

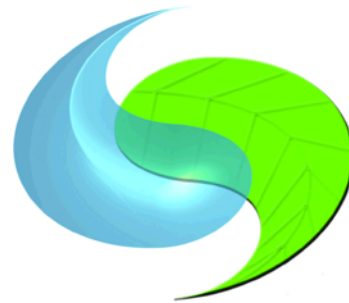
# Strategic Water Loss Reduction

Presented by  
Heather Himmelberger, P.E.  
Director, NM Environmental Finance Center  
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# Contact Info

**Heather Himmelberger, PE**

- **Director**
- **(505) 924-7028**
- **[heatherh@efc.nmt.edu](mailto:heatherh@efc.nmt.edu)**

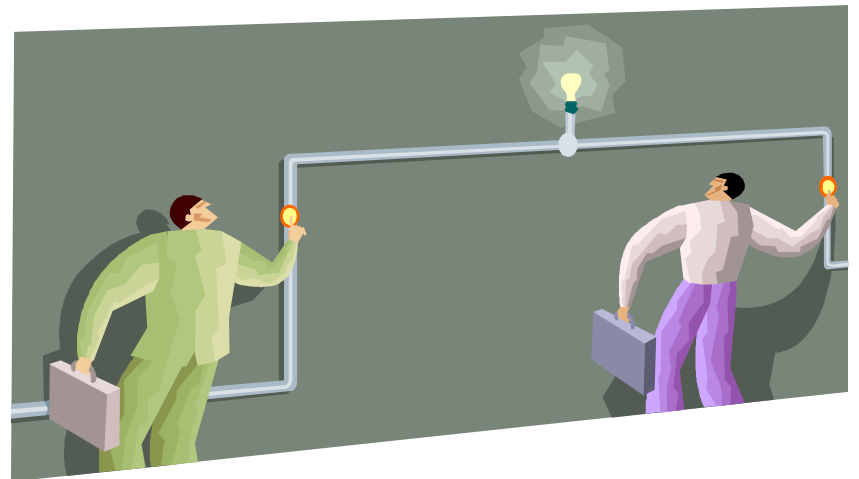


NEW MEXICO  
ENVIRONMENTAL  
FINANCE CENTER

2445 Alamo, SE

Albuquerque, NM 87106

# Which Losses to Focus on



# Water Audit – What does it tell you?

System Input Volume	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	Revenue Water
			Billed Unmetered Consumption	
		Unbilled Authorized Consumption	Unbilled Metered Consumption	
			Unbilled Unmetered Consumption	
	Water Losses	Apparent Losses	Unauthorized Consumption	Non- Revenue Water
			Customer Meter Inaccuracies	
		Real Losses	Leakage in Transmission & Distribution Mains	
			Leakage at Overflows and Reservoirs	
Leakage on Service Connections up to Metering Point				

# High Unbilled Authorized Consumption

System Input Volume	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	Revenue Water
			Billed Unmetered Consumption	
		Unbilled Authorized Consumption	Unbilled Metered Consumption	
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# High Unbilled Authorized Consumption

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- Not Water Losses
- Revenue lost because a decision has been made to subsidize the user(s)
- May be metered or not
- Examples
  - Schools
  - Parks
  - Fire
  - City facilities
- If this use is high, biggest issue is equitability
  - Is it fair for all users to subsidize?
  - Should unmetered use be metered?
  - Every user in this category should get a statement describing how much service they receive

# High Apparent Losses

System Input Volume	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	Revenue Water	
			Billed Unmetered Consumption		
		Unbilled Authorized Consumption	Unbilled Metered Consumption		Non- Revenue Water
			Unbilled Unmetered Consumption		
	Water Losses	Apparent Losses	Unauthorized Consumption		
			Customer Meter Inaccuracies		
		Real Losses	Leakage in Transmission & Distribution Mains		
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	Leakage on Service Connections up to Metering Point				

