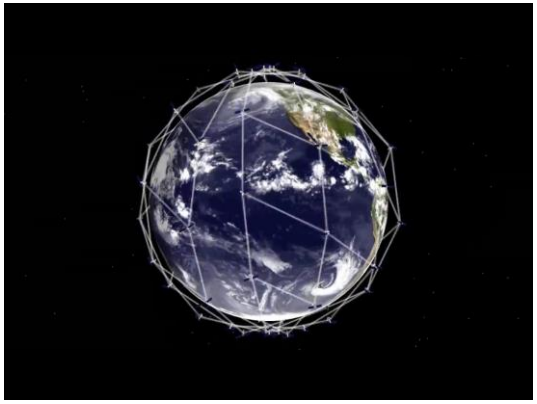
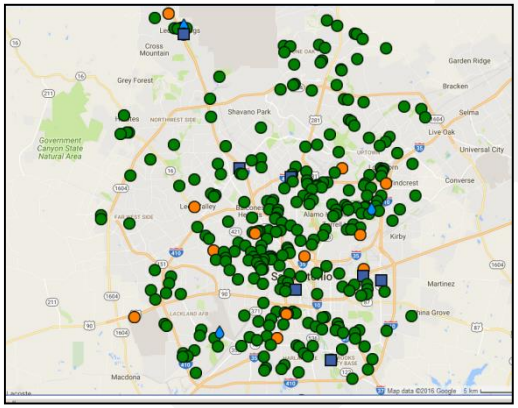


# *Utilizing Remote Monitoring in Wastewater Collection Systems*


***By: Brogan Quist***
***SmartCover Systems***

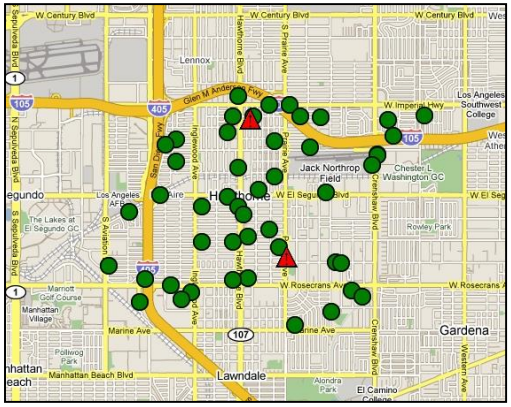

***Represented Locally by PumpTech, Inc.***

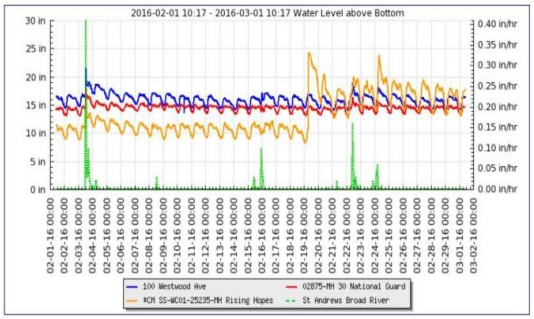
**Water Environment School 2017**
**Clackamas, OR**



# Outline

1. What is the Problem?
2. What are the current solutions?
3. Are there more solutions?
4. Case Studies and Examples
5. Other Problems/Applications




# The Problem

- **I&I Issues**
  - Plant overloaded with rain water
  - Expensive to find and treat
  - Can cause surcharging

- **Sewer Spills**
  - Public Health Impact
  - Monetary Hit: Fines, clean up costs, litigation
  - Bad PR: News articles
  - CSOs (capacity issues)

- **High Frequency Cleaning**
  - Costly, stress on resources and time
- **Pipe Life**
  - Old pipe means repairs need to start happening
  - Can be up to millions of dollars to repair just a few miles of pipe
  - Where do you start??

