

Regular Workshop – March 23, 2015  
Agenda Item 12

Agenda Item: Inflow and Infiltration (I&I) Study Results

Presenter: Town Manager

Summary: The Town Commission requested a staff update on the recent Inflow & Infiltration Study (I&I) as well as an update on slip-lining, and lift station rehabilitation.

Longboat Key resident, Mr. Lenny Landau has done research regarding I&I in the Longboat Key wastewater collection system and has been asked to present his findings as part of the Regular Workshop Meeting discussion.

Following Mr. Landau's presentation, Ms. Laura Baumberger with Carollo Engineers will present an update on the Town's I&I study, project status, and future plans.

Attachments: 3-16-15 Memo, Assistant Town Manager to Manager;  
Landau PowerPoint Presentation;  
Carollo Engineers' PowerPoint Presentation.

Recommended

Action: None, informational only.

## M E M O R A N D U M

Date: March 16, 2015

**TO:** Dave Bullock, Town Manager  
**FROM:** Anne Ross, Assistant Town Manager  
**SUBJECT:** Inflow and Infiltration (I&I) Study Results

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The Town Commission requested a staff update on the recent Inflow & Infiltration Study (I&I) as well as an update on slip-lining, and lift station rehabilitation.

Longboat Key resident, Mr. Lenny Landau has done research regarding I&I in the Longboat Key wastewater collection system and has been asked to present his findings as part of the Regular Workshop Meeting discussion.

Following Mr. Landau's presentation, Ms. Laura Baumberger with Carollo Engineer's will present an update on the Town's I&I study, project status, and future plans.

Attached is a PowerPoint presentation that will be used as part of the March 23, 2015 Regular Workshop Meeting presentation.

Please don't hesitate to contact me if you have any questions.

Informational only, no action required.

# LBK Water & Sewer System

## Analysis

*Update Thru December 2014*



L. Landau  
March 23, 2015

# Preamble

I Tried Using Water a Sewer Data to  
Assess Seasonal Population Trends  
**It Made No Sense!**

- Now I understand why?
- "The Unwatched Pot"
  - "The River Beneath Us"

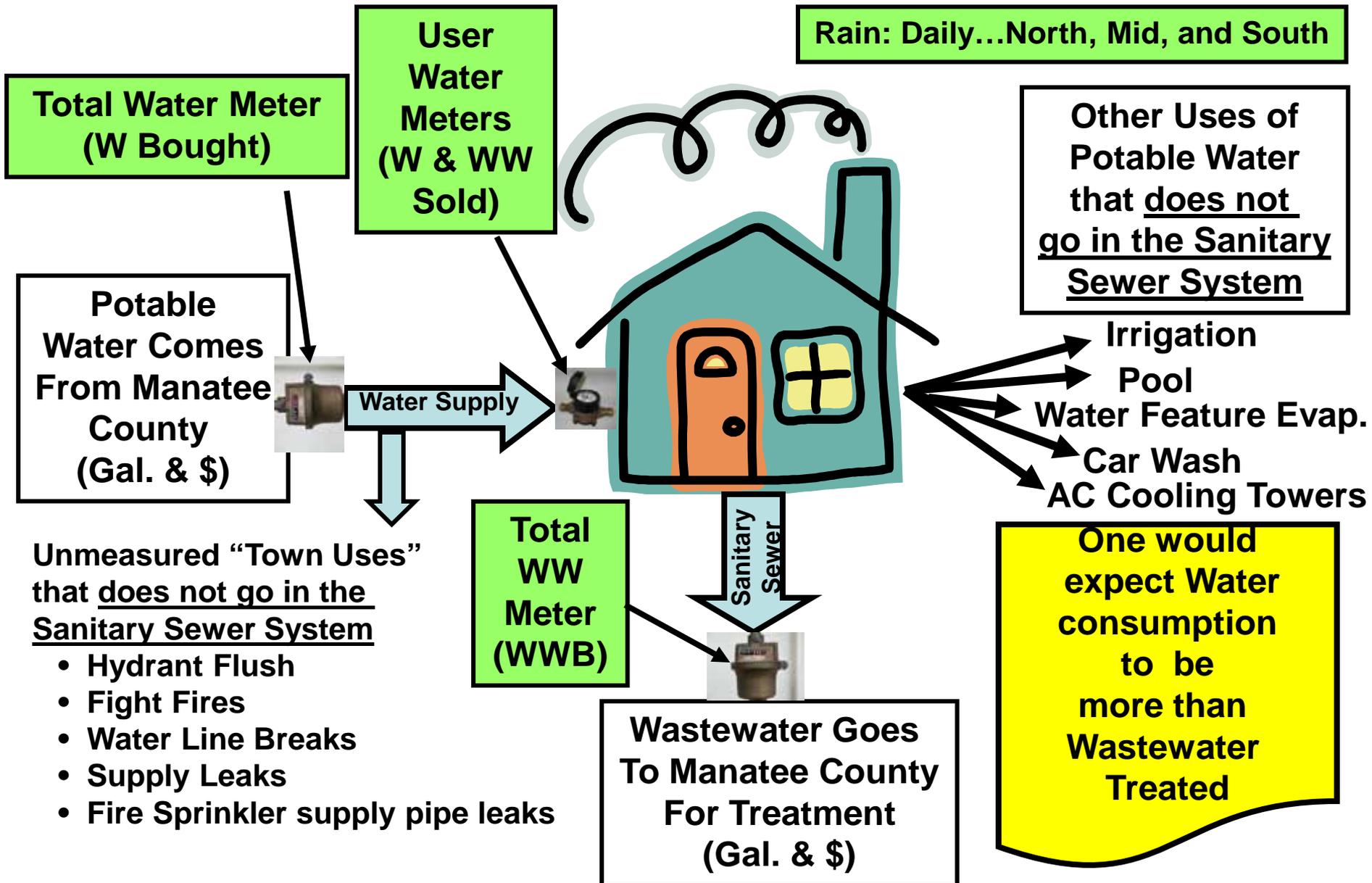
# Water Insights

- System is very tight!
- Since 2001 Water Consumption down over 40%!
- However, Consumption doesn't track "expected" need?...It's Backwards!
- Irrigation Consumption is constant all year, rain or shine.

# Wastewater Insights

- Since 2011 Annually more Wastewater has been Treated than Water Bought! It should be the opposite!
- Saltwater leaking into the system (Infiltration) is almost 50% of the total Wastewater flow, and it is getting worse!
- Rain has little impact

# Water & Sewer System Overview



# Sanitary Sewer (Wastewater)

(THIS)



**“Sanitary Sewer” : A sewer which carries wastewater and to which storm, surface, and ground waters are not intentionally admitted**

# Storm Sewer

# (NOT THIS)



**“Storm Sewer”:** A sewer used for rainwater, surface water, condensate, cooling water, or other liquid wastes

# LBK Water & Sewer

## BILLING RATES EFFECTIVE 07-01-13

### WATER RATES (INCLUDES IRRIGATION):

Service Charge Per Unit	\$11.65
Meter Billing Charge Per Meter	\$2.49
<b>TOTAL BASE CHARGE</b>	<b>\$14.14</b>
<b>Usage Charge - Per Thousand 0 through 5,000 gallons</b>	<b>\$2.23</b>
Usage Charge - Per Thousand 5,001 through 10,000 gallons	\$3.16
Usage Charge - Per Thousand 10,001 through 15,000 gallons	\$4.09
Usage Charge - Per Thousand 15,001 through 25,000 gallons	\$5.94
Usage Charge - Per Thousand 25,001 through 50,000	\$7.79
Usage Charge - Per Thousand Over 50,000	\$9.64

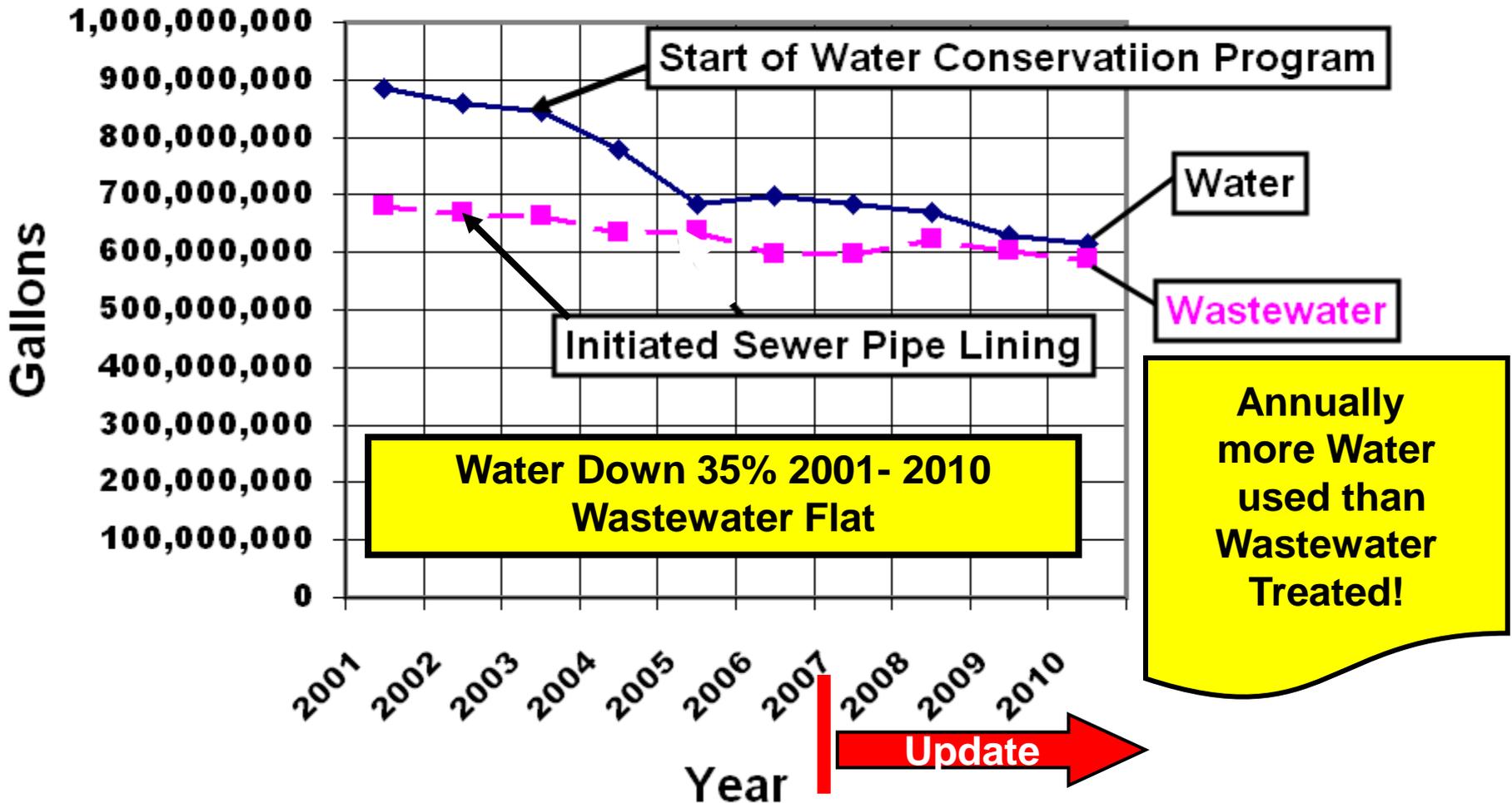
### SEWER RATES:

Service Charge - Base per unit	\$15.70
<b>Usage Charge - Per Thousand 1,000 through 7,000 gallons *</b>	<b>\$5.57</b>
<b>MAXIMUM sewer billing is \$54.69 per unit, for single-family homes, which is 7,000 gallons of usage. There is no maximum sewer billing for all other classes *</b>	

\* Commercial properties pay for all wastewater

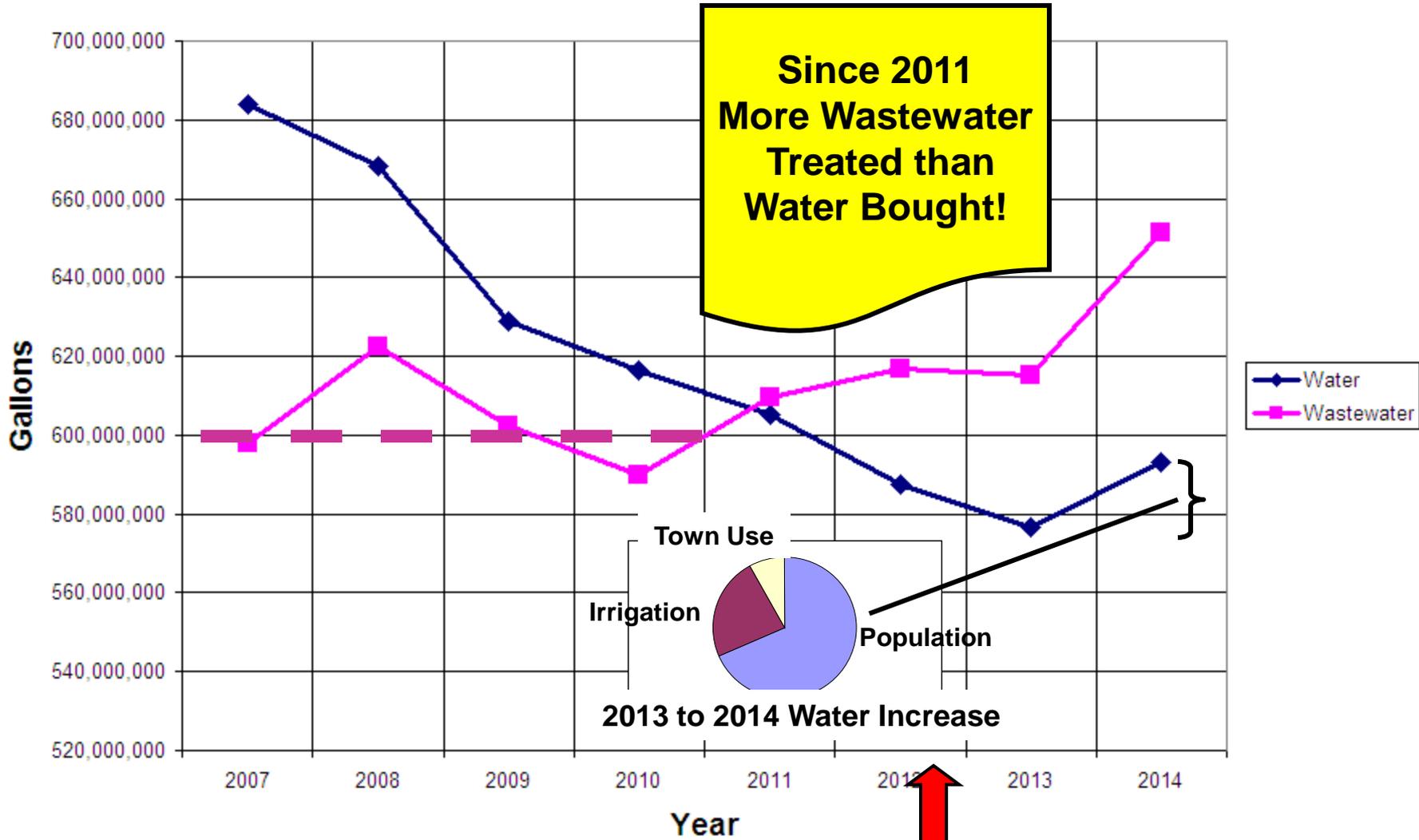
# LBK Water and Wastewater History

(Total billed by Manatee County)

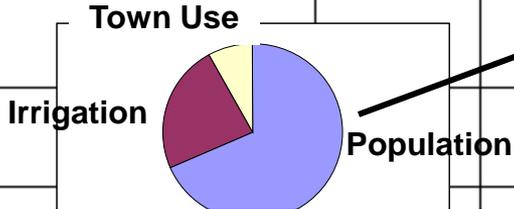


Manatee Co. charges LBK for Water and WW based upon total Gallons measured.