# High Apparent Losses

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- Not actually losing water!!!!
- Represents revenue lost to the system
  - User(s) not paying for water they use
- Two sources
  - Illegal use of water; illegal hook-ups
  - Meter inaccuracies
    - Meters typically fail low
- If this portion of the water balance is high – insufficient revenues

# High Real Losses

System Input Volume	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	Revenue Water
			Billed Unmetered Consumption	
		Unbilled Authorized Consumption	Unbilled Metered Consumption	
			Unbilled Unmetered Consumption	
	Water Losses	Apparent Losses	Unauthorized Consumption	Non- Revenue Water
			Customer Meter Inaccuracies	
		Real Losses	Leakage in Transmission & Distribution Mains	
			Leakage at Overflows and Reservoirs	
		Leakage on Service Connections up to Metering Point		

# High Real Losses

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- These factors represent water that is lost from the system
  - Water that has been pumped from source, but never reaches customers/users
- Three sources
  - Pipe leakage
  - Reservoir leaks and overflows
  - Leakage on service connections (prior to meter)
- If this portion of the water balance is high – losing water resources

# So Where to Start? Look at Water Balance Profile

<b>Input Volume</b> <b>300,000 gpd</b>	<b>Authorized Consumption</b> <b>275,000 gpd (92%)</b>	<b>Billed Consumption</b> <b>180,000 gpd</b>	<b>Billed Metered</b> <b>170,000 gpd</b>	<b>Revenue Water</b>
			<b>Billed Unmetered</b> <b>10,000 gpd</b>	
	<b>Water Losses</b> <b>25,000 gpd (8%)</b>	<b>Unbilled Consumption</b> <b>95,000 gpd</b>	<b>Unbilled Metered</b> <b>25,000 gpd</b>	<b>Non-Revenue Water</b>
			<b>Unbilled Unmetered</b> <b>70,000 gpd</b>	
	<b>Real Losses</b> <b>13,000 gpd</b>	<b>Apparent Losses</b> <b>12,000 gpd</b>	<b>Unauthorized Consumption</b> <b>10,000 gpd</b>	
			<b>Customer Meter Inaccuracies</b> <b>2,000 gpd</b>	
		<b>Leakage in Mains</b> <b>10,000 gpd</b>		
		<b>Leakage/Overflows at Reservoirs</b> <b>1,000 gpd</b>		
		<b>Leakage on Service Connections</b> <b>2,000 gpd</b>		

# What's the Biggest Problem?

- Unbilled Consumption, especially unmetered
  - 32% of the volume; 23% from unbilled, unmetered

Input Volume <b>300,000 gpd</b>	Authorized Consumption <b>275,000 gpd (92%)</b>	Billed Consumption <b>180,000 gpd</b>	Billed Metered <b>170,000 gpd</b>	Revenue Water
		Unbilled Consumption <b>95,000 gpd</b>	Billed Unmetered <b>10,000 gpd</b>	
			Unbilled Metered <b>25,000 gpd</b>	Unbilled Unmetered <b>70,000 gpd</b>
		Water Losses <b>25,000 gpd (8%)</b>		Apparent Losses <b>12,000 gpd</b>
	Real Losses <b>13,000 gpd</b>		Customer Meter Inaccuracies <b>2,000 gpd</b>	
			Leakage in Mains <b>10,000 gpd</b>	
			Leakage/Overflows at Reservoirs <b>1,000 gpd</b>	
			Leakage on Service Connections <b>2,000 gpd</b>	

# Look at Water Balance Profile

<b>Input Volume</b> <b>450,000 gpd</b>	<b>Authorized Consumption</b> <b>290,000 gpd</b> <b>(64%)</b>	<b>Billed Consumption</b> <b>250,000 gpd</b>	<b>Billed Metered</b> <b>220,000 gpd</b>	<b>Revenue Water</b>
			<b>Billed Unmetered</b> <b>30,000 gpd</b>	
	<b>Water Losses</b> <b>160,000 gpd</b> <b>(36%)</b>	<b>Unbilled Consumption</b> <b>40,000 gpd</b>	<b>Unbilled Metered</b> <b>20,000 gpd</b>	<b>Non-Revenue Water</b>
		<b>Apparent Losses</b> <b>12,000 gpd</b>	<b>Unauthorized Consumption</b> <b>10,000 gpd</b>	
			<b>Customer Meter Inaccuracies</b> <b>2,000 gpd</b>	
<b>Leakage in Mains</b> <b>100,000 gpd</b>				
<b>Real Losses</b> <b>148,000 gpd</b>	<b>Leakage/Overflows at Reservoirs</b> <b>8,000 gpd</b>			
	<b>Leakage on Service Connections</b> <b>40,000 gpd</b>			

