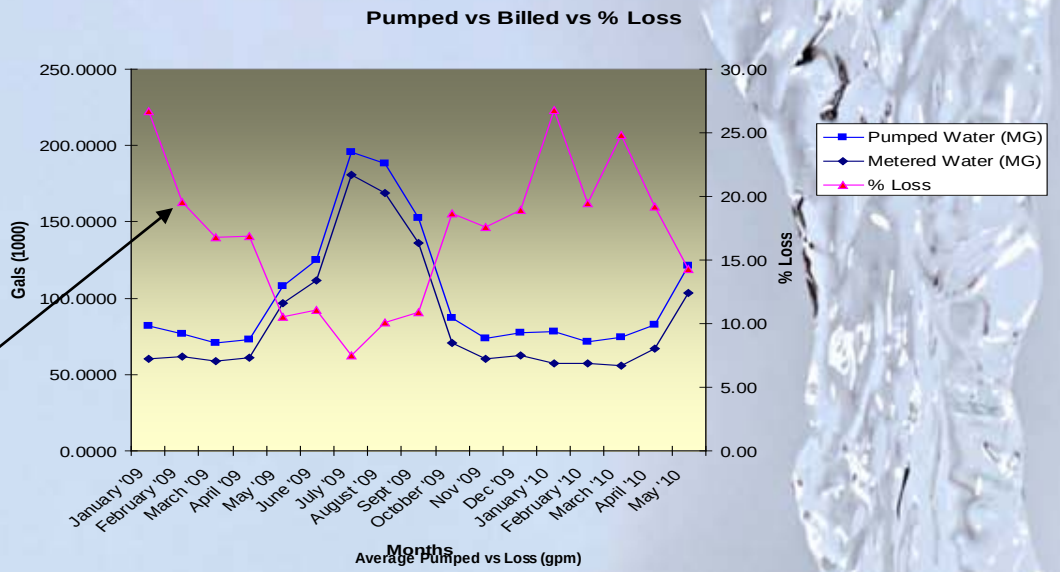
Any Village Water Loss



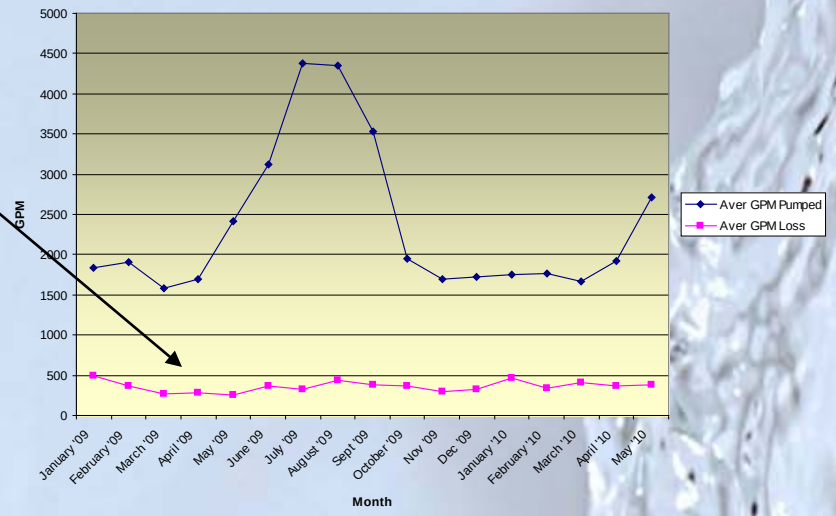
Any Village Water Loss



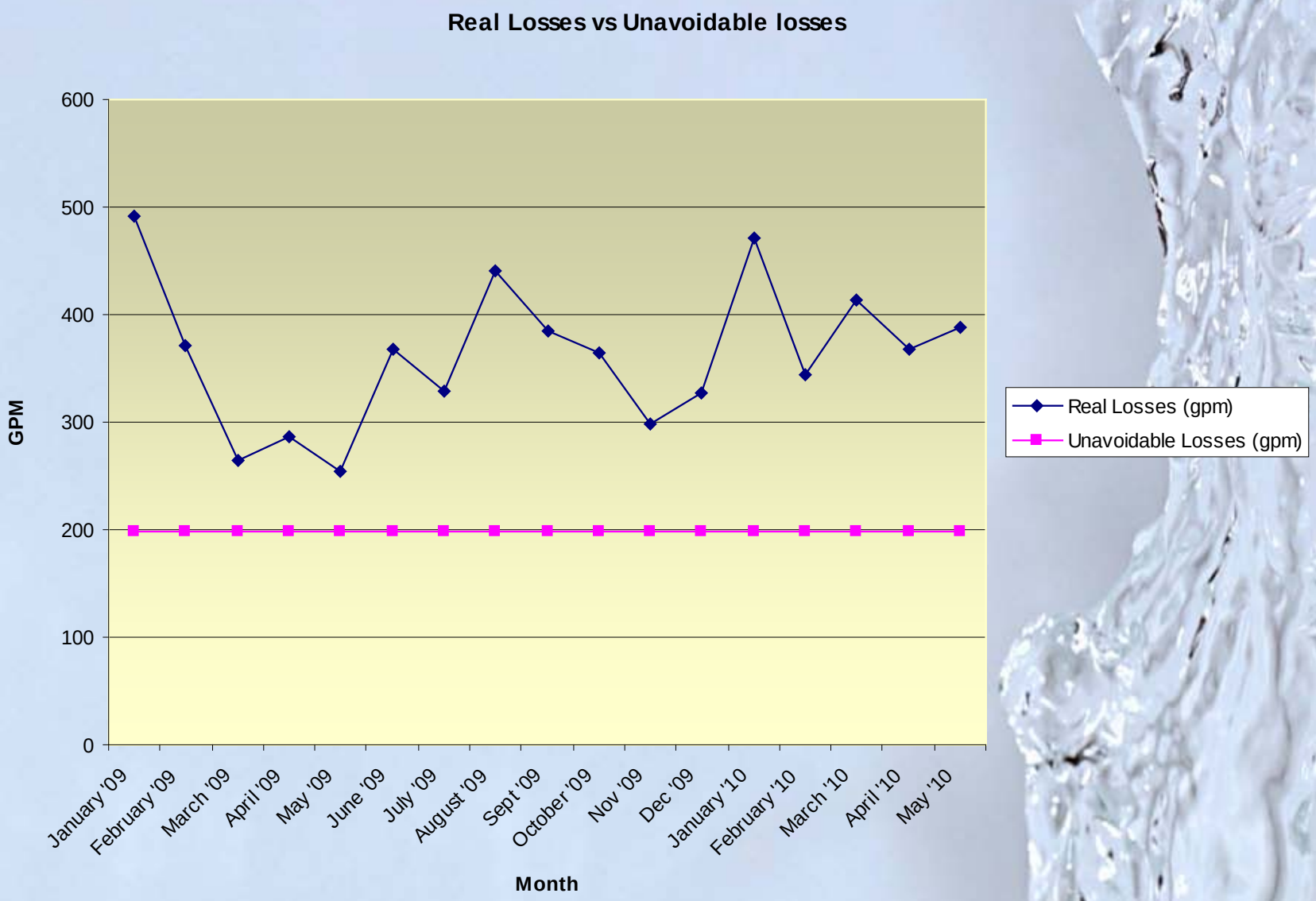
Any Village Water Loss