# 2007 thru 2014 Annual Water & Wastewater

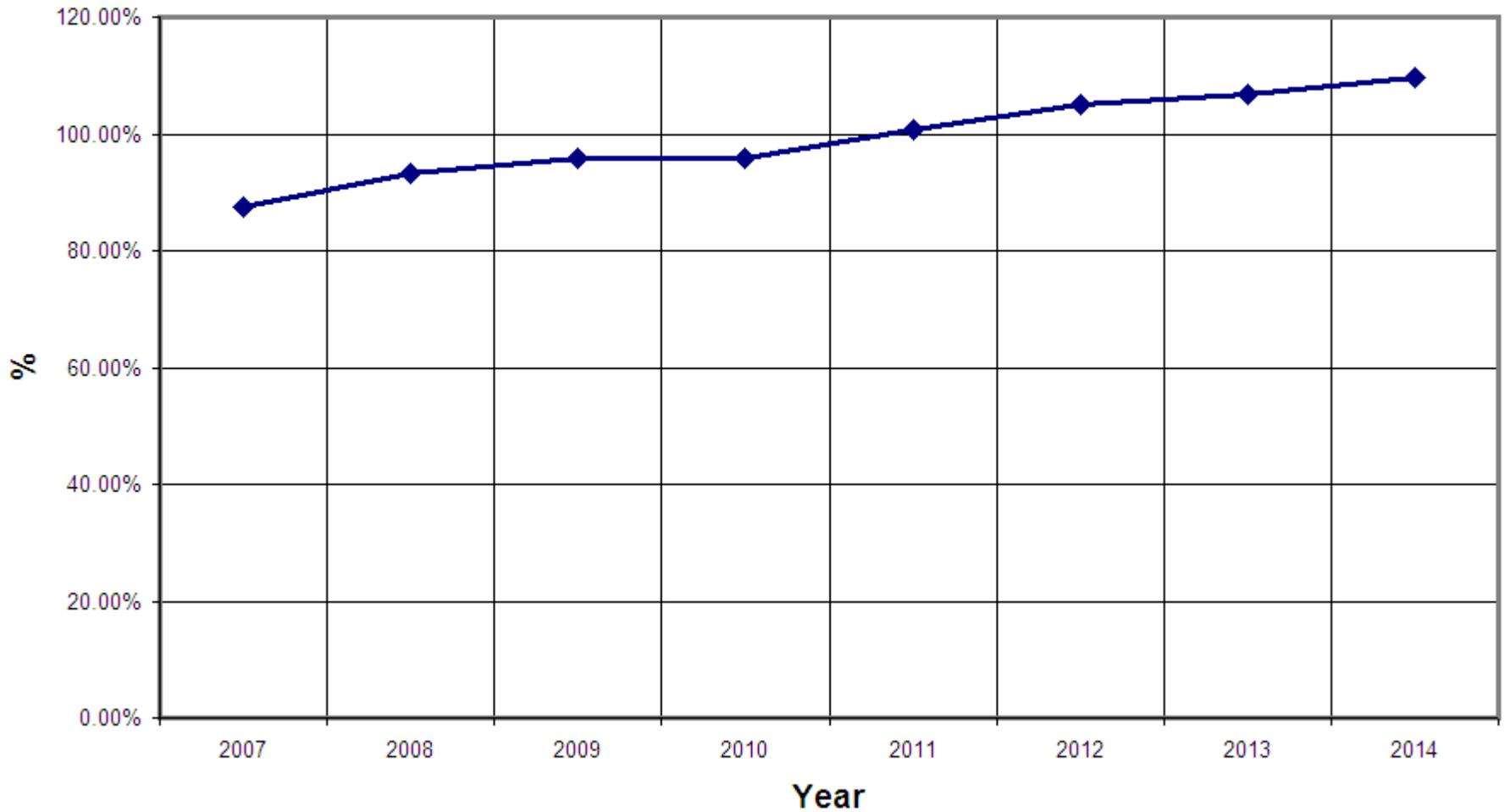


**Since 2011  
More Wastewater  
Treated than  
Water Bought!**

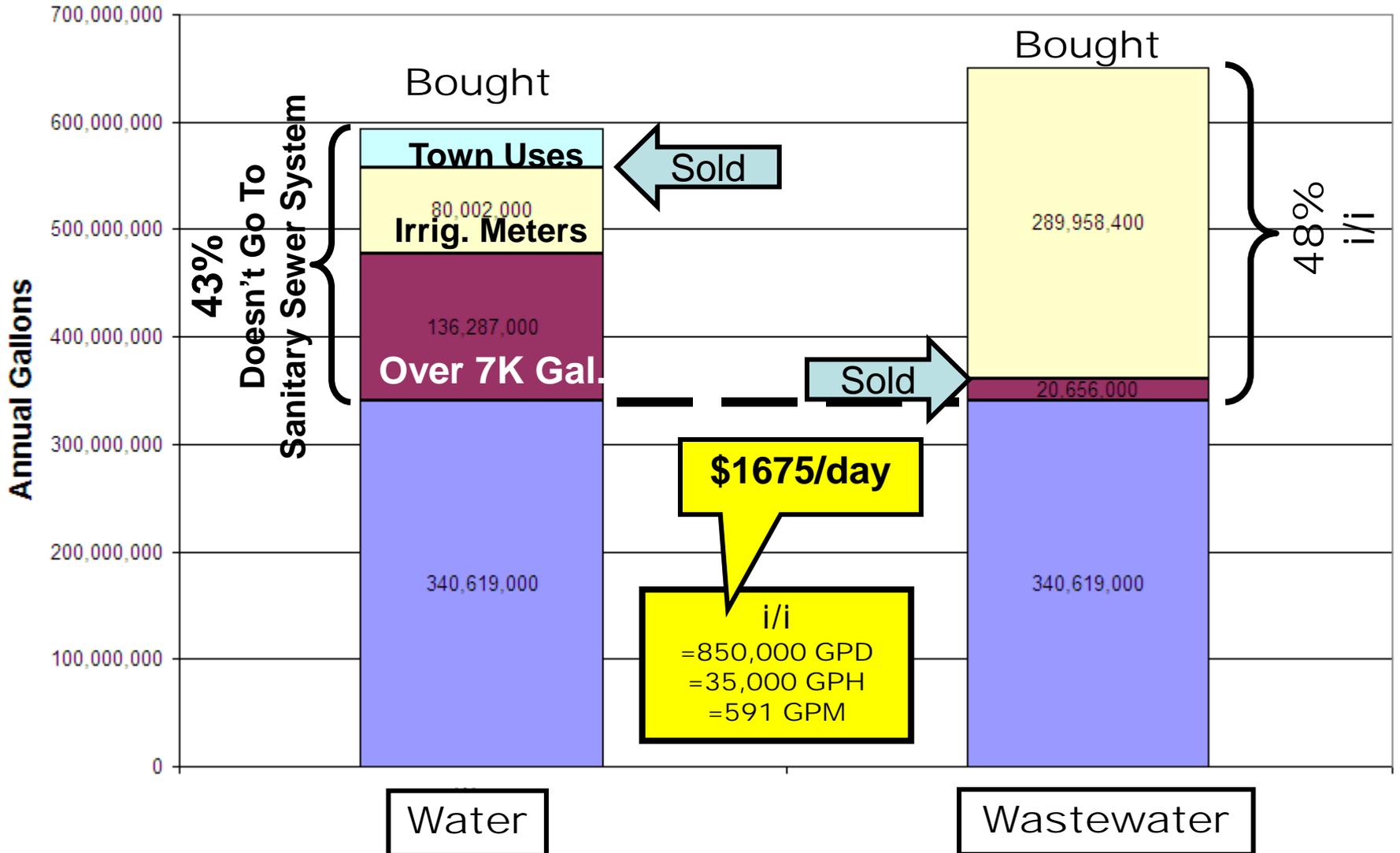


**Installed New  
Water Meters**

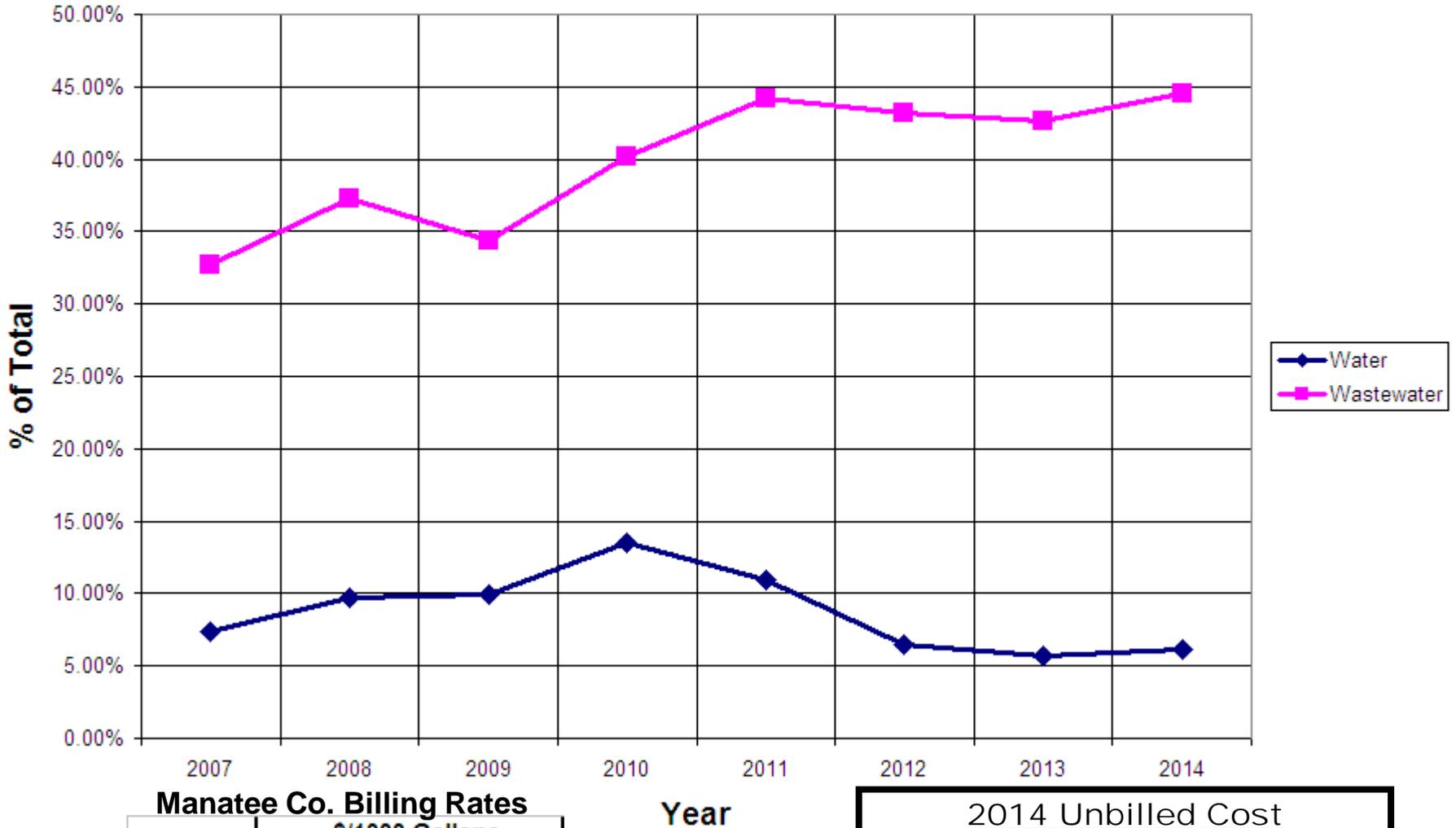
## Annual Wastewater % of Water (Bought)



# LBK 2014 Water & Wastewater Summary



## Unbilled Water & Wastewater % of Total (Bought – Sold)

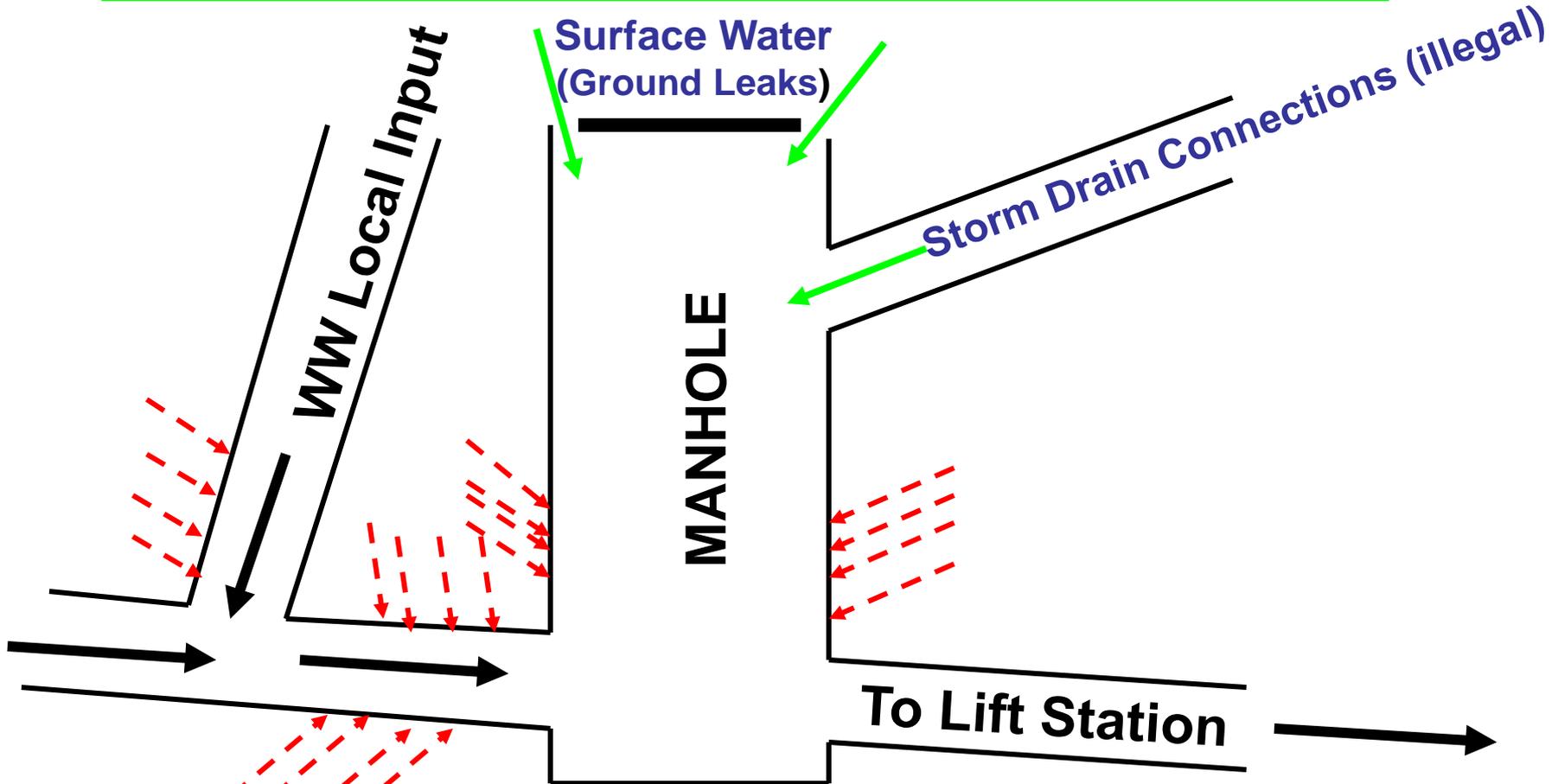


Manatee Co. Billing Rates		
	\$/1000 Gallons	
	Water	Wastewater
2014	\$1.59	\$1.97

2014 Unbilled Cost  
 Water...\$59,000  
**Wastewater...\$571,000**

# Inflow & Infiltration (i/i) Schematic

**INFLOW:** Surface Flow into the Sanitary Sewer System

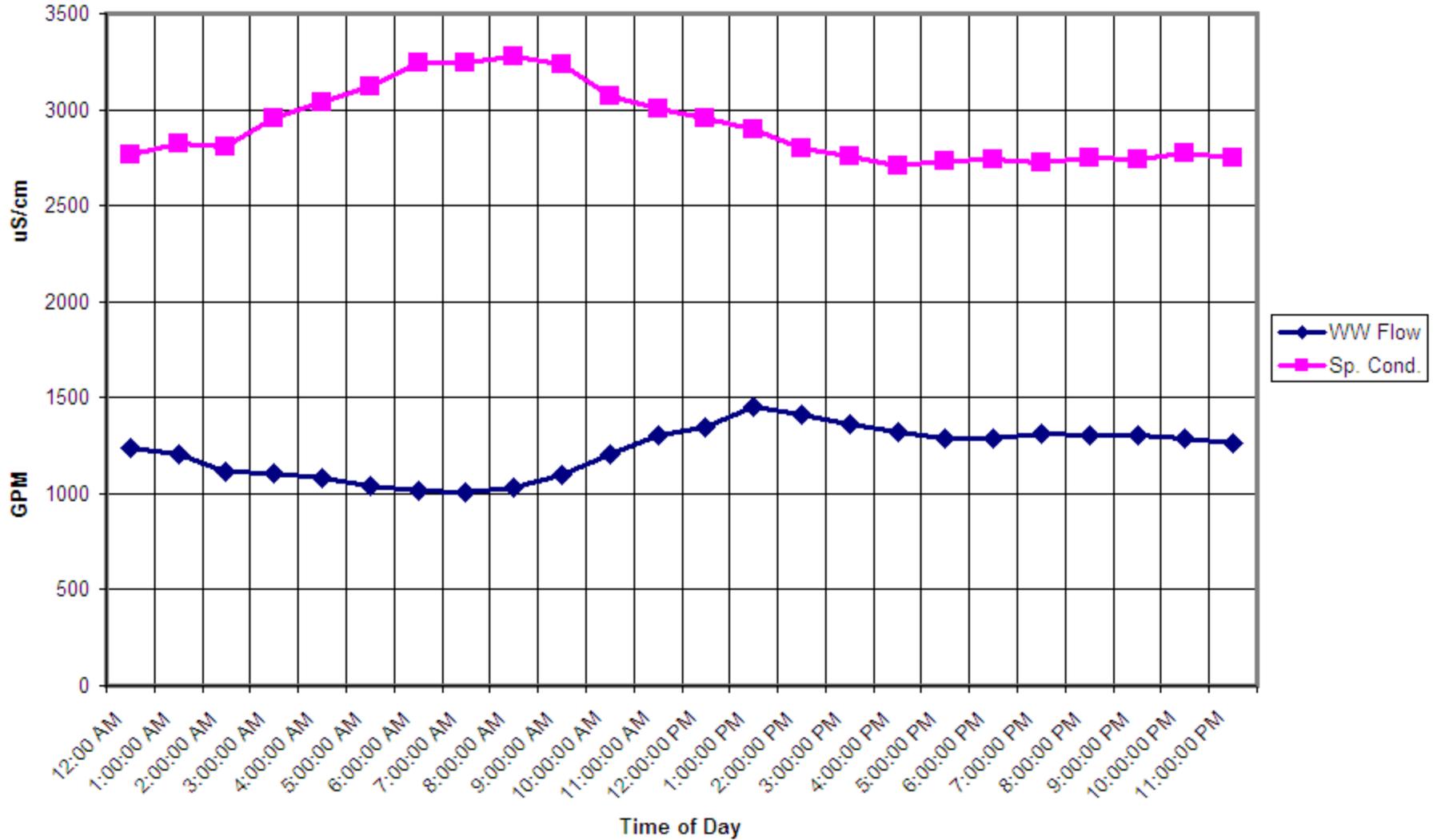


**INFILTRATION:** Subsurface Leaks into the Sanitary Sewer System

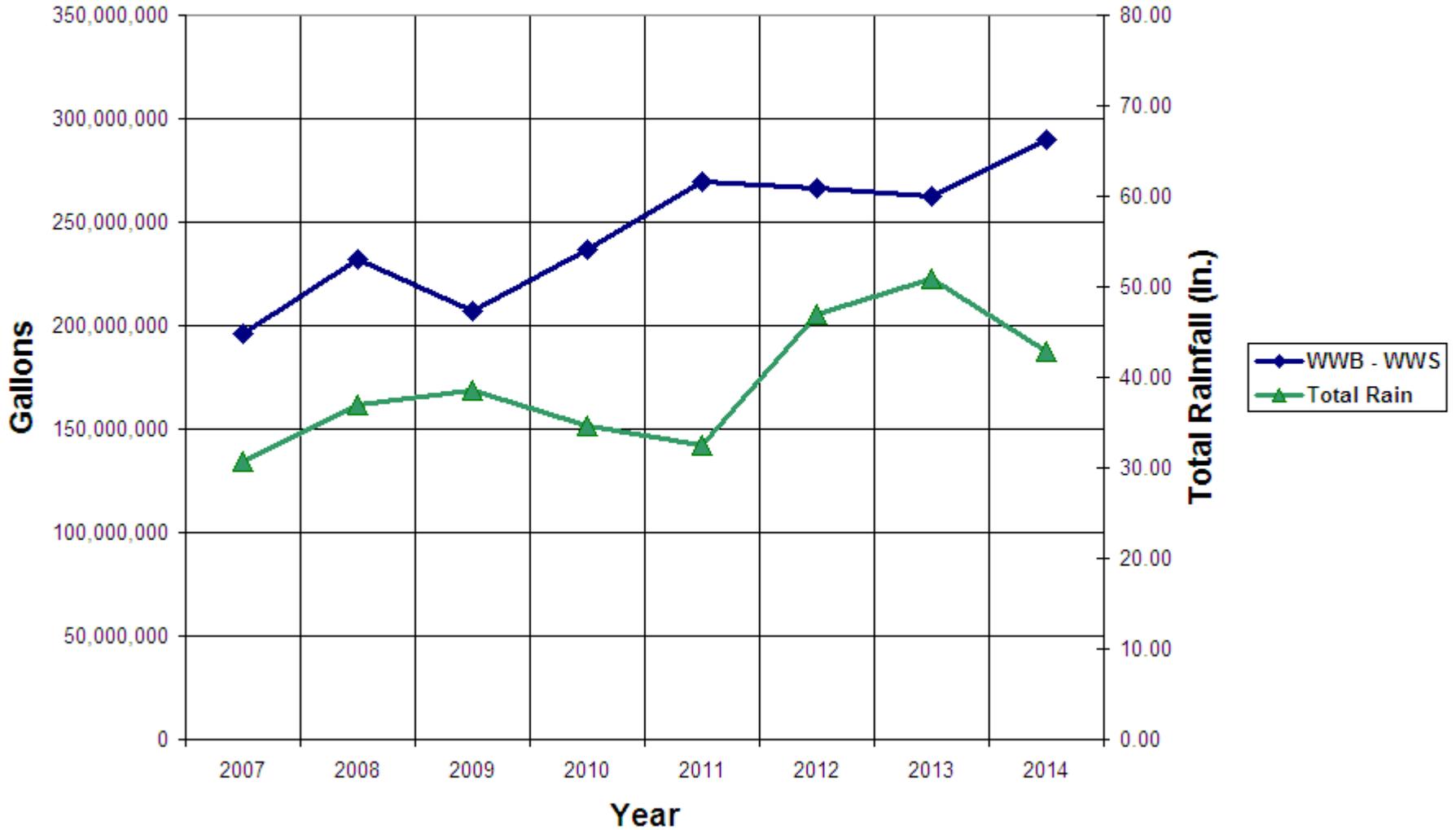
Infiltration increases the salinity of Wastewater