# The Current Solutions

Manual monitoring

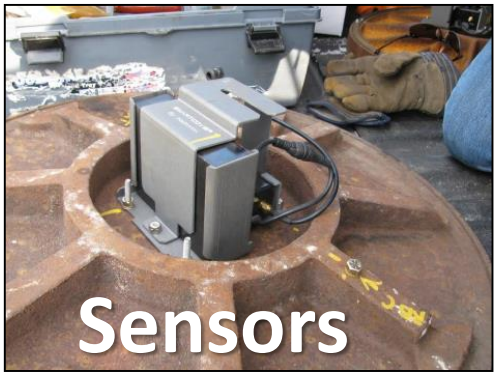
Regular cleaning

Video Inspection

Replace, refurb, repair

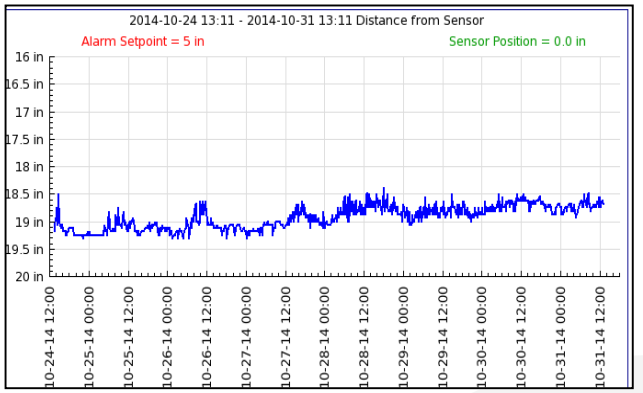
$$$

# Another Tool in Your Toolset






# More About the Technology




- **Ongoing data acquisition**
  - Continuous level data collection
- **Automated trend analysis**
  - Predicts future events
  - Visibility of unseen assets
- **High Reliability Communications**
  - Global, redundant satellite coverage
- **Battery Powered**
  - Independent of electrical grid and outages
- **Fast, Easy, Secure User Access to Data**
  - Web Browser access: computers, phones or tablets
- **Alarms, Alerts & Advisories**
  - Email, text message continuously informs users

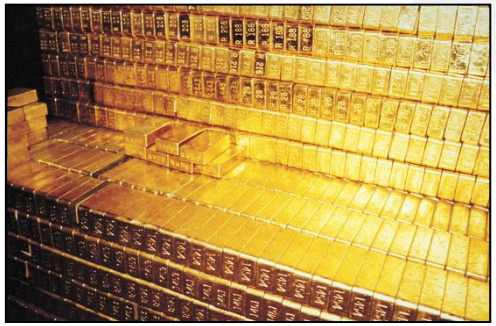
# Case Studies and Examples

# I&I: Impact

**Storm water stresses collection system capacity**

**Storm water can overwhelm treatment plant**

**Treating storm water is EXPENSIVE**



# Flow Estimation and I&I

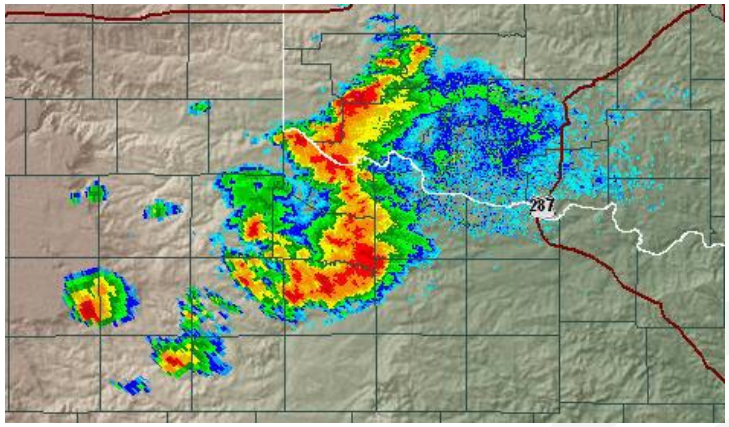
**Open Channel Flow Estimation can be applied to I&I studies through Manning's Equation**