# What's the Biggest Problem?

- Real Water Losses, especially leaky mains
  - 33% of the volume; 22% from leaky mains

Input Volume <b>450,000 gpd</b>	Authorized Consumption <b>290,000 gpd</b> (64%)	Billed Consumption <b>250,000 gpd</b>	Billed Metered <b>220,000 gpd</b>	Revenue Water
			Billed Unmetered <b>30,000 gpd</b>	
		Unbilled Consumption <b>40,000 gpd</b>	Unbilled Metered <b>20,000 gpd</b>	Non-Revenue Water
			Unbilled Unmetered <b>20,000 gpd</b>	
	Water Losses <b>160,000 gpd</b> (36%)	Apparent Losses <b>12,000 gpd</b>	Unauthorized Consumption <b>10,000 gpd</b>	
		Real Losses <b>148,000 gpd</b>	Customer Meter Inaccuracies <b>2,000 gpd</b>	
Leakage in Mains <b>100,000 gpd</b>				
		Leakage/Overflows at Reservoirs <b>8,000 gpd</b>		
		Leakage on Service Connections <b>40,000 gpd</b>		

# Look at Water Balance Profile

<b>Input Volume</b>  <b>275,000 gpd</b>	<b>Authorized Consumption</b> <b>165,000 gpd (60%)</b>	<b>Billed Consumption</b> <b>150,000 gpd</b>	<b>Billed Metered</b> <b>120,000 gpd</b>	<b>Revenue Water</b>
			<b>Billed Unmetered</b> <b>30,000 gpd</b>	
		<b>Unbilled Consumption</b> <b>15,000 gpd</b>	<b>Unbilled Metered</b> <b>10,000 gpd</b>	<b>Non-Revenue Water</b>
			<b>Unbilled Unmetered</b> <b>5,000 gpd</b>	
	<b>Water Losses</b> <b>110,000 gpd (40%)</b>	<b>Apparent Losses</b> <b>80,000 gpd</b>	<b>Unauthorized Consumption</b> <b>30,000 gpd</b>	
			<b>Customer Meter Inaccuracies</b> <b>50,000 gpd</b>	
		<b>Real Losses</b> <b>30,000 gpd</b>	<b>Leakage in Mains</b> <b>20,000 gpd</b>	
			<b>Leakage/Overflows at Reservoirs</b> <b>5,000 gpd</b>	
<b>Leakage on Service Connections</b> <b>5,000 gpd</b>				


# What's the Biggest Problem?

- Apparent Losses, especially inaccurate meters
  - 29% of the volume; 18% from inaccurate meters

<b>Input Volume</b> 275,000 gpd	<b>Authorized Consumption</b> 165,000 gpd (60%)	<b>Billed Consumption</b> 150,000 gpd	<b>Billed Metered</b> 120,000 gpd	Revenue Water
			<b>Billed Unmetered</b> 30,000 gpd	
		<b>Unbilled Consumption</b> 15,000 gpd	<b>Unbilled Metered</b> 10,000 gpd	Non-Revenue Water
			<b>Unbilled Unmetered</b> 5,000 gpd	
	<b>Water Losses</b> 110,000 gpd (40%)	<b>Apparent Losses</b> 80,000 gpd	<b>Unauthorized Consumption</b> 30,000 gpd	
			<b>Customer Meter Inaccuracies</b> 50,000 gpd	
		<b>Real Losses</b> 30,000 gpd	<b>Leakage in Mains</b> 20,000 gpd	
			<b>Leakage/Overflows at Reservoirs</b> 5,000 gpd	
			<b>Leakage on Service Connections</b> 5,000 gpd	