# Wastewater Flow & Sp. Conductivity (Salinity)

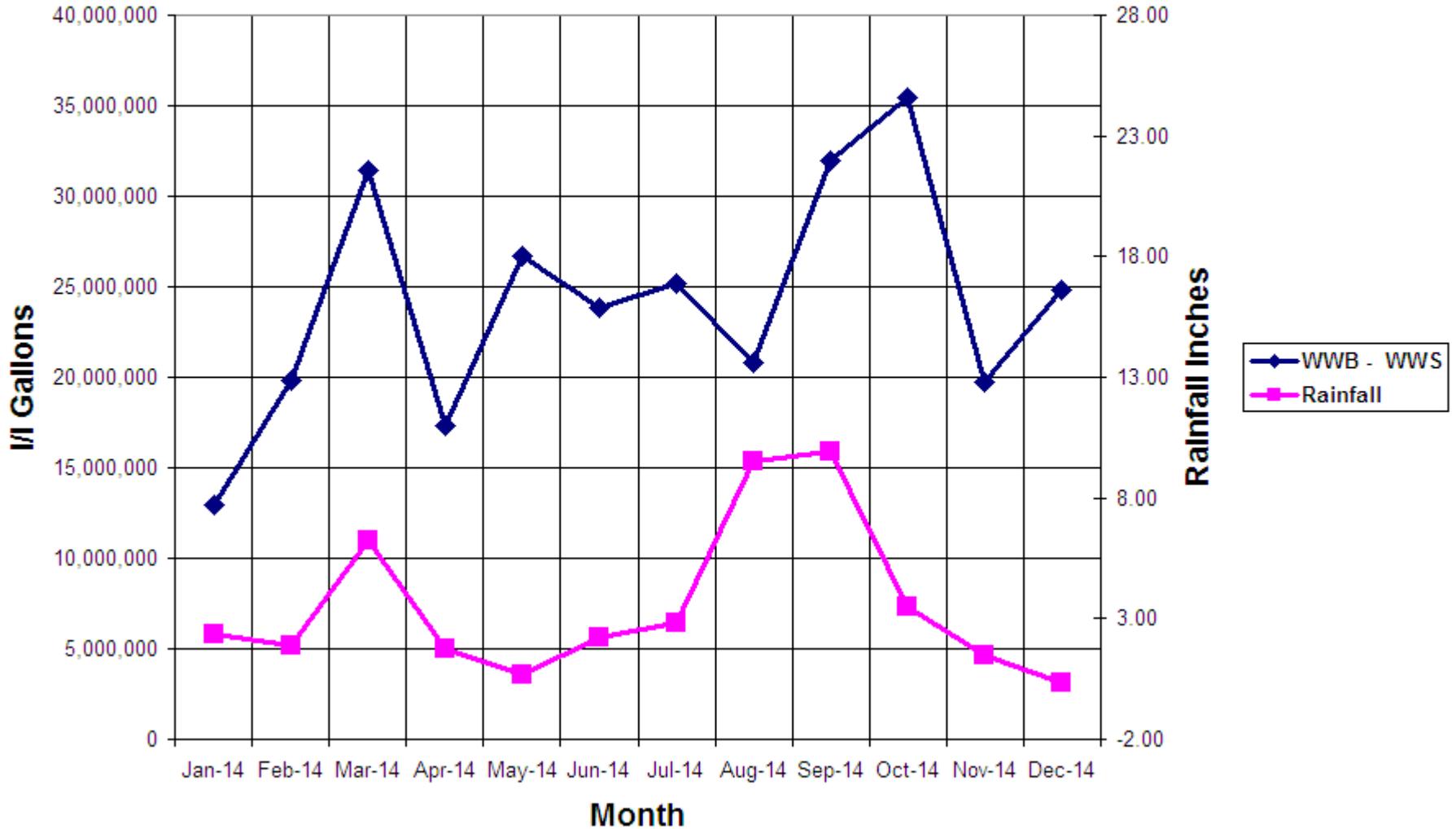
(October 9,11, & 12 2014 Average Instantaneous...No Rain)