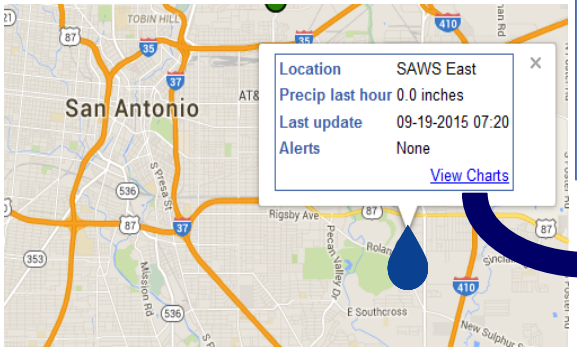
**Advantages:**

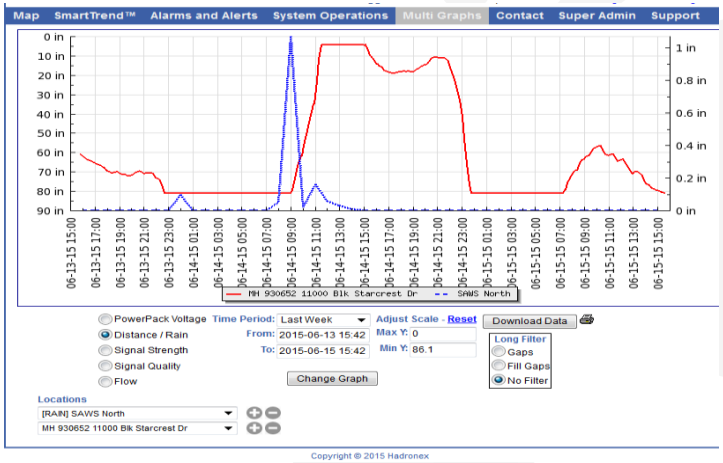
- No confined space entry
- Data sent directly to website
- Non-Contact with sewer (lower maintenance)
- Easier Mobility
- Long Battery Life

# Overlay with Rain

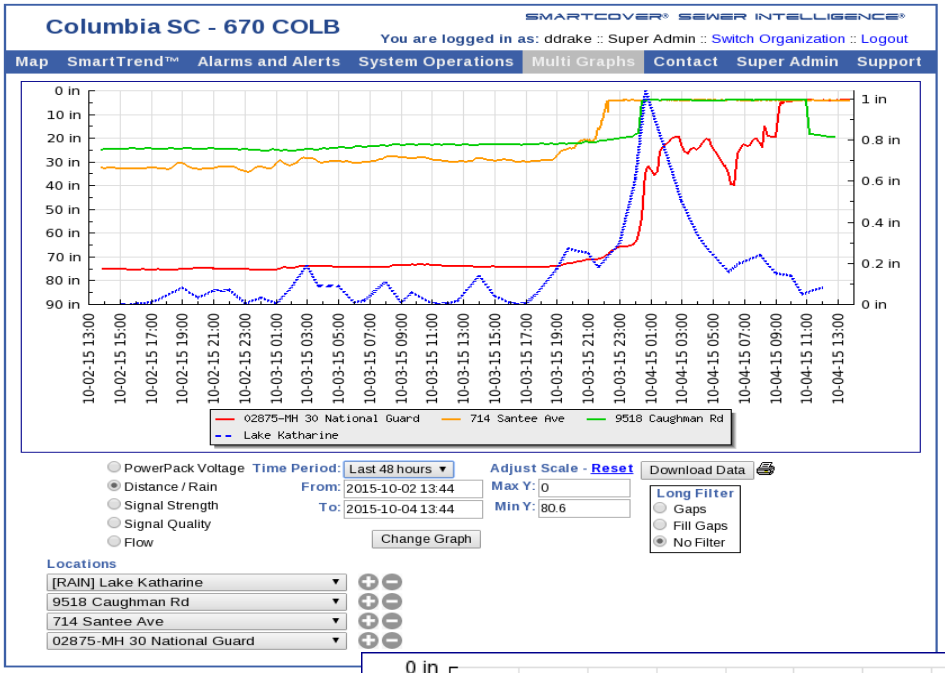
- Uses Doppler Radar and other monitors for data source
- Provides hourly updates
- 1 km$^2$ (0.62 miles) area
- 0.001 inch sensitivity
- Downloads to spreadsheets