**Step 1:** Find the biggest source of the water or revenue loss and address it first



If 40% of the problem is apparent losses and only 5% of the problem is leaks – your money is best spent on addressing apparent losses not on leak detection

Money should be spent where it will have the most impact

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- Let's assume, either:
    - Apparent losses and/or unbilled water use were a major issue for the system and have already been addressed, but there is still an issue with real losses
    - Apparent losses and unbilled water use were not an issue, but the system has a problem with real water losses



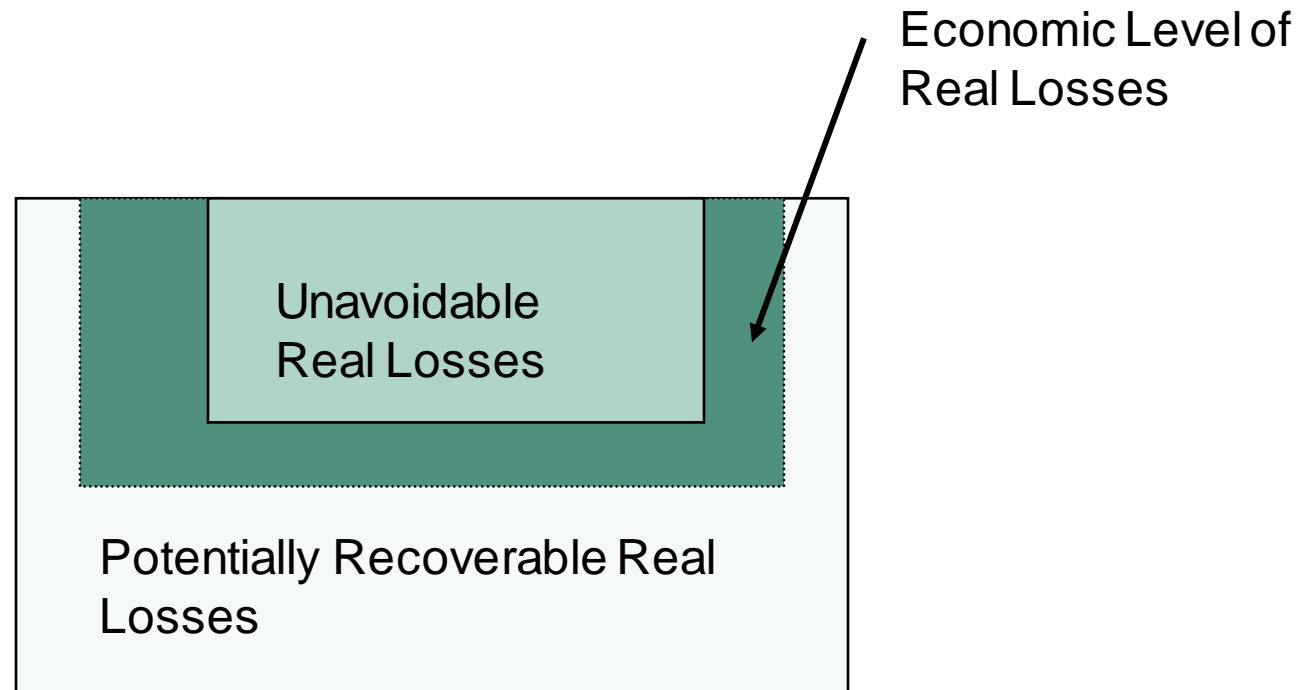
Let's concentrate on just the real  
losses

# Real Losses

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- Can we save all of the losses that are considered “real losses”
  - No
  - Why not?
  - Some losses are considered “unavoidable real losses”
  - Some losses are considered uneconomical to address

# More on Real Losses



Real Loss reduction is only looking for the “**Potentially Recoverable Real Losses**” portion. If this portion is not significant to the system, stop here