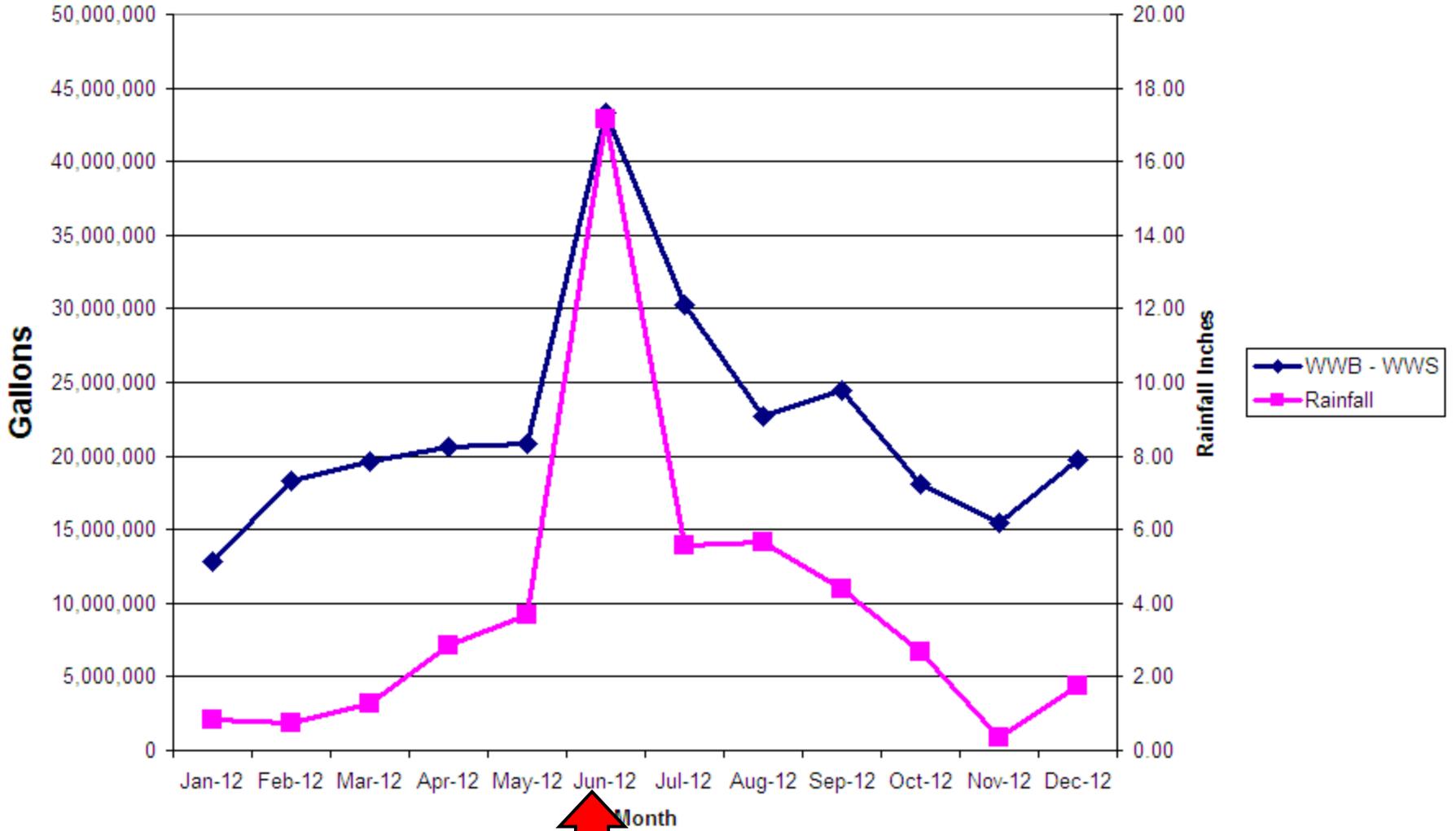
# Annual i/i & Rainfall Summary



# Monthly 2014 i/i & Rainfall



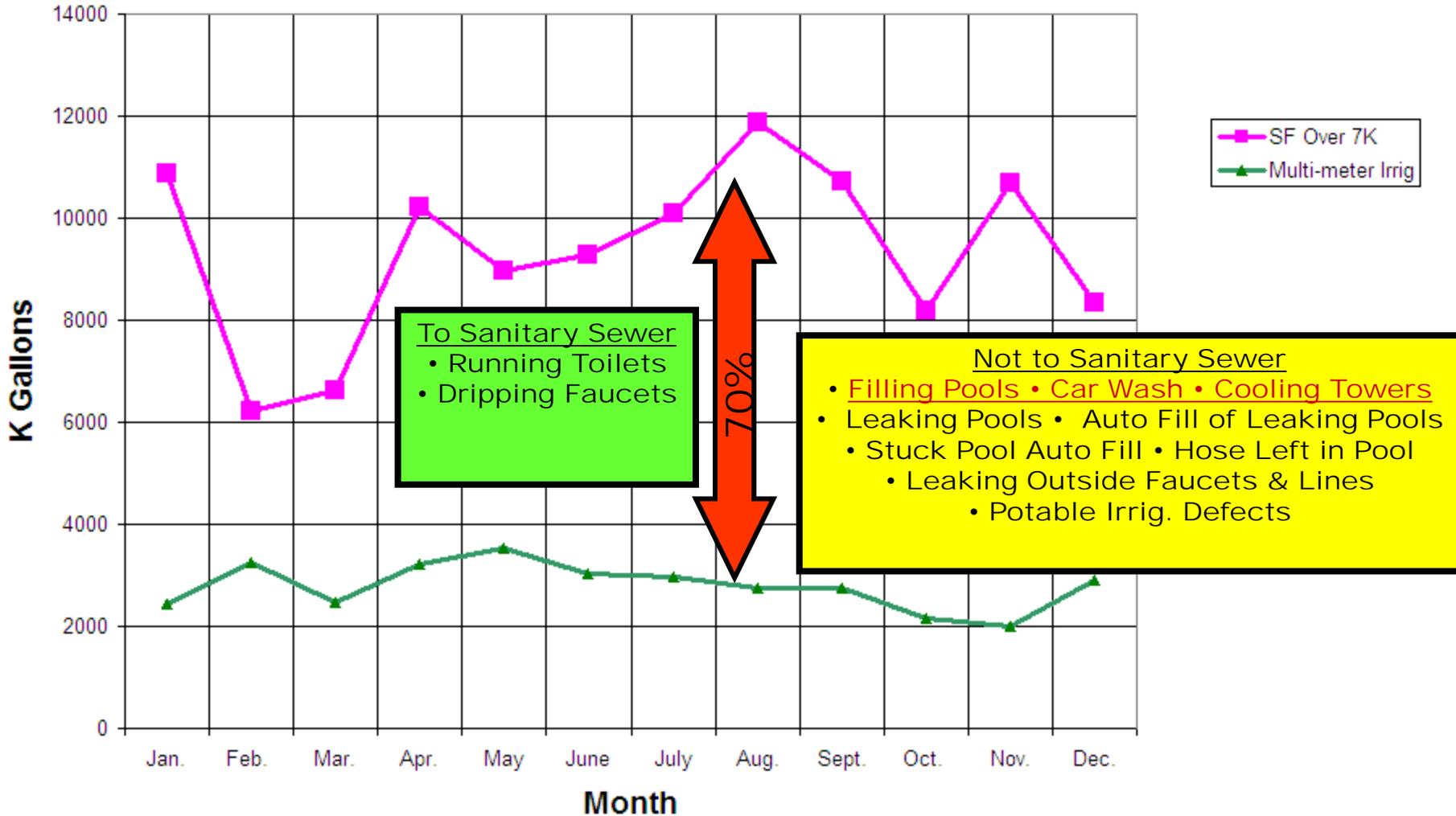
# 2012 i/i and Rainfall



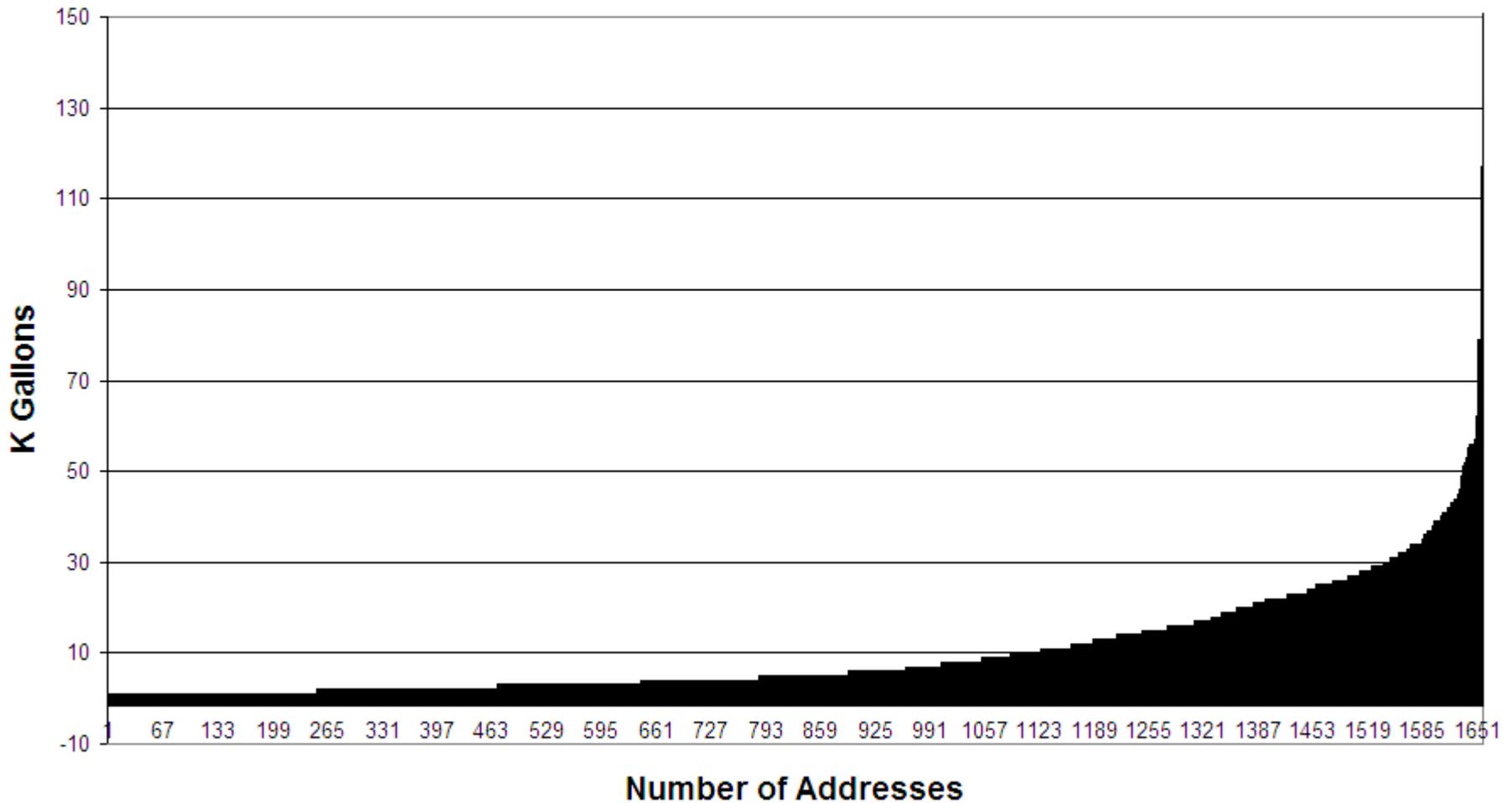
**Hurricane Debby**



## 2014 Over 7000 Gal. & Multi-meter Est. Irrigation



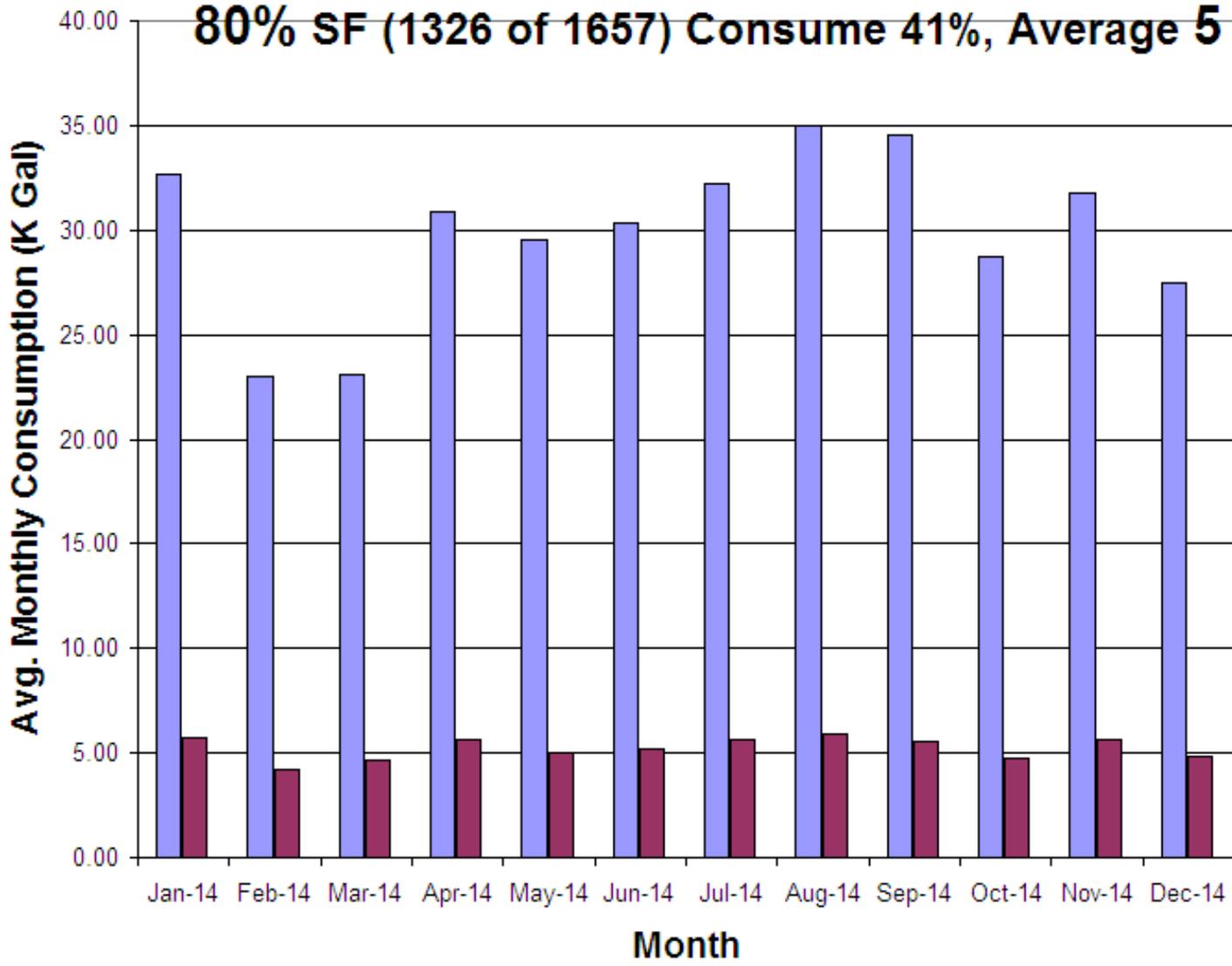
# June 2014 SF Water Consumption by Address (Month = Avg.)



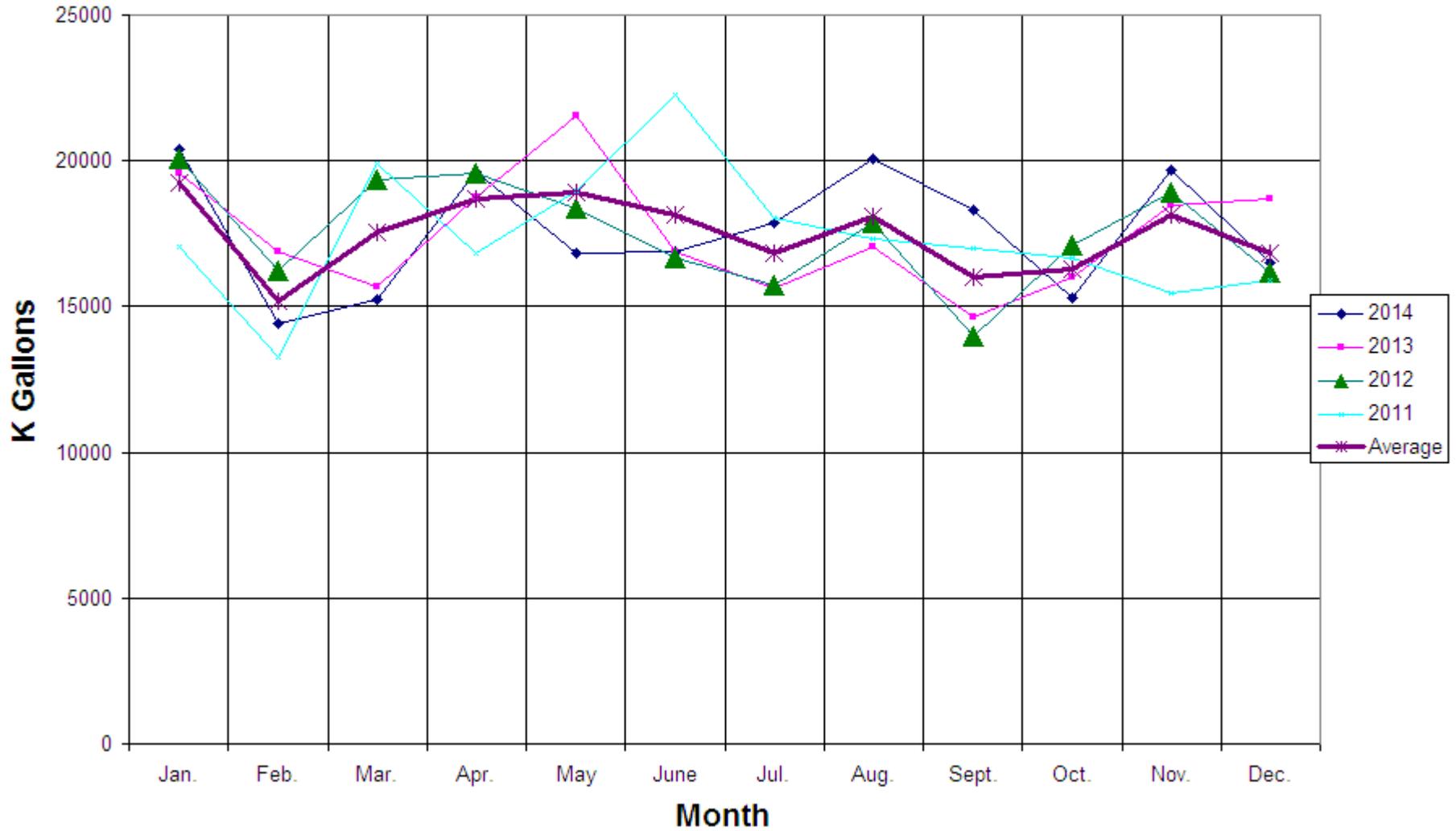
# 2014 Single Family Average Monthly Consumption

**20% (331 of 1657) Consume 59%, Avg. 30 KGal/Mo**

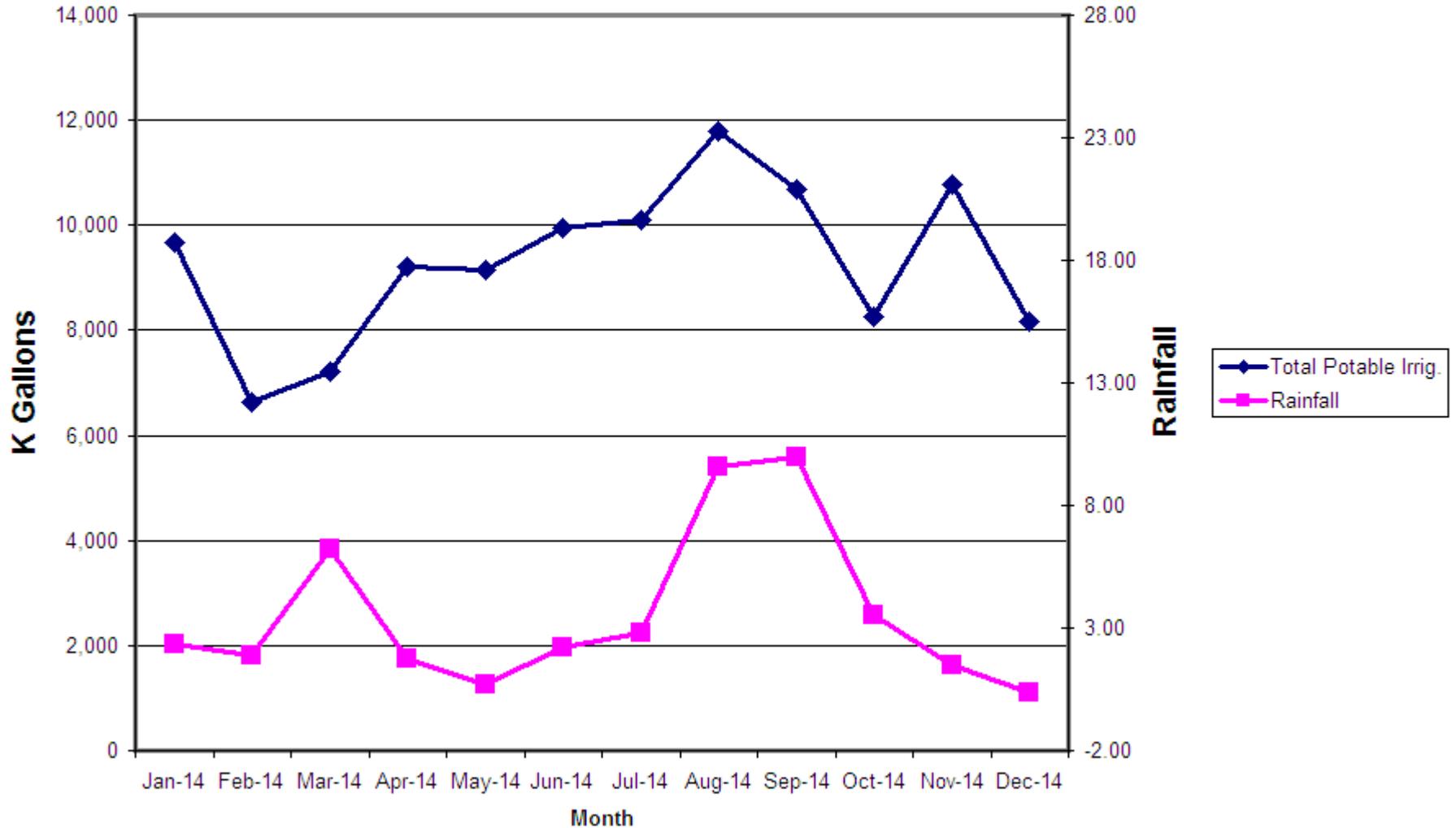
**80% SF (1326 of 1657) Consume 41%, Average 5 KGal./Mo.**



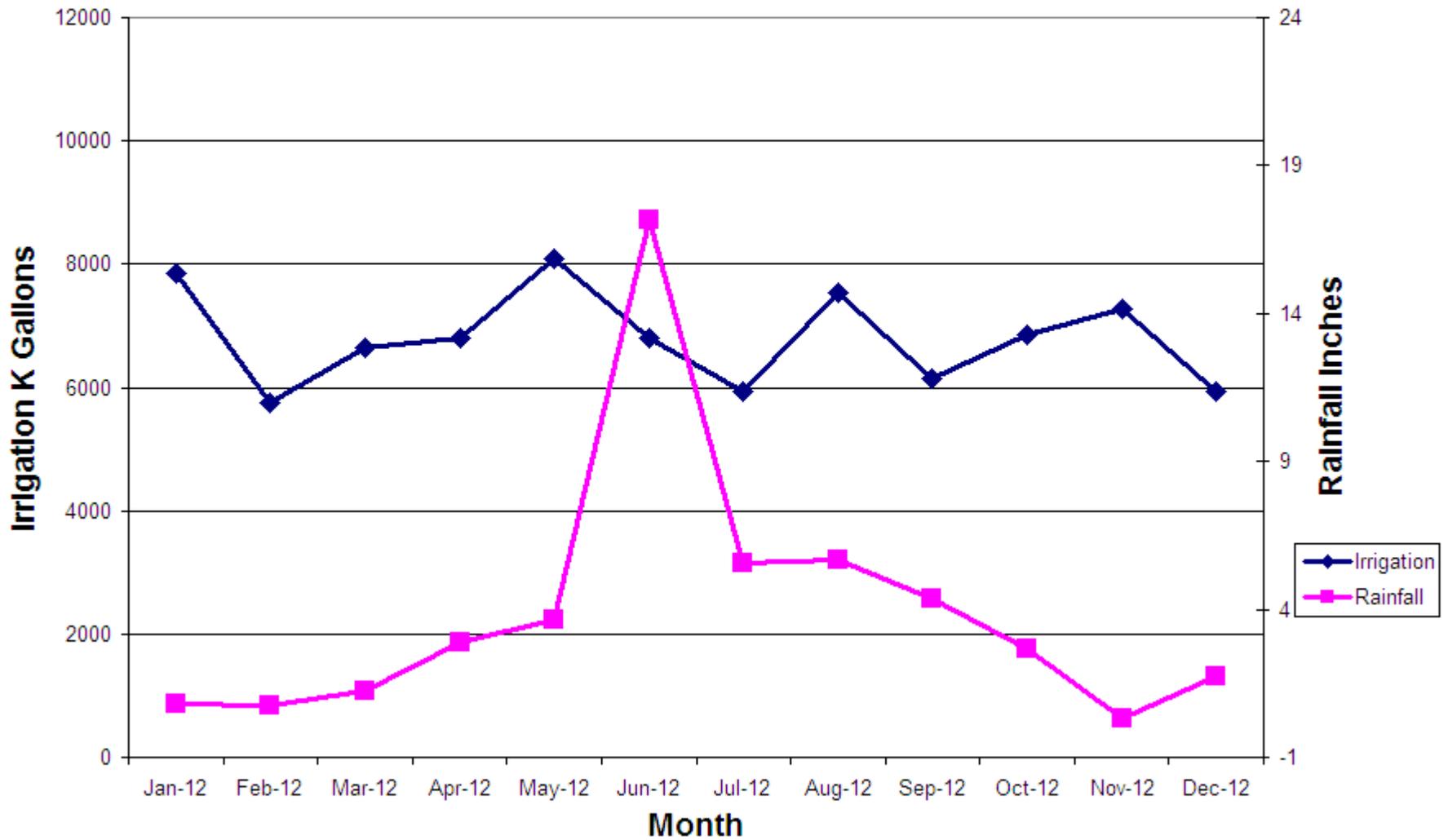
## 2011 thru 2014 Total Monthly SF Consumption