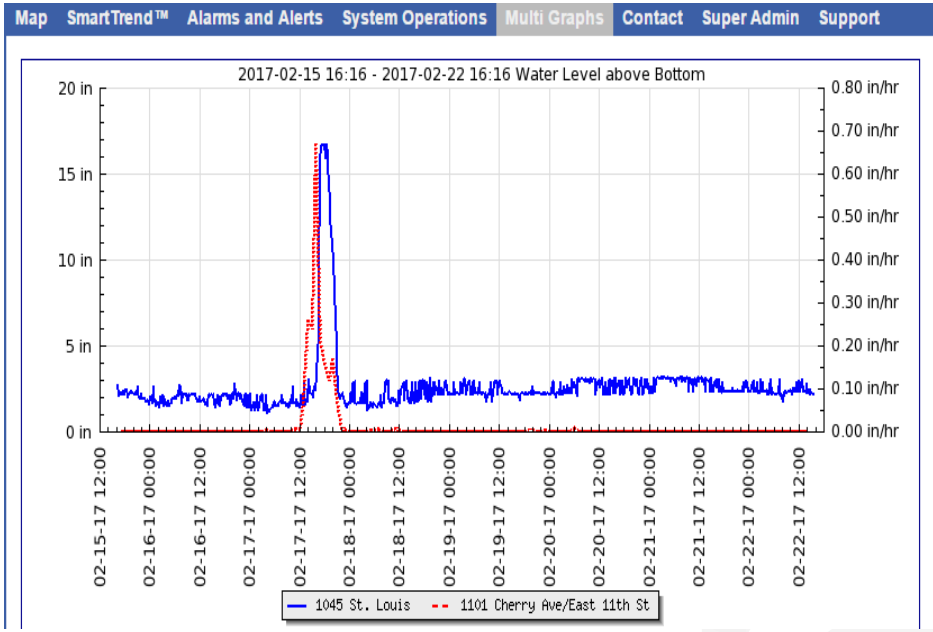


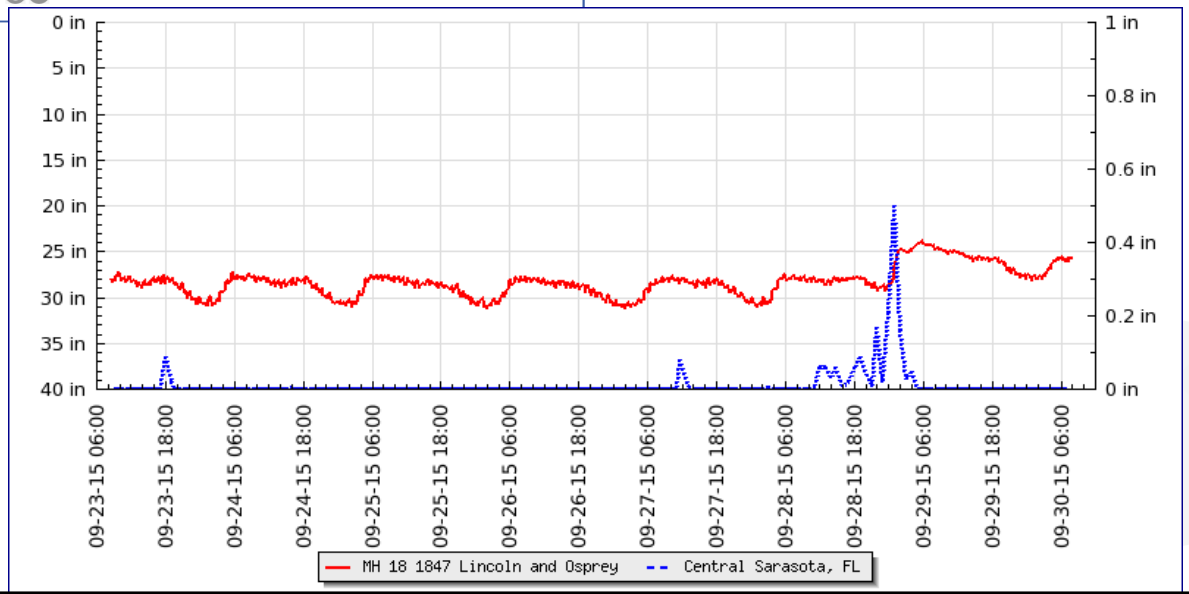



# Examples


Columbia SC - 670 COLB
SMARTCOVER® SEWER INTELLIGENCE®
You are logged in as: ddrake :: Super Admin :: Switch Organization :: Logout
Map SmartTrend™ Alarms and Alerts System Operations Multi Graphs Contact Super Admin Support
02875-MH 30 National Guard
714 Santee Ave
9518 Caughman Rd
Lake Katharine
PowerPack Voltage
Distance / Rain
Signal Strength
Signal Quality
Flow
Time Period: Last 48 hours
From: 2015-10-02 13:44
To: 2015-10-04 13:44
Change Graph
Adjust Scale - Reset
Max Y: 0
Min Y: 80.6
Download Data
Long Filter
Gaps
Fill Gaps
No Filter
Locations
[RAIN] Lake Katharine
9518 Caughman Rd
714 Santee Ave
02875-MH 30 National Guard


Map SmartTrend™ Alarms and Alerts System Operations Multi Graphs Contact Super Admin Support
2017-02-15 16:16 - 2017-02-22 16:16 Water Level above Bottom
1045 St. Louis
1101 Cherry Ave/East 11th St