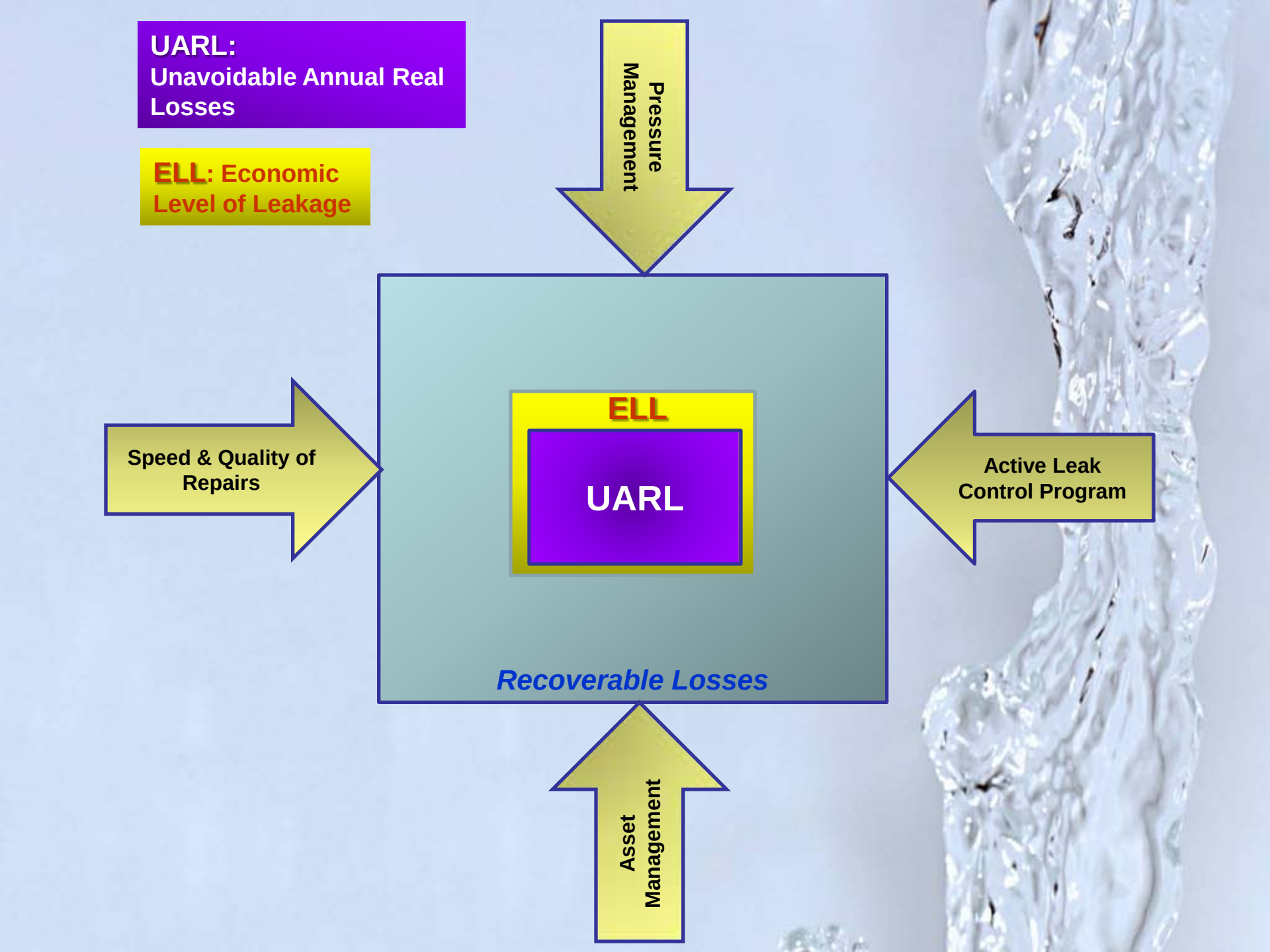


Percent Loss curve does not match GPM loss curve.



Any Village Water Loss

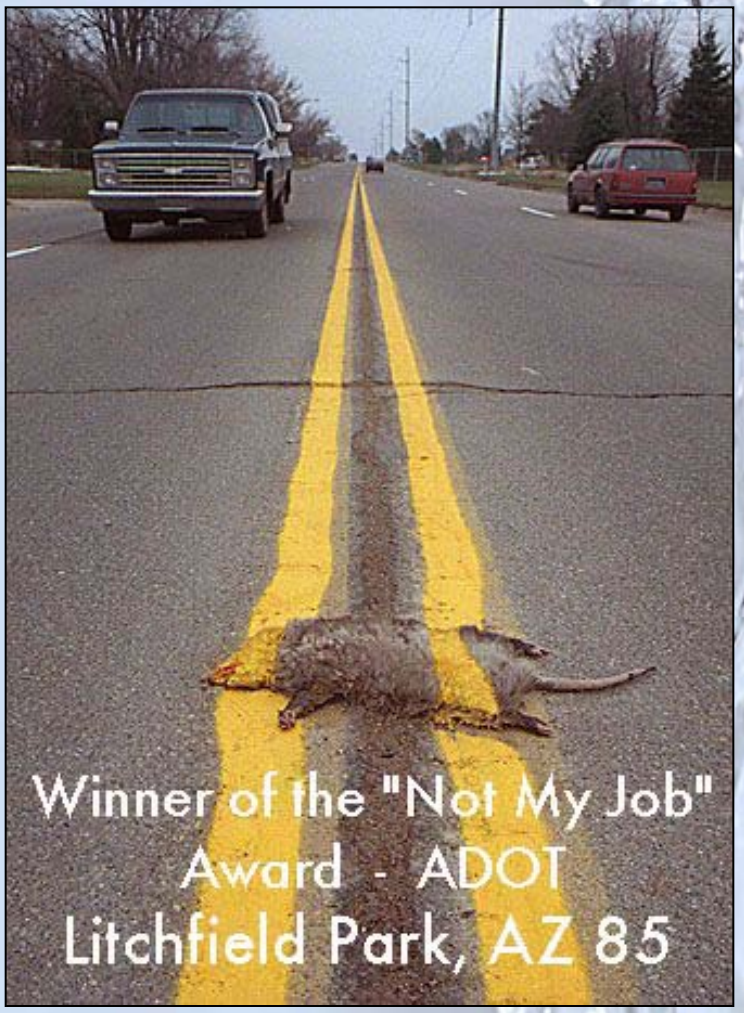



UARL:
Unavoidable Annual Real Losses
ELL: Economic Level of Leakage
Pressure Management
Speed & Quality of Repairs
ELL
UARL
Active Leak Control Program
Recoverable Losses
Asset Management

Questions?

johnnyv@mesimpson.com

Don’t play Possum with Water Loss Management!!