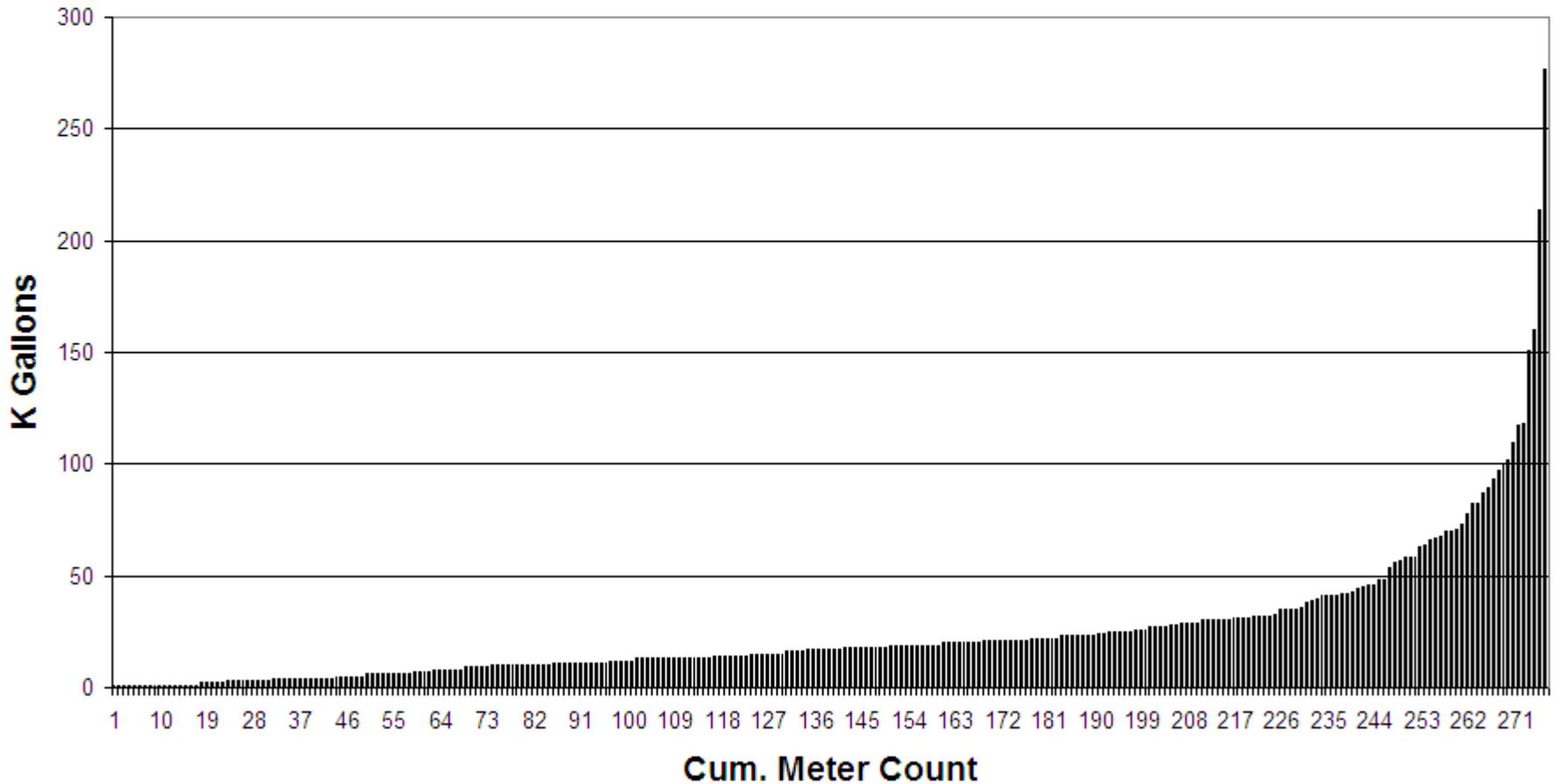
## 2014 Irrigation & Rainfall



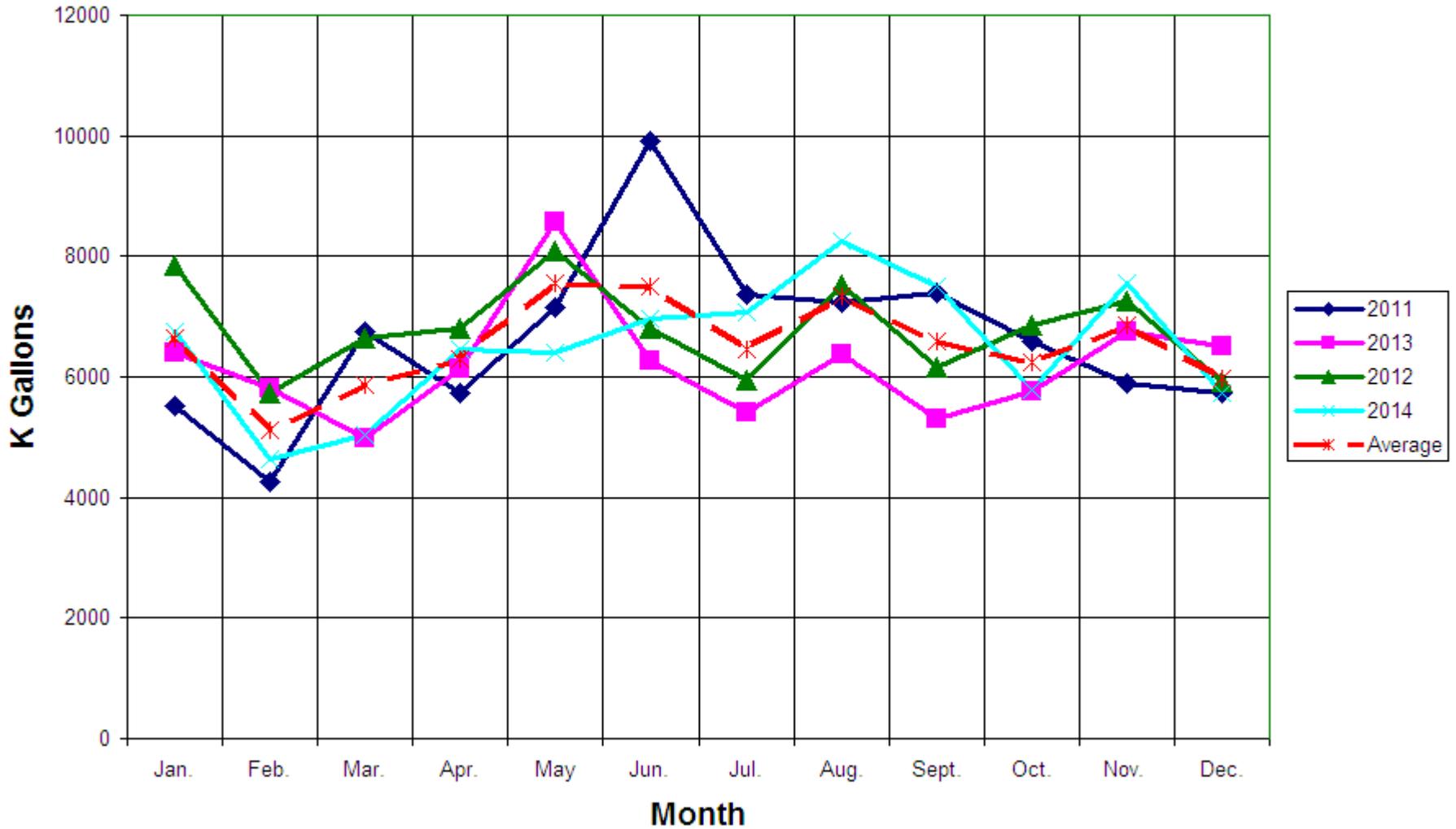
## 2012 Irrigation Meters & Rainfall



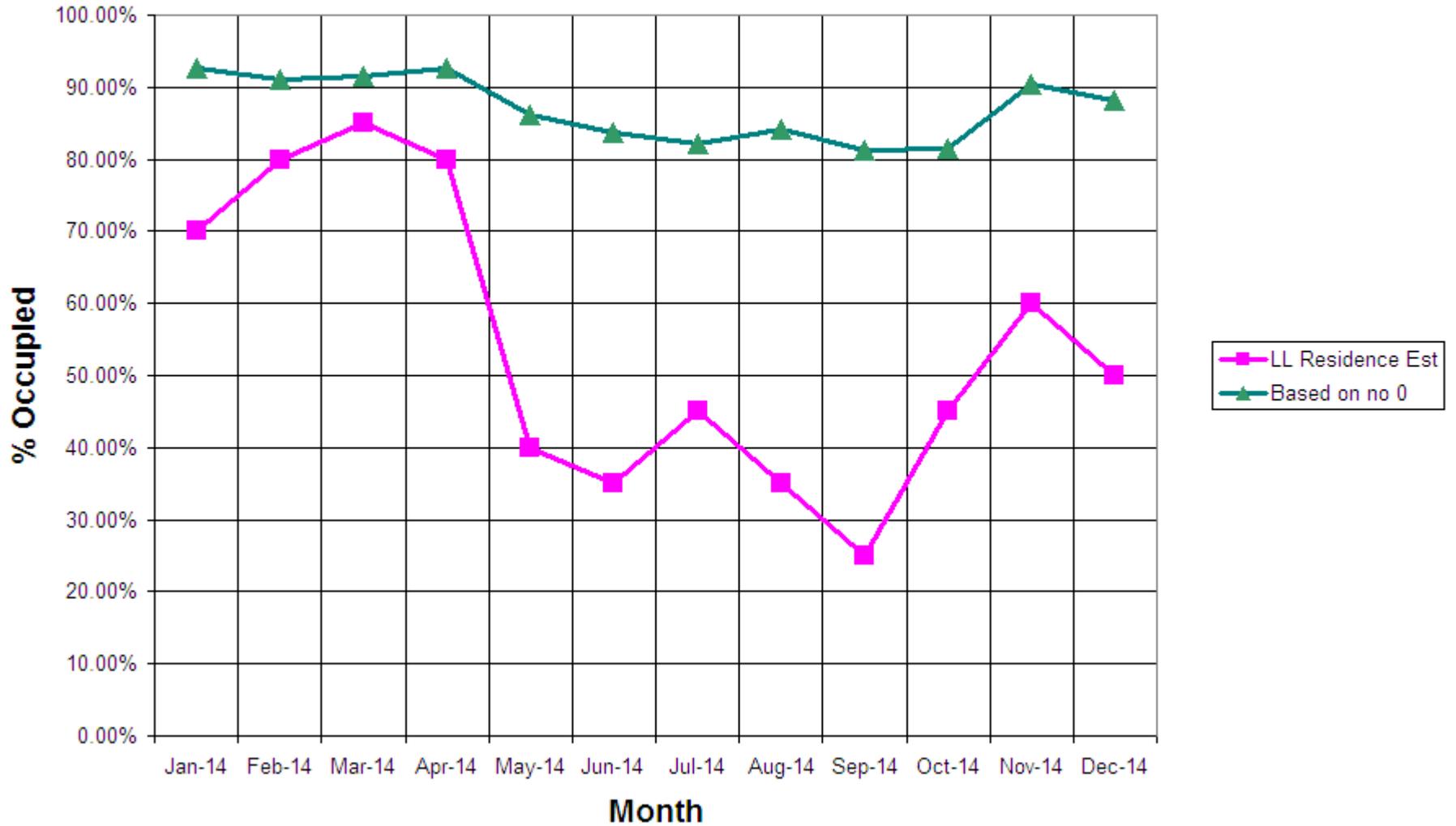
**June 2014 Irrigation Meters by Count**  
**20% (55 of 277) Use 56%, Avg. 70 KGal./Mo.**  
**80% (222 of 277) Use 44%, Avg. 14 KGal./Mo.**



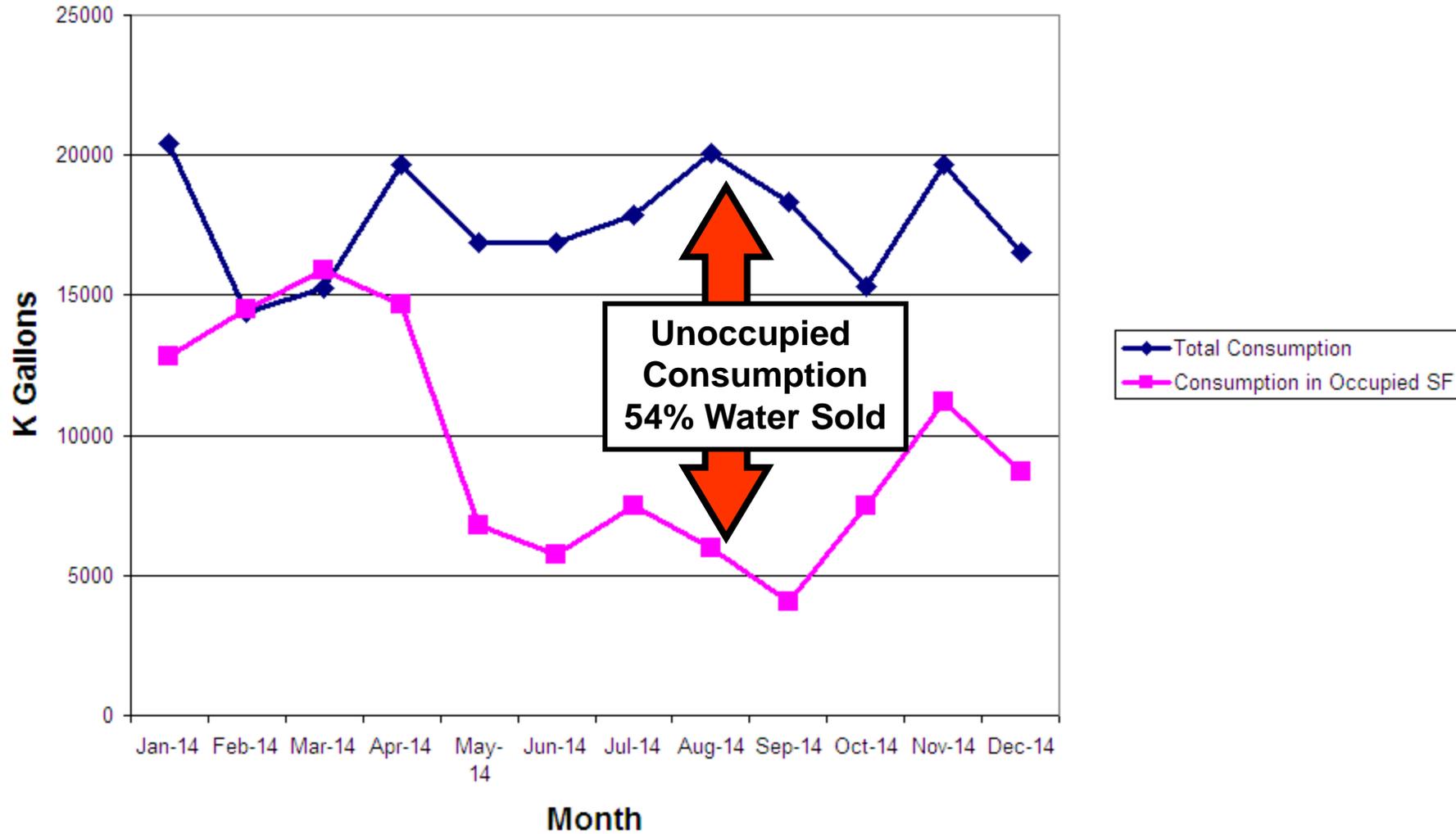
## 2011 - 2014 Monthly Irrigation Meters



## SF Occupancy Comparison

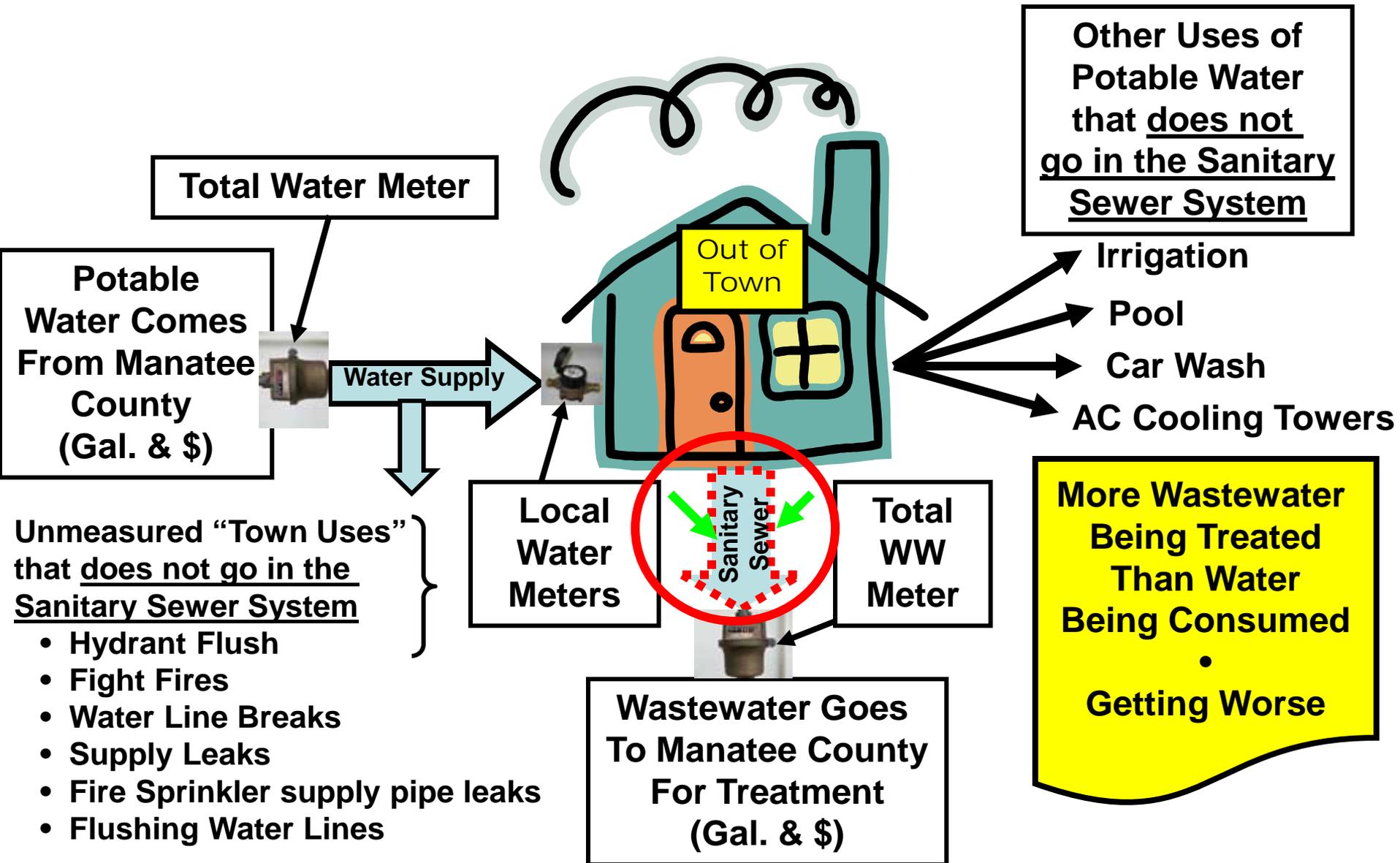


## Total & Occupied and Total SF Consumption



# Water & Sewer System Overview

## 2015 Update



# Summary

- **Water**

- **Consumption trend is Down!**
- **Town Use/Losses under 6%...very good...System is working very well!**
- **However:**
  - **Consumption in Un-occupied homes is out of control and a huge opportunity to conserve water and customer cost.**
  - **Irrigation use of Potable water appears to be on automatic...Another opportunity to save water with no impact on vegetation.**

- **Sewer**

- **Infiltration approaching 50%...System Deteriorating!**
- **Difference between WW Bought & WW Sold is a close approximation of i/i**
- **Elevated Chloride levels during low water consumption period confirms salt water infiltration is the infiltration source**
- **NO clear infiltration benefit seen from Slip lining, or the system is deteriorating faster than improvements... spent \$6 - \$7M since 2001**
- **Heavy concentrated RAIN (event) drives inflow, however, it is limited, and has a small overall impact compared to infiltration.**
- **Appears that “some” of the water consumed over 7000 Gallons goes into the Sanitary Sewer System.**

# If it was up to me:

## Water:

- Stay Vigilant...Maintain water awareness
- Implement Water Conservation Programs
  - Address Potable Water "WASTE"
    - Household: Occupied & Unoccupied
    - Irrigation based on "need"
  - Develop automated systems to identify LEAKS & Notify "Owners"... Toilets & Pools Biggest Problems

IF A HOUSING UNIT USES MORE THAN  
"5000" GALLONS/MO., SOMETHING IS WRONG!