MH 18 1847 Lincoln and Osprey
Central Sarasota, FL

# Sewer Spill Overflow (SSO) Prevention

California Water Environment Association

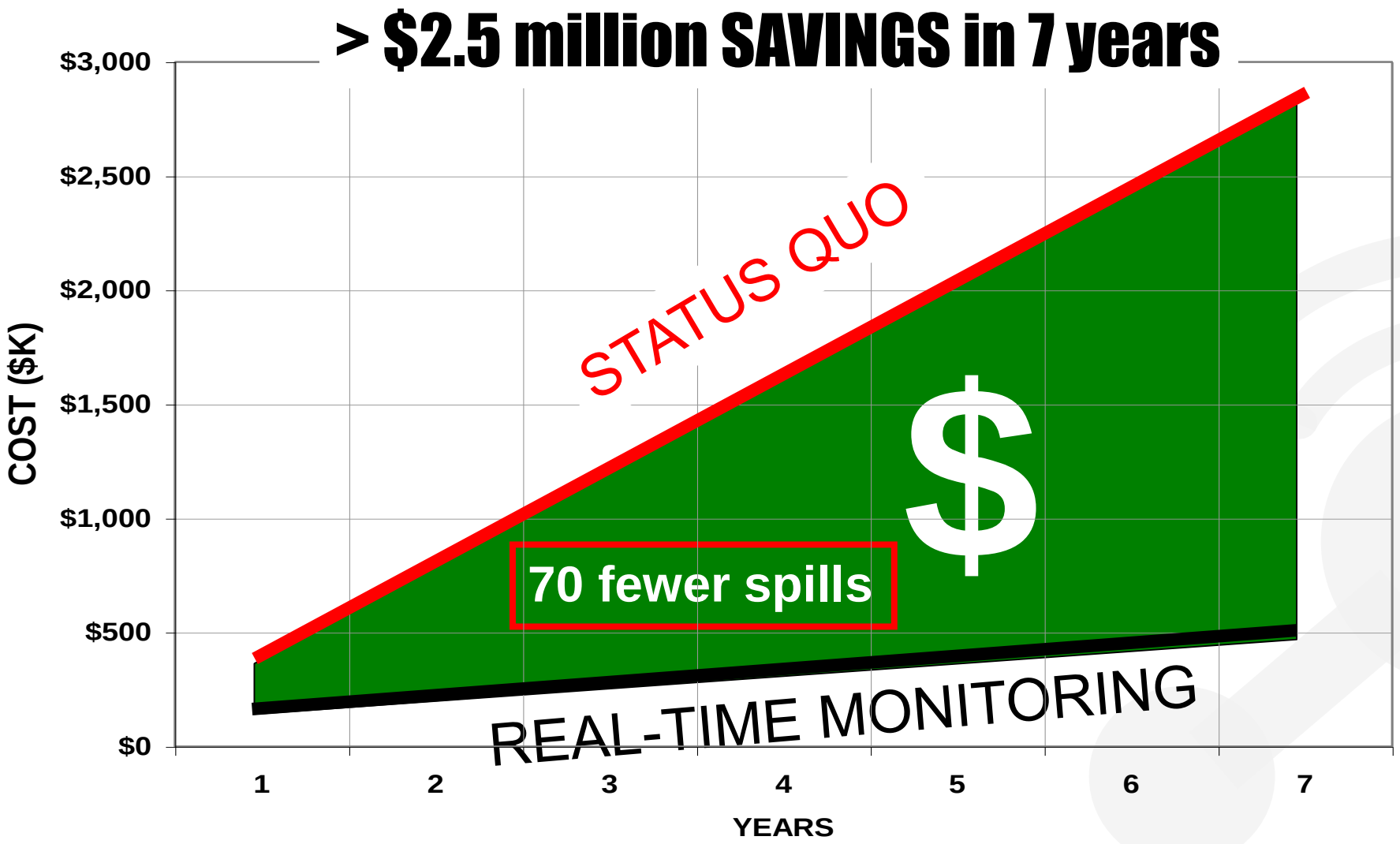
Protecting our water environment through education and training.