# Methods to Address Real Losses

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- Pressure Management
- Active Leakage Control
- Speed and Quality of Repairs
- Pipeline Asset Management

Only going to address 2 of these: Active Leakage Control and Speed and Quality of Repairs

# Active Leak Control

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- One size does not fit all
- Every system should do the amount and type of leak detection that best fits their system, resources, personnel, and goals
- Leak detection is not an all or nothing proposition; can do a little or a not

# Strategies to Address Real Water Losses

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- Establish goals for the program
- How much of the system in which to look for leaks
- Leak detection related critical assets
- Leak detection related to asset replacement
- Leak detection related to special studies

# Establish Goals for the Program

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- It is important to know what you want to accomplish with leak detection
- Different goals lead to different strategies
  - Types of goals
    - Reduce water loss to lowest possible level
    - Prevent catastrophic failures
    - Determine pipe condition

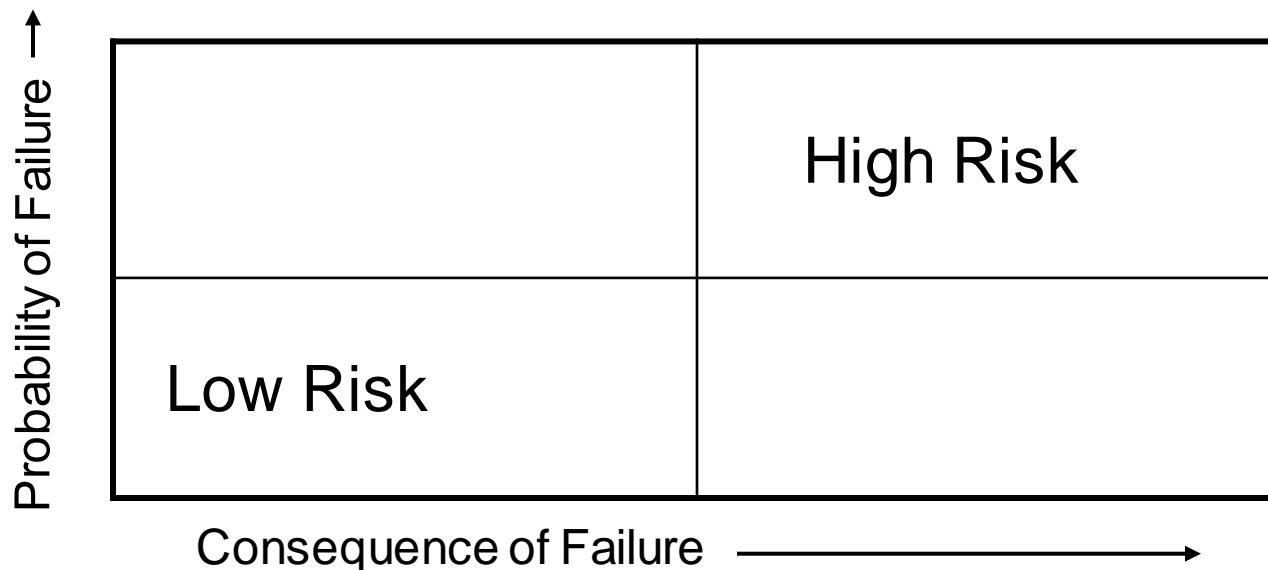
# Quantity of System to Look for Leaks

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- Leak detection doesn't have to be done on the whole system; it can be done on all or part of the system
- Can do a part each year so that over time (x number of years) the whole system is done
- Can only do a subset of the system, such as older portion, part with particular pipe types, part with particular soil types, etc.
- Can do a critical part of the system every year and then do the entire system every 3 years or 5 years

# Leak Detection Related to Critical Assets

- Not all assets have the same criticality – or importance – to the utility
- Critical assets are those that have a high likelihood that they will fail and a high consequence if they do fail



# Leak Detection Related to Critical Assets

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## Examples:

- Pipe under major highway
  - Pipe under railroad
  - Large pipes
  - Pipe that is main distribution main for the system
- Leak detection can be done on just the critical assets to make sure there is no problem with the critical assets
  - Leak detection can help prevent catastrophic failures (nothing can guarantee no catastrophic failures)