## Wastewater:

- Stop slip lining!
- Focus on evaluating the Wastewater system (define the problem)
- Identify major infiltration locations/causes
- Develop a plan to reduce/eliminate



**The End**

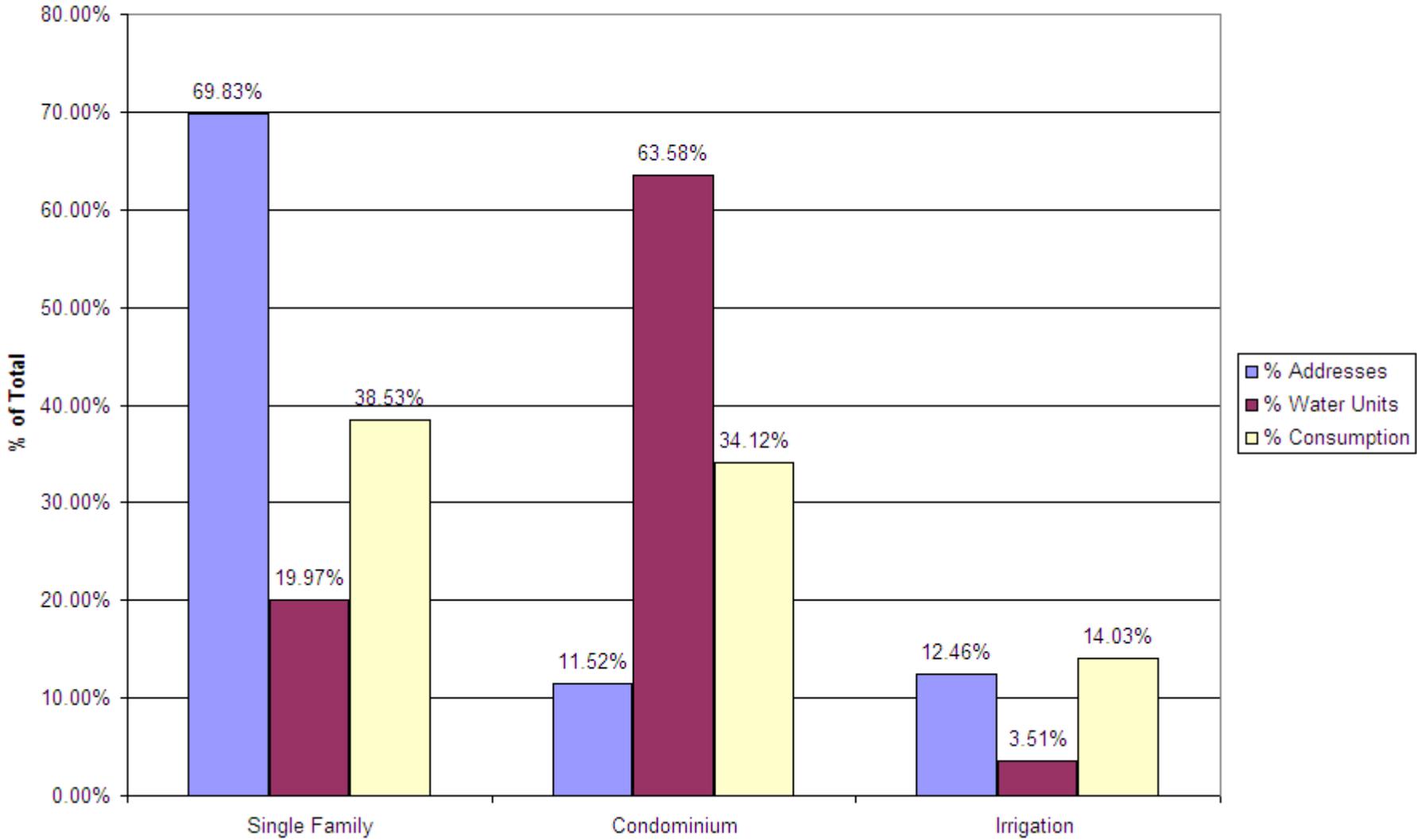


# Data References

- **Total Water & Wastewater Bought & Sold/Month**
- **Water by Address/Meter /Month**
- **Water & Wastewater Usage by hour**
- **Rain, North, Mid, South /day**
- **Manatee County Water and Sewer Billing Rates**
- **LBK Water & Sewer Billing Rates**
- **February 2002 CDM LBK Irrigation Water Supply Options Evaluation.**

Turning Data Into Information

### Single Family, Condo, & Irrig %



# Potable Water Uses

## “INTENDED” USES

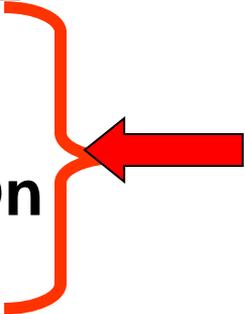
- Sink & Shower
- Clothes Washer
- Dish Washer
- Toilets
- Irrigation
- Pool
- Hose Uses
- Cooling Tower
- Water Features
- Etc....

## “UNINTENDED” USES

### Impacts Wastewater

- Running Toilets 
- Dripping/Leaking Faucets:
  - Sinks, Showers, etc.

### Does not Impact Wastewater

- Manual & Automatic Filling of Leaky Pools
  - Automatic Pool Fill Stuck On
  - Hose Left on in pool
  - Leaking outside faucet or lines
  - Defects in Potable Water Irrigation
- 

## “LOST” WATER

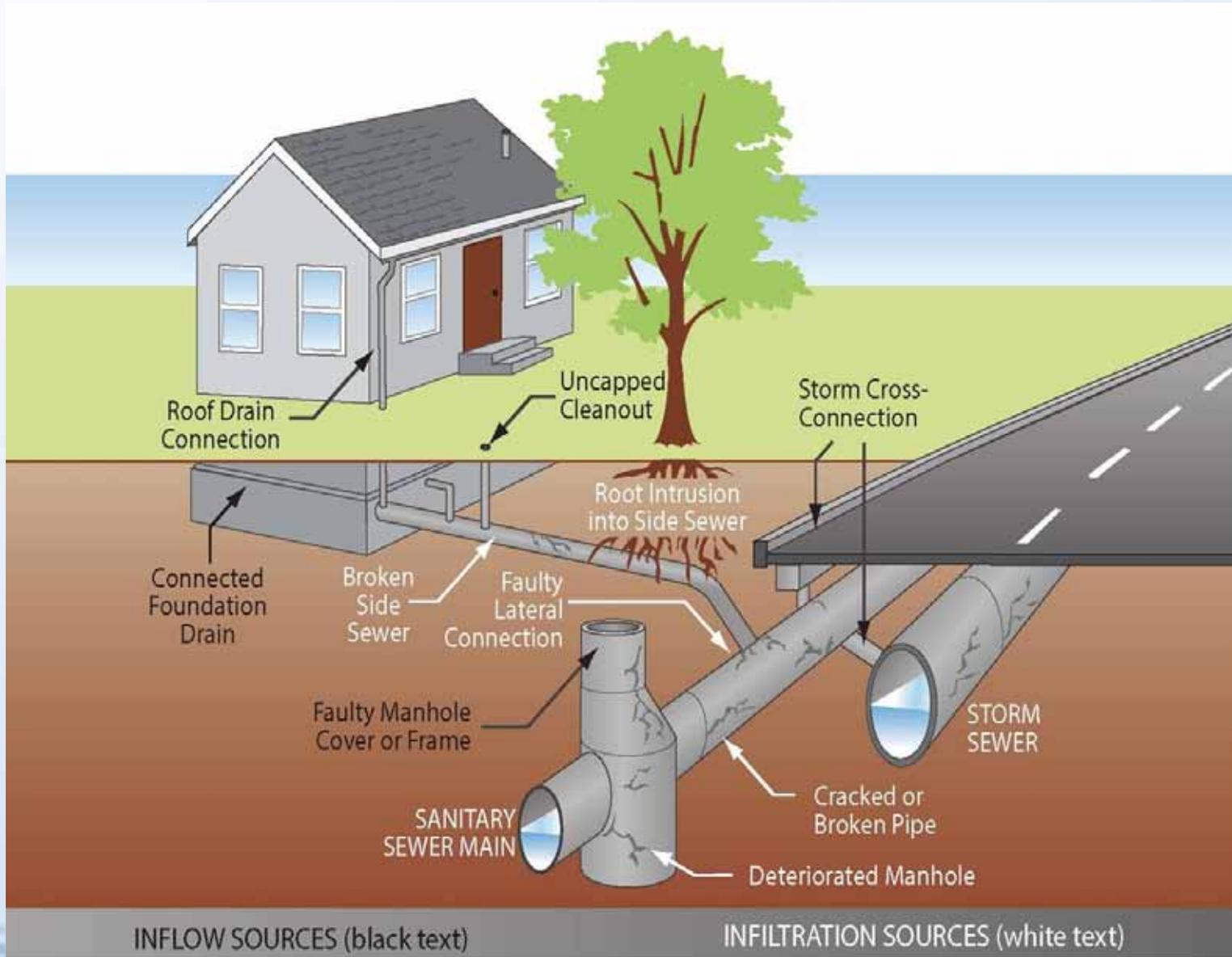
# Inflow & Infiltration Study and Rehabilitation Pilot Study



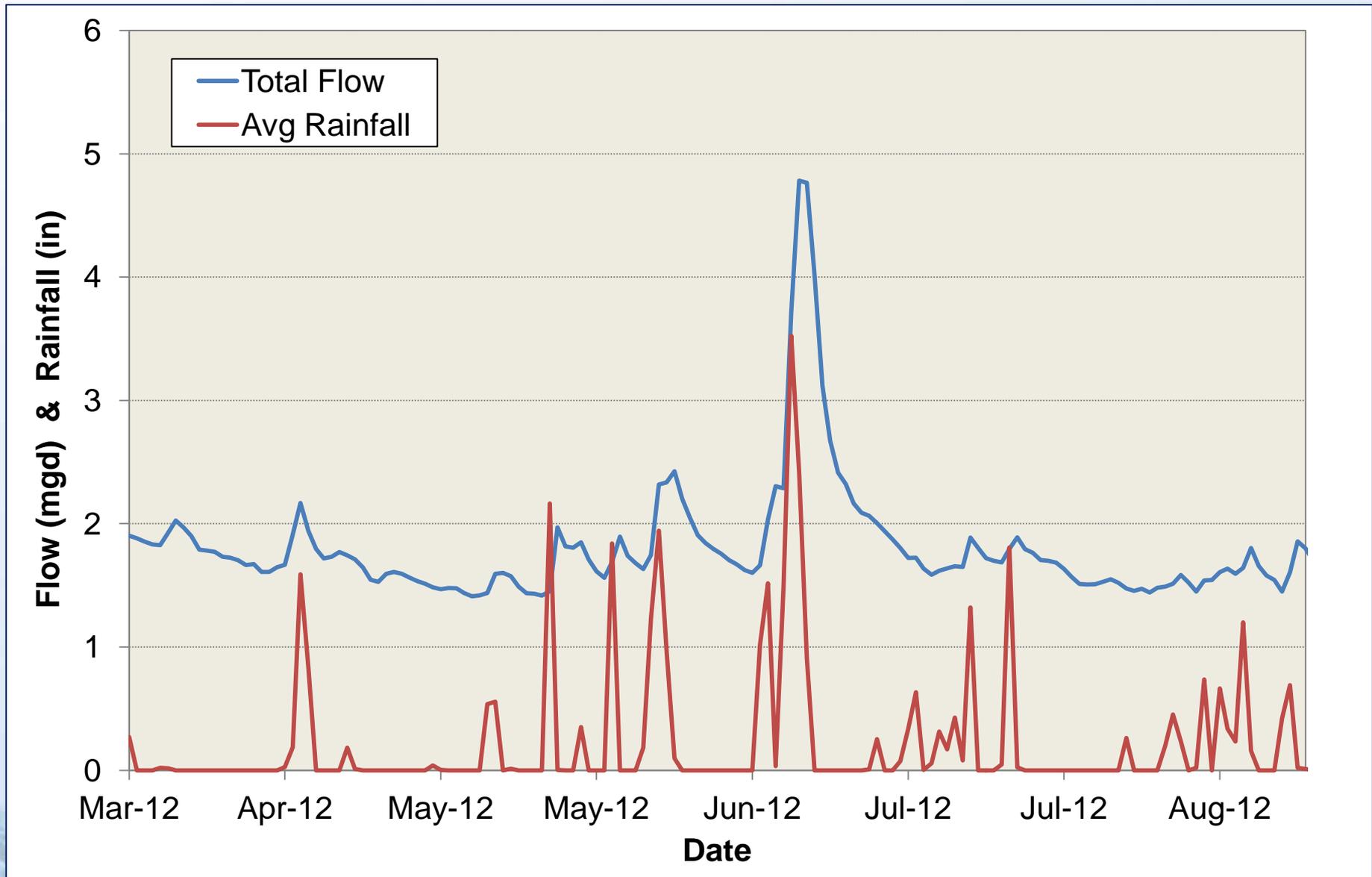
Town Commission Regular Workshop

March 23, 2015

# What is Infiltration and Inflow (I&I)?



# Inflow occurs during rainfall events



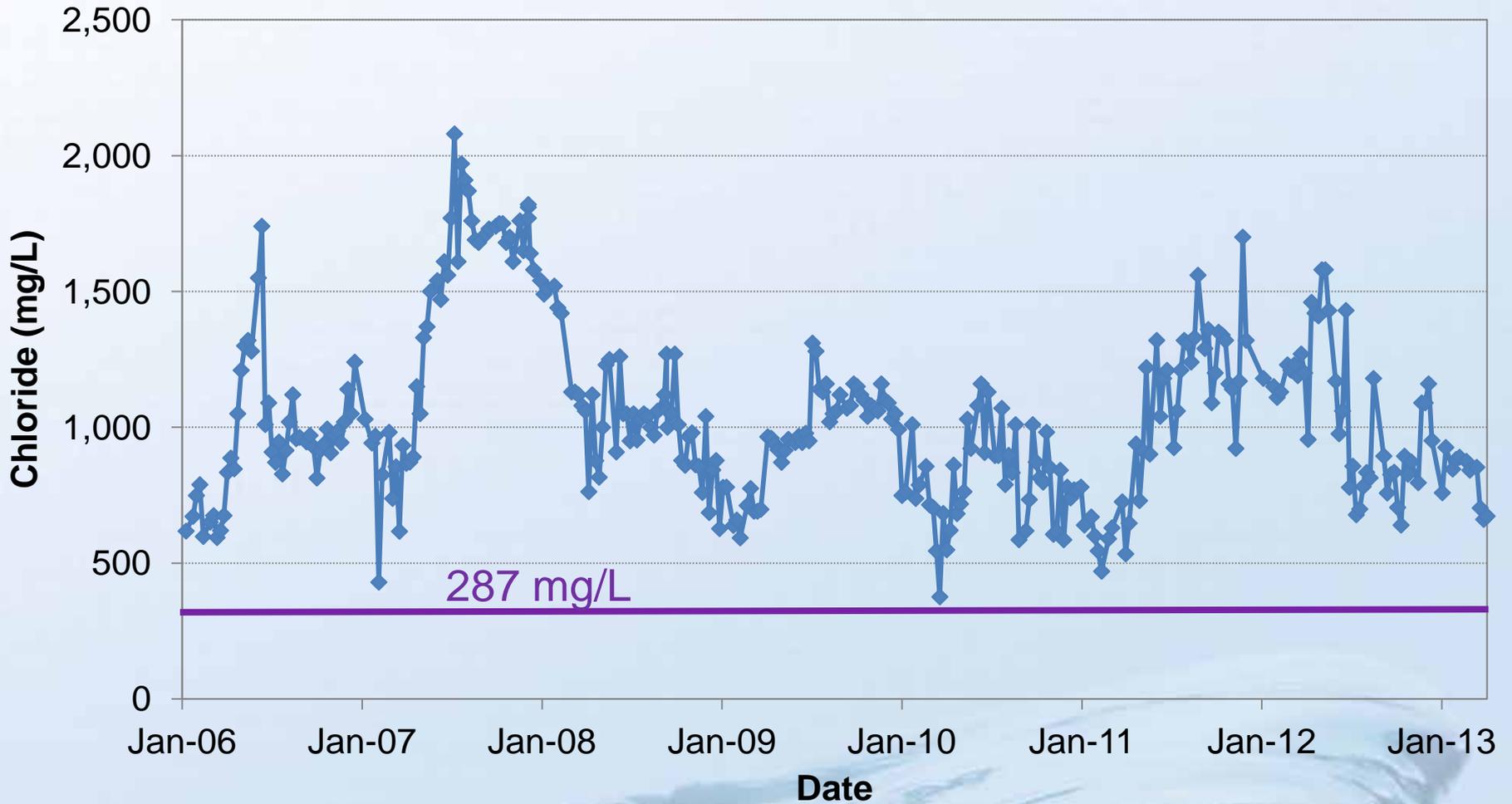
# Typical Extreme Flow Peaking Factors



# Why is I&I a Problem for Longboat Key?

1. Treatment fees are paid to Manatee County to treat this excess water
2. Manatee County Sewer Use Ordinance requires chloride concentration of less than 287 mg/L

# Historical Wastewater Chloride Concentration



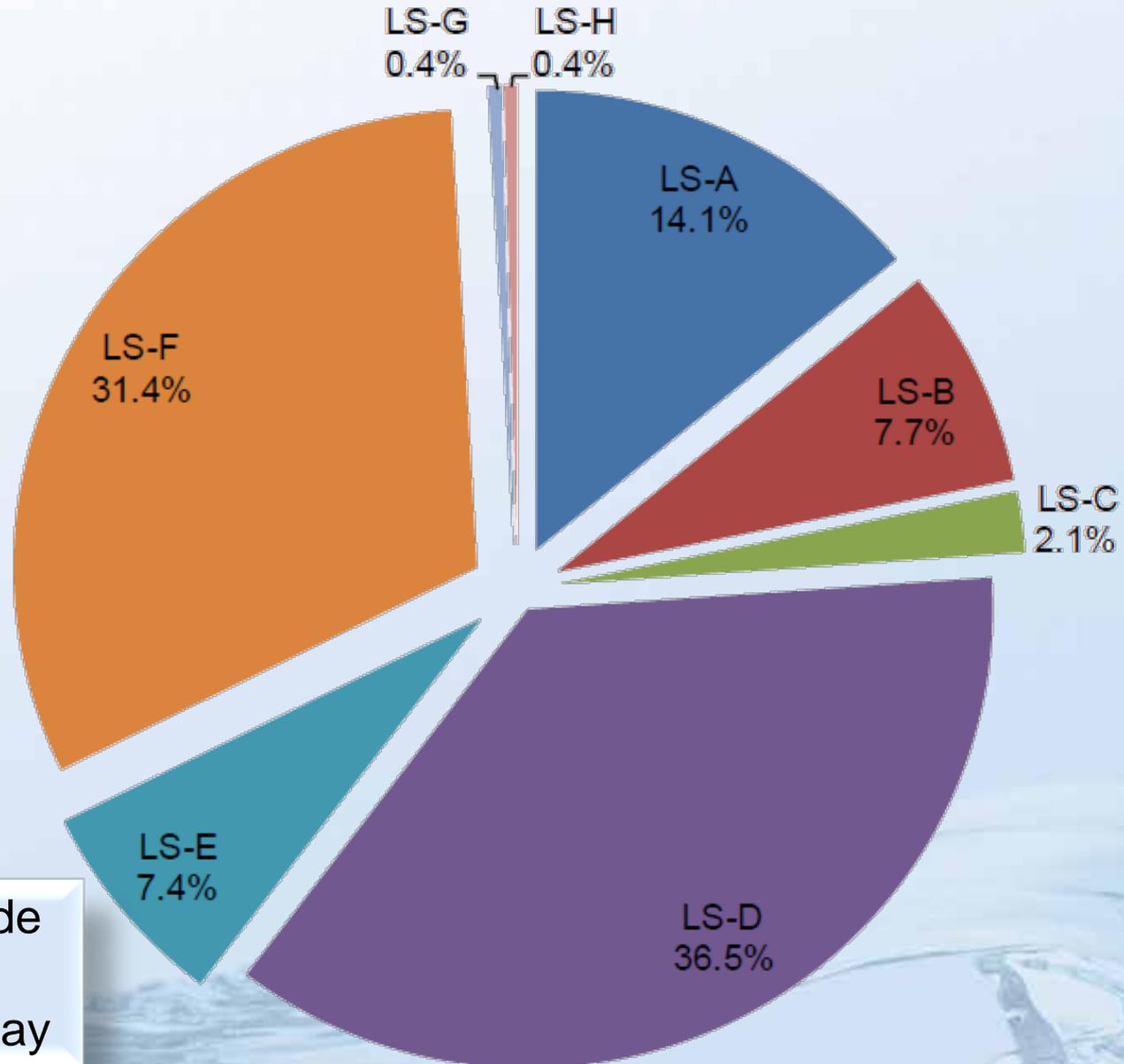
# Town's Historical Rehabilitation Projects