## Elimination of Sewer Overflows using a Continuous Real-Time Monitoring System

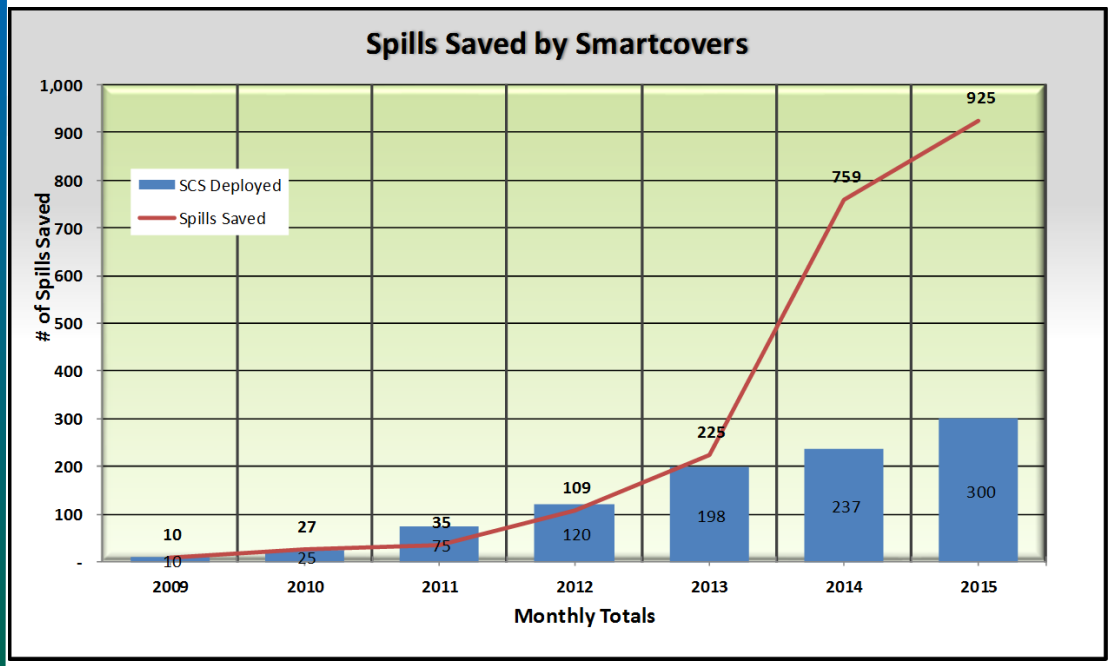
**Rick Carver, City of Hawthorne**

Gregory Quist, Ph.D. & David Drake, Hadronex

# Hawthorne Savings



# SSO prevention Story #2 (of many)




| Year | SCs Managed | Cost | SSOs Saved | SSO Clean Up Cost Fines from CD after 2013 (5k per SSO) | EPA CD Fine |
|---|---|---|---|---|---|
| 2009 | 10 | $ 40,152.83 | 10 | $ 50,000.00 | |
| 2010 | 25 | $ 49,952.90 | 17 | $ 85,000.00 | |
| 2011 | 75 | $ 311,366.20 | 8 | $ 40,000.00 | |
| 2012 | 120 | $ 471,761.78 | 74 | $ 370,000.00 | |
| 2013 | 198 | $ 498,439.24 | 116 | $ 580,000.00 | $ 31,500.00 |
| 2014 | 237 | $ 598,545.70 | 534 | $ 2,670,000.00 | $ 240,300.00 |
| 2015 | 300 | $ 277,132.24 | 166 | $ 830,000.00 | $ 74,700.00 |
| | | **$ 2,247,350.89** | **925** | **$ 4,625,000.00** | **$ 346,500.00** |

***Program Results:***

- **Period 2009-2015**
  **> 925 spills saved**
- **System coverage 0.3%**
- **Gross savings ~ $4.9MM**
- **NET SAVINGS ~ $2.7MM**

| | | |
|---|---|---|
| $ | 4,971,500.00 | Cost Savings |
| $ | 2,247,350.89 | Cost of SC Program |
| **$** | **2,724,149.11** | SAWS saved |

***Building on Success…***

# SSO Prevention: Lift Station Back Up

## Independent, Redundant Monitoring "Solution"

- Battery powered- off the grid
- Satellite radio- running while cellular may be overloaded or down

## Complements SCADA

- Lift station back-up
  - Power loss from severe storms/lighting strikes
- Pump failure or partial failure

SMARTCOVER SYSTEMS™
TURNING YOUR DATA INTO DECISIONS™

CASE STUDY

22Jan14

### SmartCover® Monitoring at Lift Stations when Everything Else Goes Down

"At approximately 2AM on New Year's Day a drunk driver on El Segundo Boulevard collided with not one but two Edison power poles. This knocked out the power to more than 4,000 SoCal Edison customers in the city of El Segundo.

Because we have SmartCover® units installed on our lift station wet wells we were able to get alarms with level measurements on our emergency on-call phones. **This technology enabled us to prioritize** which lift stations were most critical to respond to with backup generators and emergency pumps.