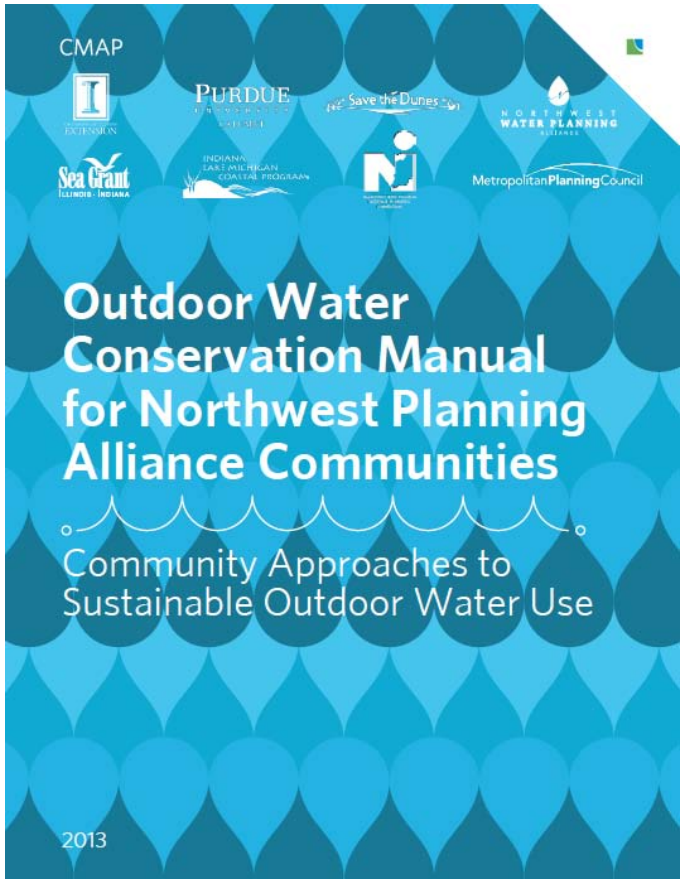


Discussion: Internal & External Communications and Outreach Strategies

Abby Crisostomo, Metropolitan Planning Council

Discussion: Internal & External Communications and Outreach Strategies

- **Coordinating with other municipal staff on education and enforcement**
- **Sharing outreach tools**
- **Pairing sticks and carrots**



Wrap-up, Questions, Announcements

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Resource List

- Model Water Use Conservation Ordinance, *Chicago Metropolitan Agency for Planning*

http://www.cmap.illinois.gov/water-2050/resources

- Regional Water Conservation Lawn Watering Ordinance, *Northwest Water Planning Alliance*

http://www.nwpa.us/pdfs/resource_center/NWPA%20Regional%20Lawn%20Watering%20Ordinance%20110712-FINAL.pdf

- "Promoting Sustainable Building and Development Practices in Lake County"- Sample Ordinances and Information Sources, *Lake County*

http://issuu.com/lakecounty/docs/sustainablepractices?mode=embed&layout

- Immeasurable Loss: Modernizing Lake Michigan Water Use, *Metropolitan Planning Council*
- http://www.metroplanning.org/waterloss
- M36 Water Audit, *American Water Works Association*

http://www.awwa.org/resources-tools/water-knowledge/water-loss-control.aspx

Workshop 3: Indoor & Outdoor Water Use

July 31, 2013, 8:30 am to noon, DuPage Water Commission

- Importance of water conservation for indoor and outdoor water use
  - Jared Teutsch, *Alliance for the Great Lakes*
- Identifying and prioritizing top water users and how to work with commercial and industrial customers
  - Karl Johnson, *MWH Global*
- How to work with residential users on indoor and outdoor water use
  - Karl Johnson and Hillary Holmes, *MWH Global*
- Performance tracking for water conservation ordinances and initiatives
  - Ned Paschke, *University of Wisconsin, Madison*