# Leak Detection Related to Asset Replacement

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- Often, there is insufficient funding to replace all assets that need replacement
- Therefore, decisions must be made regarding which assets to replace and which to keep in service
- Leak detection can help identify which pipes to replace and which to keep in service

# Leak Detection Related to Special Studies

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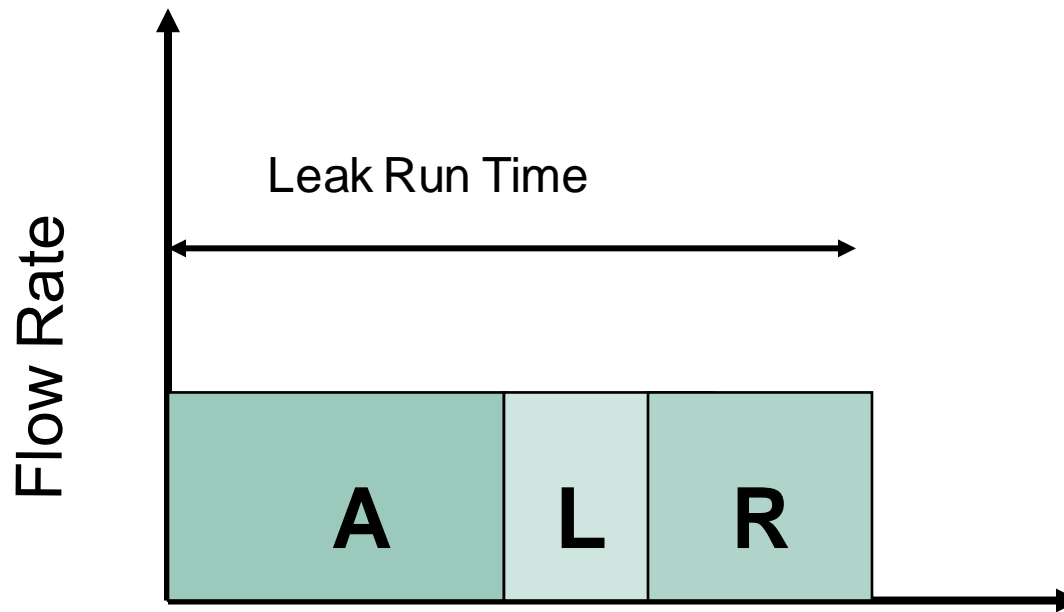
- Leak detection can be used to obtain information on particular issues of concern
- For example:
  - Road construction impacts on leaks
  - Soil types and leaks
  - Pipe types and leaks

# Speed and Quality of Repairs

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- Finding leaks in and of itself does not save one drop of water
- What saves water is repair of the leak or replacement of the leaky pipe
- The sooner the leak is repaired the sooner the water loss will stop and the more water that will be saved

# Volume of Water Lost



Run Time = Awareness + Location + Repair

Leak Volume Loss = Leak Run Time X Flow Rate

# Volume of Water Lost – Cont.

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- Awareness of leaks varies depending on how it is found
- Leaks will be found sooner or later depending on the frequency of leak surveys
  - For example, if a survey is done every 2 years, the leak may last for a year or more before it is found

# In Summary,

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- If there are insufficient resources to repair leaks, or a lack of desire or interest in repairing leaks, leak detection is a waste of time and money
- Only undertake as much leak detection as the system is capable of handling in terms of repairs (both money and personnel resources)

# What's not on the water balance?

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## ■ Customer side leaks

- Not the utilities responsibility, but can be a significant source of water loss
  - Not lost revenue
  - Lost water resources
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- Should the utility care?
    - If it's high they should

# What are some strategies to address customer side losses?

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- Educational campaigns
- Incentive programs
- Increasing block rate structure
- Investigation of highest water users in the community
- Rebate programs to make repairs
- Repairing indoor plumbing, but charging the customer for it
- Others???????



Questions?



Comments?