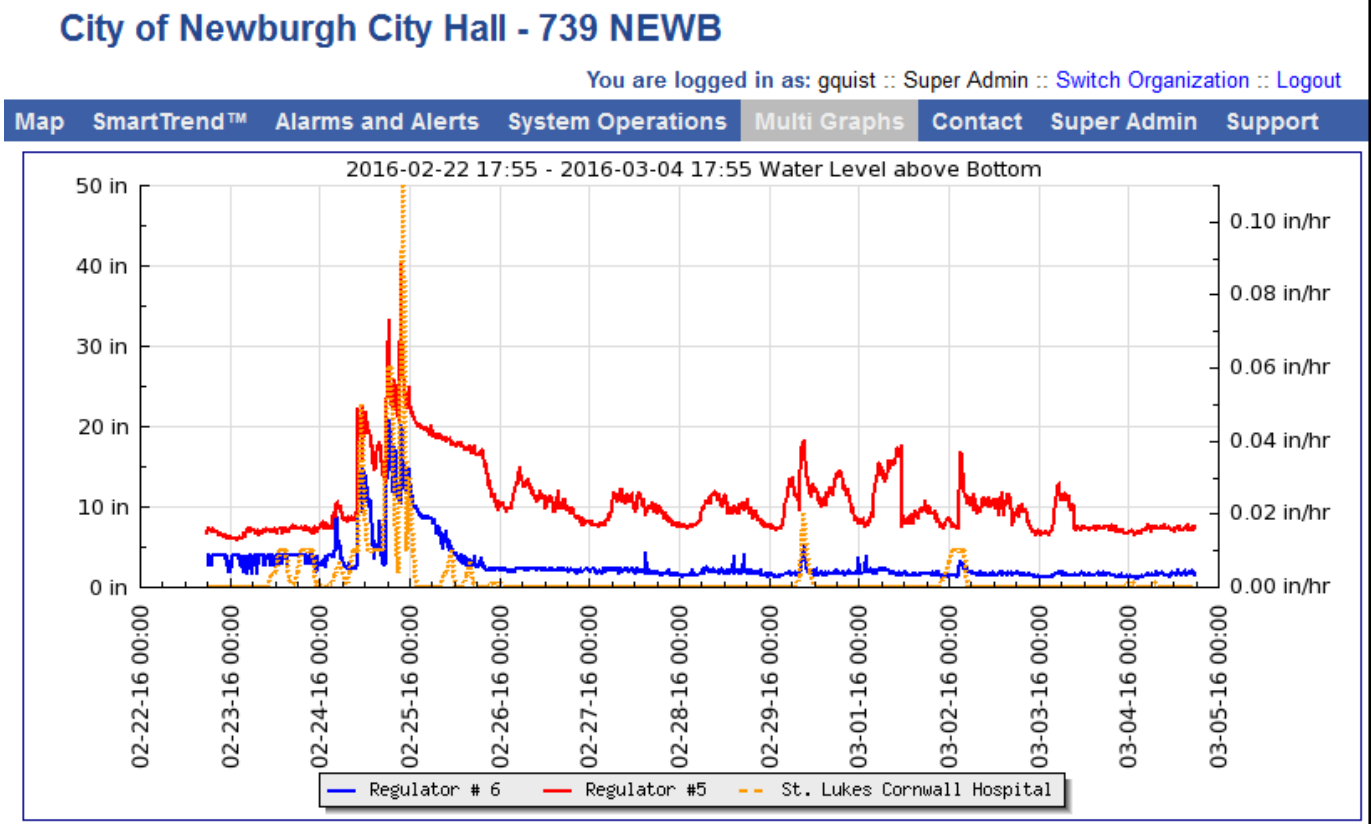
Part way through the 18 hour outage the power was temporarily restored and the generators and pump were broken down and put away. On call employees returned home and one hour later we began **receiving SmartCover® level alarms** once again. Apparently the temporary restoration was short lived as other parts of the electrical distribution system were overloaded and were knocked out as well.


**We redeployed our emergency generators** and three staff members shuttled two generators from station to station, **avoiding any spills** on the four stations that remained without power.
To complicate things the internet was down at my office so I used my smartphone to access the SmartCover® website. This worked out **really slick** as I could check levels at the different stations and know where to tow the generators next.