Year	Lined Pipe (LF)	Laterals (No.)	Manholes (No.)	Project Cost (\$)
2002	9,120	96	18	\$682,706
2003	5,485	108	16	\$683,019
2005	928	16	2	\$70,472
2006	5,668	116	15	\$656,475
2007	5,010	68	18	\$357,448
2008	6,668	101	21	\$570,726
2009	15,622	221	51	\$1,166,998
2011	4,976	73	96	\$456,911
<b>TOTAL</b>	<b>53,477</b>	<b>799</b>	<b>237</b>	<b>\$4,644,755</b>

# Collection System I&I Study

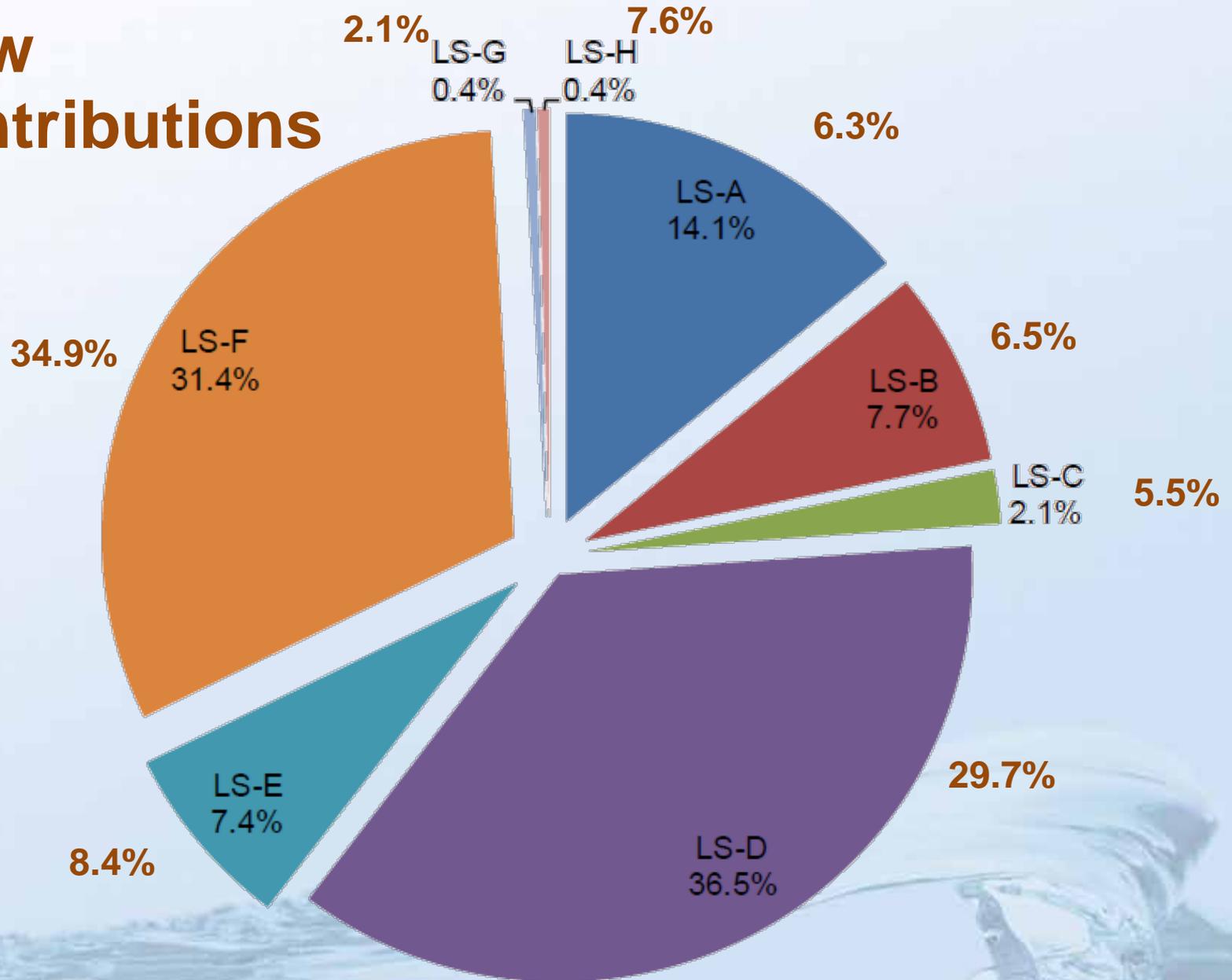
- I&I Study completed in 2012-2013
- Systematic approach to evaluating chloride concentrations and flow data to pinpoint areas with highest amount of I&I
  - Chloride “mapping”
  - Wastewater flow volumes during dry and wet periods
- Prioritized recommendations for sewer pipe rehabilitation and repairs
- Procurement of rehabilitation contractors in Fall 2013
  - Newer technologies

# Sewer Basin Chloride Contributions

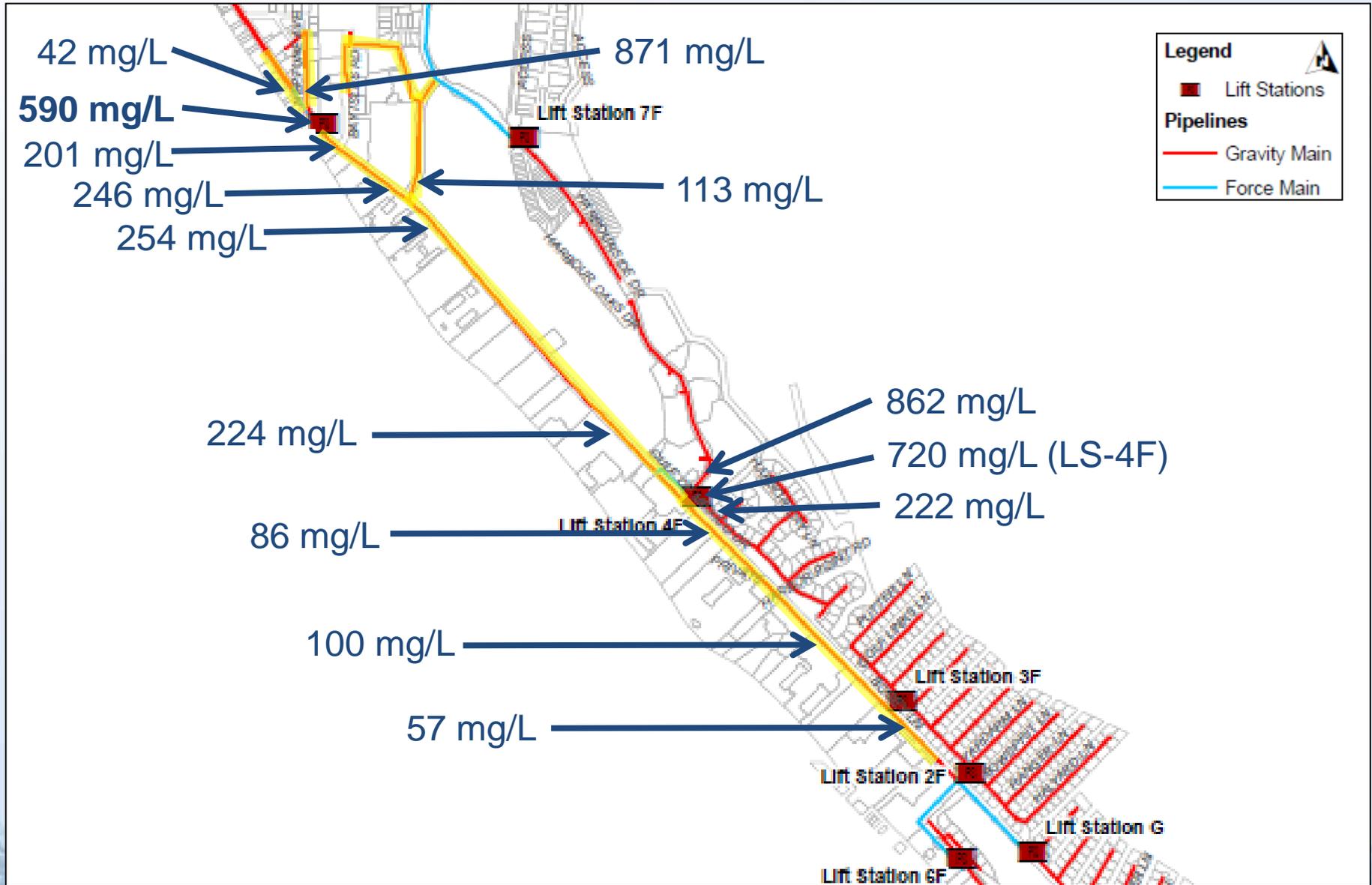


Total Chloride  
Mass =  
15,610 lbs/day

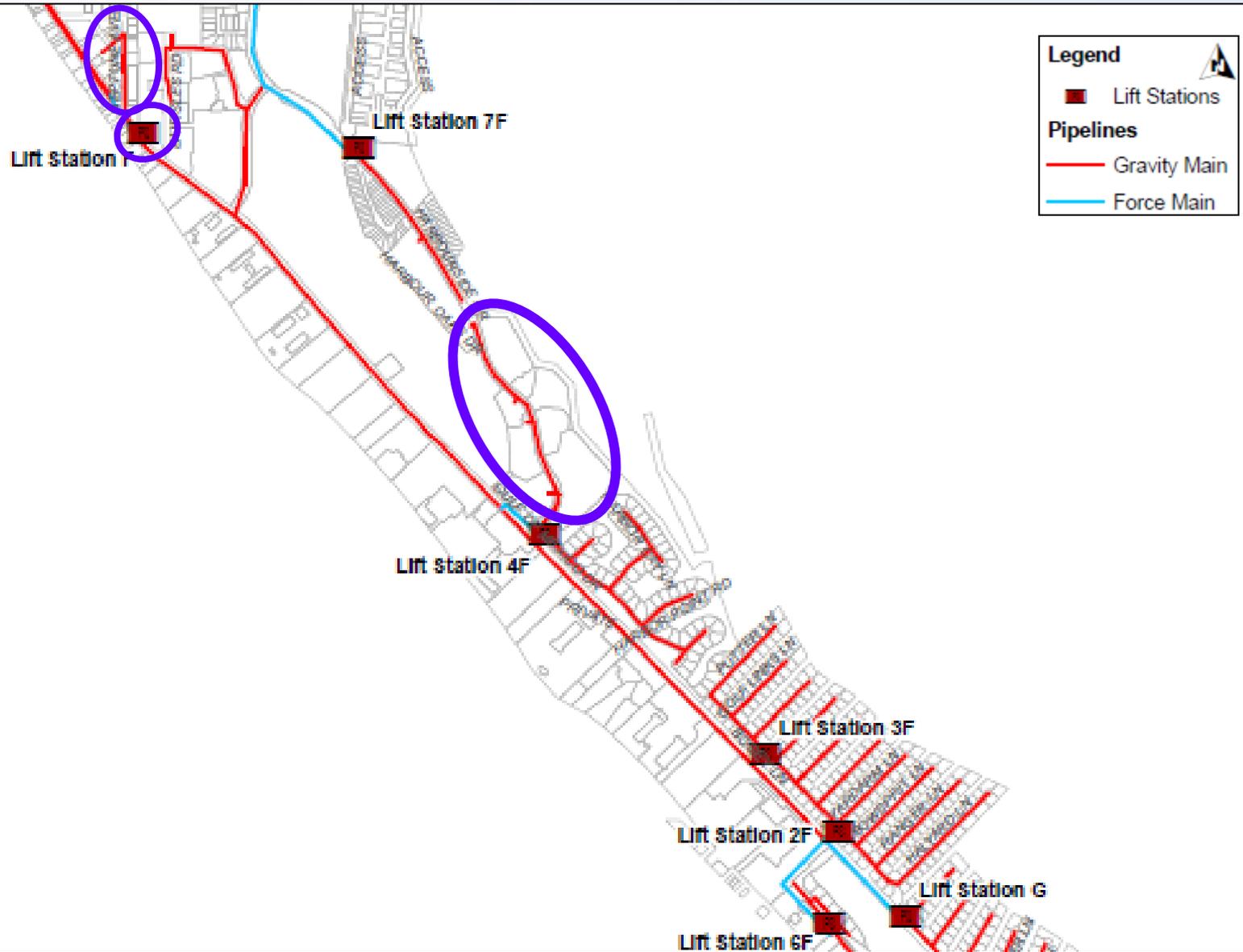
# Sewer Basin Chloride Contributions and Flow Contributions



# Lift Station F Chloride Concentration Map

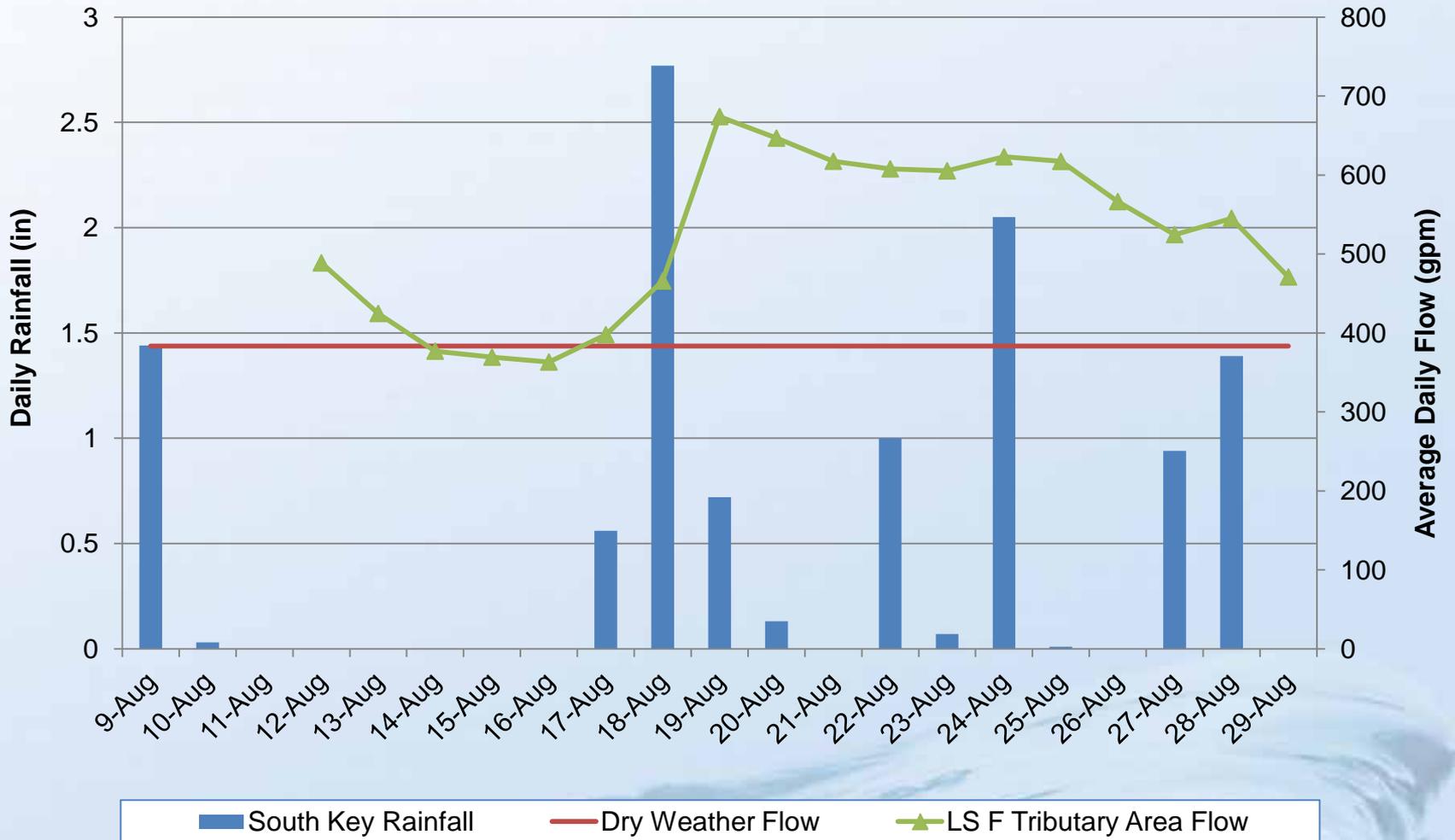


# Lift Station F – High Infiltration Areas



# Daily Rainfall and Lift Station F Flow

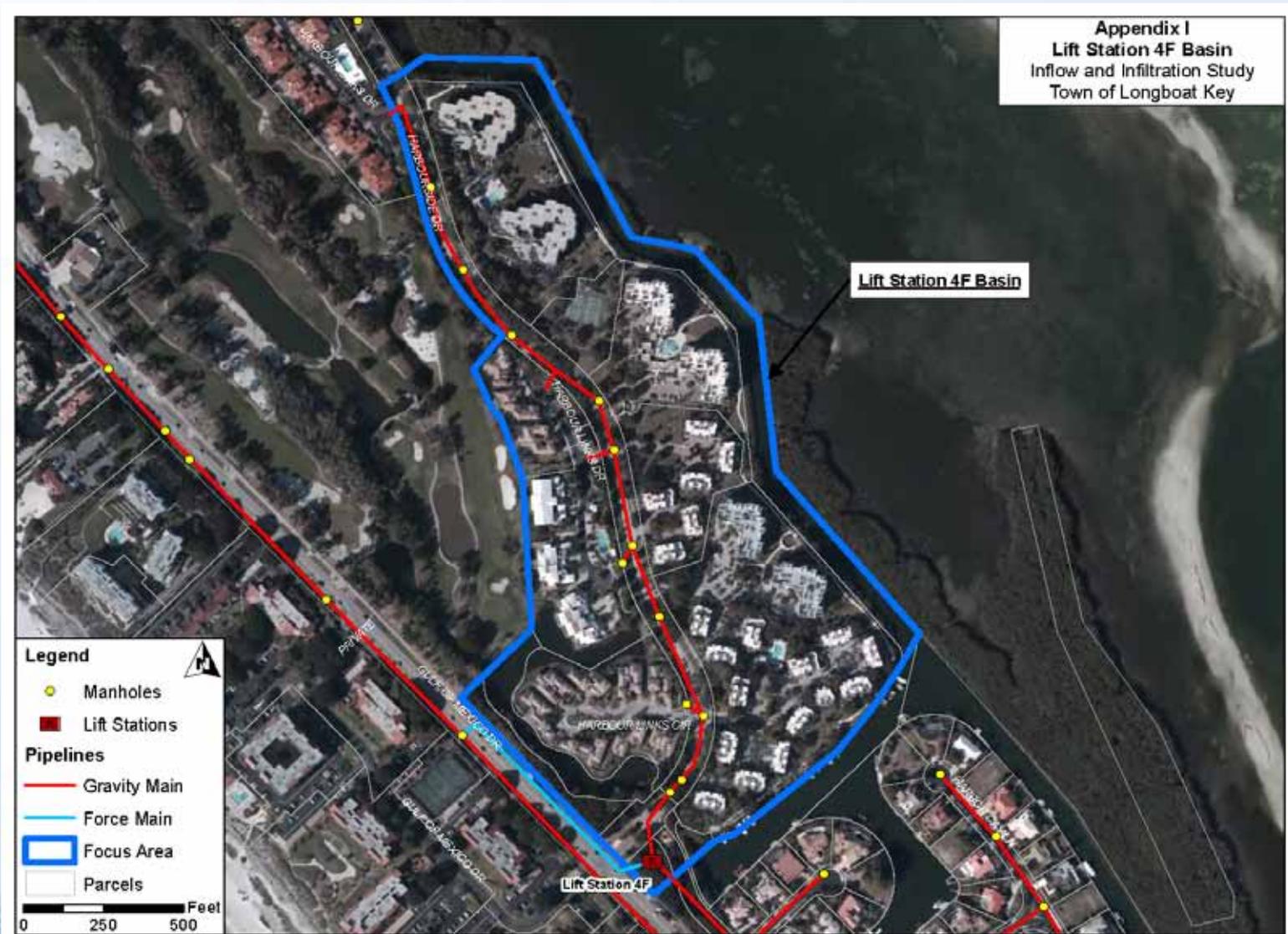
Lift Station F Tributary Area Hydrograph  
(Using flow measured at MH E-10)



# I&I Corrective Action Plan

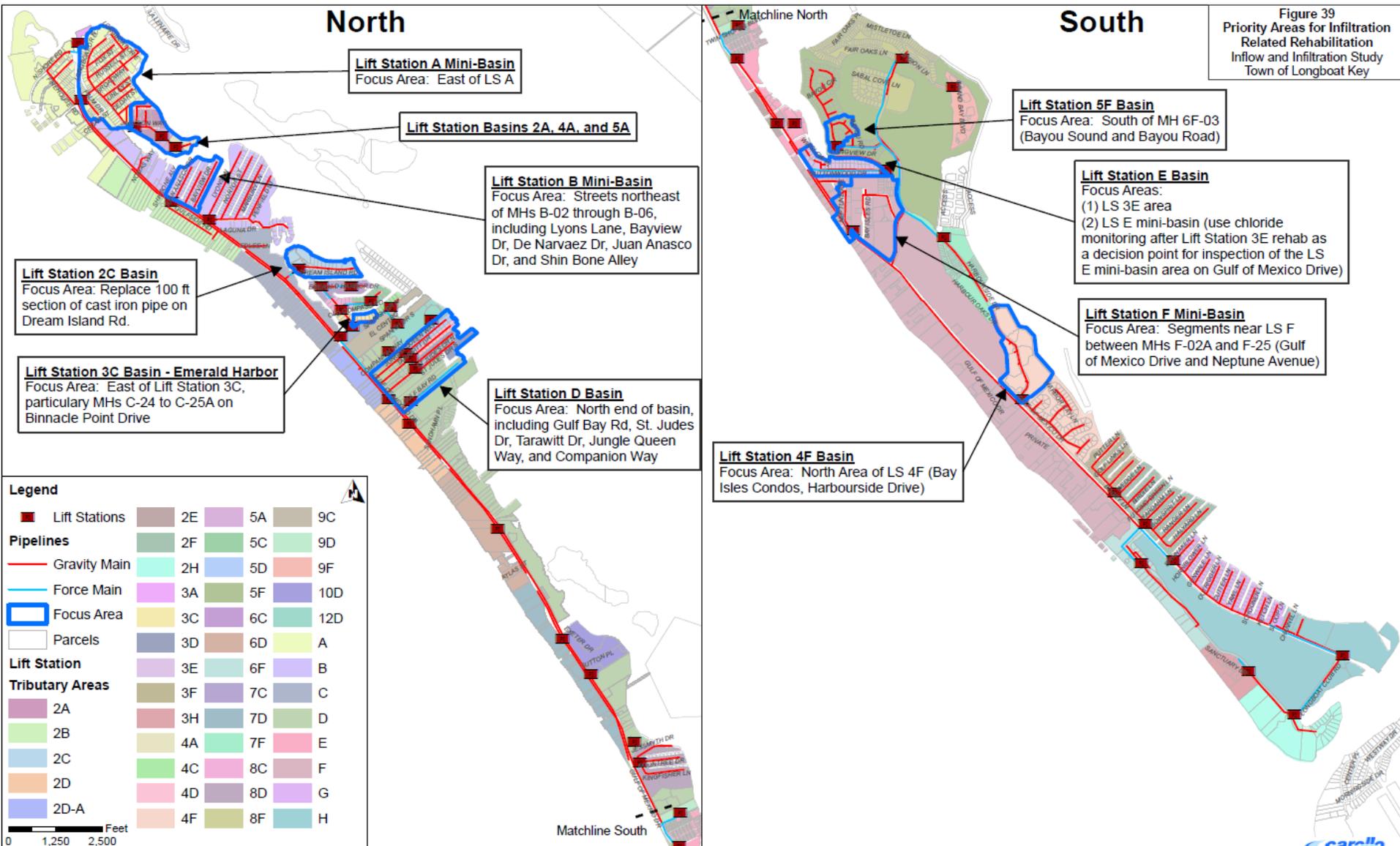
- Annual Budget:
  - Slipline Gravity Sewer and Services: \$600K
  - Wetwell and Manhole Repair: \$75K
- Basin rehabilitation prioritized based on infiltration (chloride mass) and inflow.
- Focus areas for infiltration repairs selected using chloride mapping

# I&I Study Report Identifies Target Areas for Chloride Reduction



# Priority Areas for Infiltration Related Rehabilitation

Figure 39  
Priority Areas for Infiltration  
Related Rehabilitation  
Inflow and Infiltration Study  
Town of Longboat Key



# I&I Corrective Action Plan

Priority	Basin	Scope for Infiltration Repairs	Scope for Inflow Repairs	Estimated Cost	Schedule
1	LS F Mini-Basin	Between MH F-02A and F-25 (Gulf of Mexico Drive and Neptune Ave)	All of LS F Mini-Basin	\$613,000	Year 1
2	LS D Basin	Gulf Bay Rd, St. Judes Dr, Tarawitt Dr, Jungle Queen Way, and Companion Way	LS D Mini-Basin, LS 2D and 2D-A, LS 6D, LS 7D	\$1,867,000	Year 1 - 4
3	LS A Mini-Basin	Area east of LS A	NA	\$1,402,000	Year 4 - 6
4	LS 2C Basin	Entire LS 2C basin	NA	\$247,000	Year 6-7

# I&I Corrective Action Plan

Priority	Basin	Scope for Infiltration Repairs	Scope for Inflow Repairs	Estimated Cost	Schedule
5	LS 4F Basin	North area of LS 4F (Bay Isles Condos, Harbourside Drive)	NA	\$807,000	Year 7 - 8
6	LS E Basin	Winslow Place	LS E Mini-Basin	\$573,000	Year 8 - 9
7	LS B Mini-Basin	Lyons Lane, Bayview Dr, De Narvaez Dr, Juan Anasco Dr, and Shin Bone Alley	All of Lift Station B Mini-Basin	\$781,000	Year 9 - 10
8	LS 2A, 4A, and 5A Basins	Inspection and lateral reconstruction of basin areas	NA	\$285,000	Year 10

# I&I Corrective Action Plan

Priority	Basin	Scope for Infiltration Repairs	Scope for Inflow Repairs	Estimated Cost	Schedule
9	LS 3C Basin	LS 3C basin area, Binnacle Point Drive	All of Emerald Harbor (LS 3C Basin)	\$372,000	*Note
10	LS 5F Basin	Area south of Manhole 6F-03 (Bayou Sound and Bayou Road)	NA	\$550,000	
11	LS C Mini-Basin	NA	All of LS C Mini-Basin	\$83,000	
12	LS 10D Basin	NA	Work with private owners to reduce inflow in this area.	\$55,000	

**\*Note:** If actual project costs are less than estimated or available budget increases, accelerate the plan to include additional priority areas as budget allows.

# Three-Step Rehabilitation Process



- Options for rehabilitation are dependent on the condition of the asset and economics of repair
- Each prioritized area will be inspected to determine the appropriate corrective action measures

# Summary of Total Estimated Cost for Rehabilitation over 10 Years

## Infiltration

- Cleaning
- Inspection
- CIPP lining of mainlines
- Lateral reconstruction/lining
- Manhole lining
- Contingency
- Engineering/Admin

**\$5.90 Million**

## Inflow

- Smoke testing
- Lateral reconstruction/lining (10%)
- Manhole inspection
- Chimney seals
- Inflow dishes
- Contingency
- Engineering/Admin

**\$0.74 Million**

# Pilot Study

# I&I Pilot Study

- Selected two of the areas prioritized for rehabilitation
- Conducted cleaning and testing to determine necessary repairs/rehabilitation
  - Fog testing
  - Pipeline cleaning and video inspection (mainlines and laterals to homes)
  - Manhole inspections
- Perform rehabilitation
- Measure improvements (decrease) in chloride concentration and flow
- Adjust I&I Study recommendations if needed based on results of Pilot Study

# Pilot Test Area – Broadway Street

**Figure 1**  
**Lift Station A**  
Wastewater Collection System  
Inflow and Infiltration Study  
Town of Longboat Key



# Pilot Test Area – Jungle Queen Way

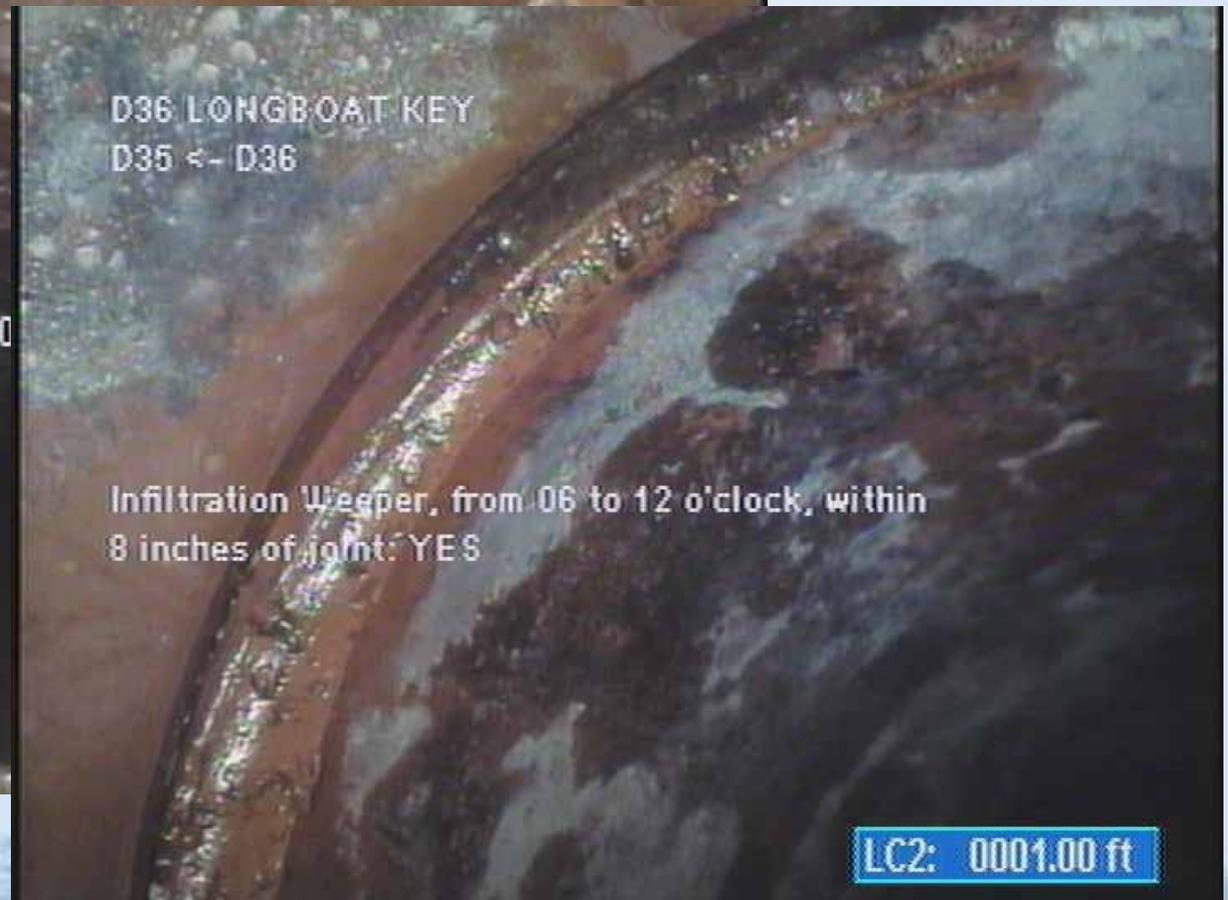
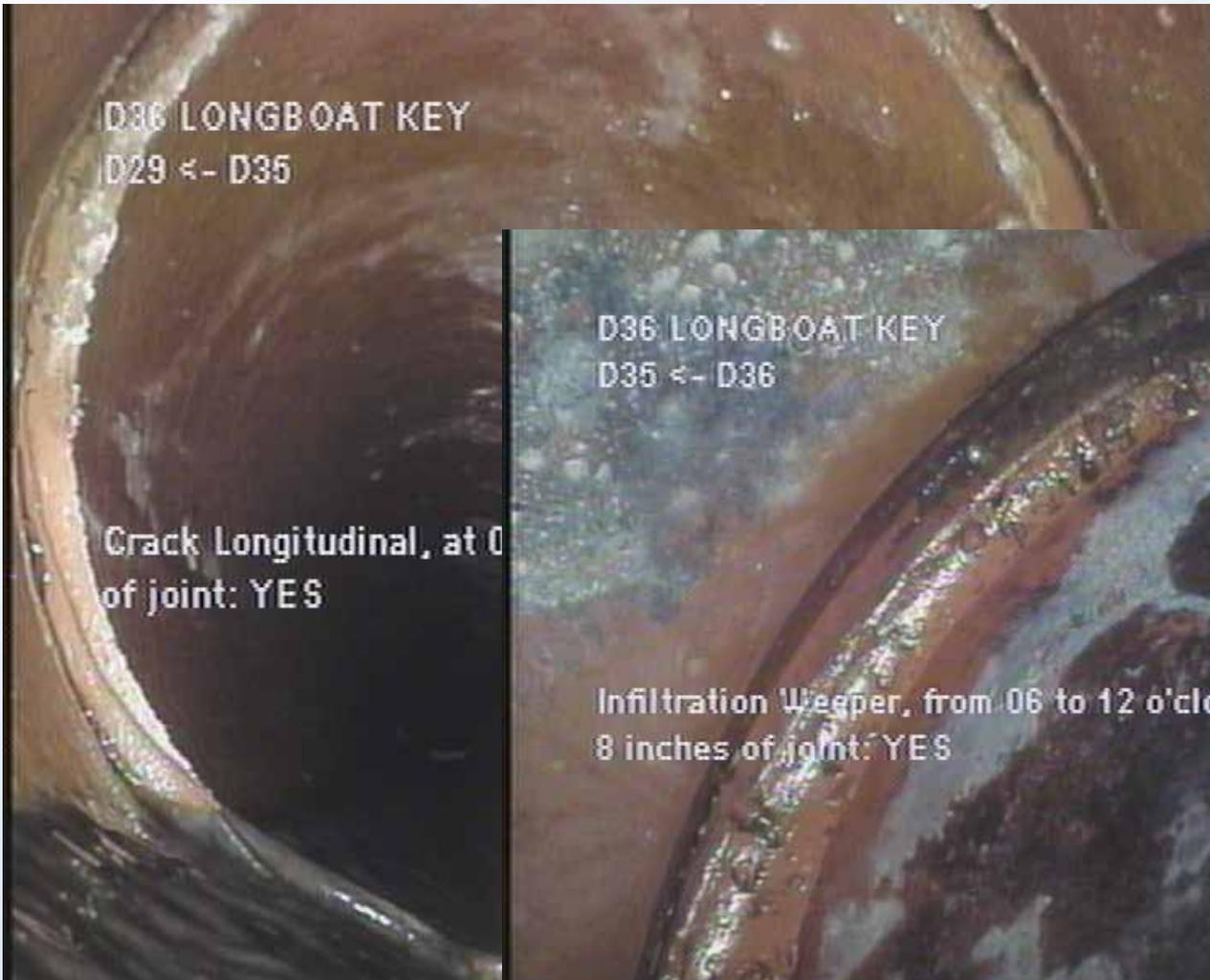


# Flow Meters Installed for Lift Stations A & F



*Flow monitoring equipment for LS-F (Manhole E-10).*

# Pilot Study Inspection Results



# Pilot Study Results on Jungle Queen Way – Laterals to Homes

Address	Material	Length (ft)	Remarks/Recommendations
708 JQW	VCP	11	Good condition
687/705 JQW	VCP	6	Good condition
690 JQW	VCP	10	Recommend CIPP lining (crack)
798 JQW	VCP	12	Good condition
780 JQW	VCP	12	Good condition
777 JQW	VCP	9	Recommend CIPP lining (infiltration)
762 JQW	VCP	13	Recommend CIPP lining (infiltration)
765 JQW	VCP	8	Good condition
744 JQW	VCP	12	Recommend CIPP lining (infiltration)
741 JQW	VCP	11	Recommend CIPP lining (infiltration)
726 JQW	VCP	12	Recommend CIPP lining (infiltration)

# Next Steps

- Cleaning / Inspections – 1<sup>st</sup> Quarter 2015
- Rehabilitation / Repairs – 2<sup>nd</sup> – 3<sup>rd</sup> Quarter 2015
- Pilot Study Report – 3<sup>rd</sup> Quarter 2015
- Modify I&I Study as needed and move forward with sewer rehabilitation – 4<sup>th</sup> Quarter 2015
- On-going monitoring of flow and chloride



**End of Agenda Item**