Any spill from a lift station would have been catastrophic as the volume from a wet well would be much greater than a typical SSO and the City of El Segundo is directly adjacent to the Pacific Ocean.
**Thank you Hadronex** for a great product and staff support that came through when needed. Because of our SmartCover® deployment I was able to enjoy the holidays rather than writing up spill reports."
***Gil Busick, Wastewater Supervisor for City of El Segundo***

***SmartCover® technology helped prevent SSO events during a serious power outage.***

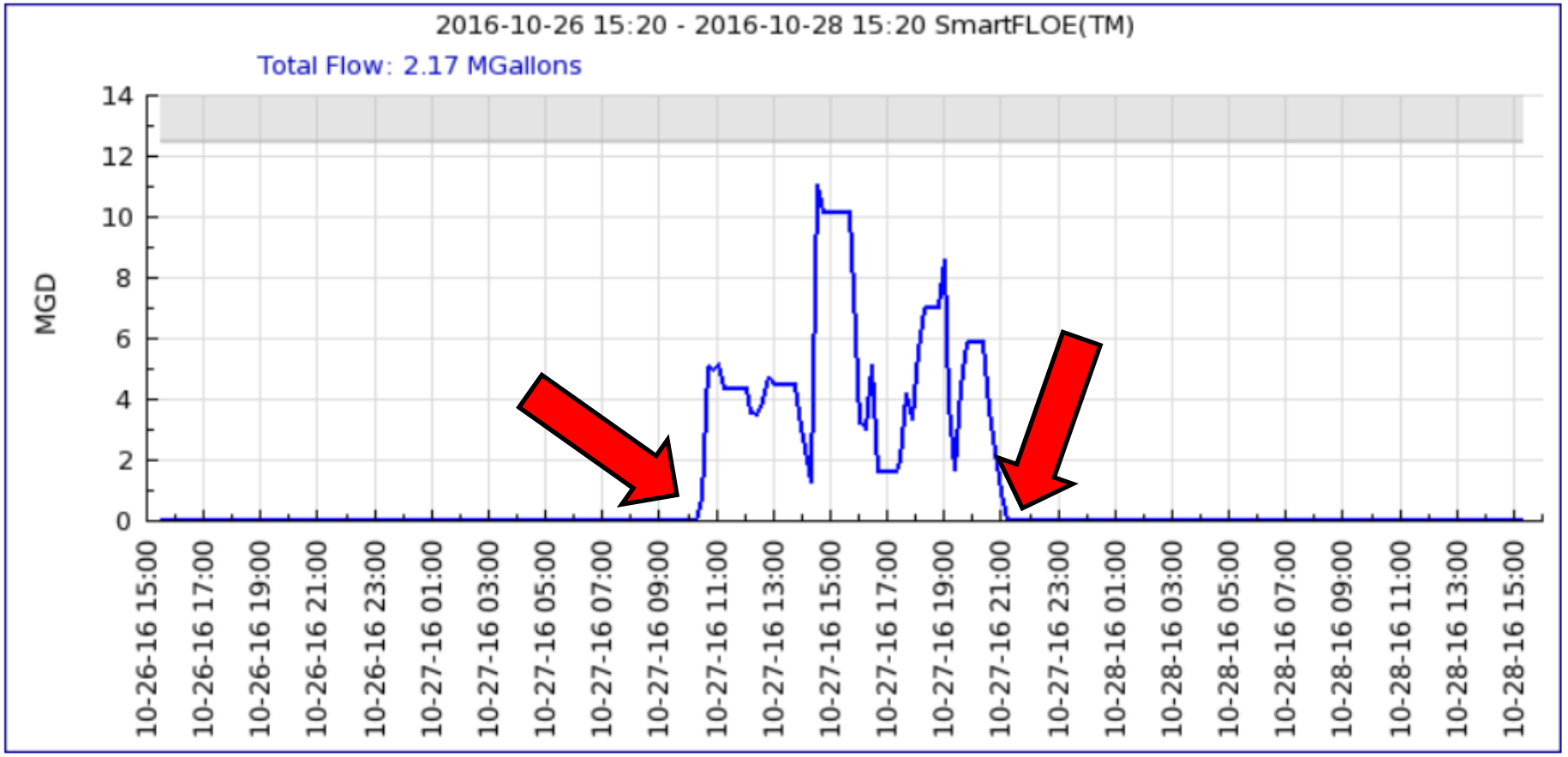
# CSO Monitoring



# Start, Stop, Duration, Volume

**Calculates:**
**Start, Stop, Duration, Volume**

Regulator #2



# High Frequency Cleaning

**High Frequency Cleaning *demands* resources …**

- **Personnel**
- **Equipment**
- **Management**
- **Capital funding (trucks)**

**High Frequency Cleaning Impacts Assets**

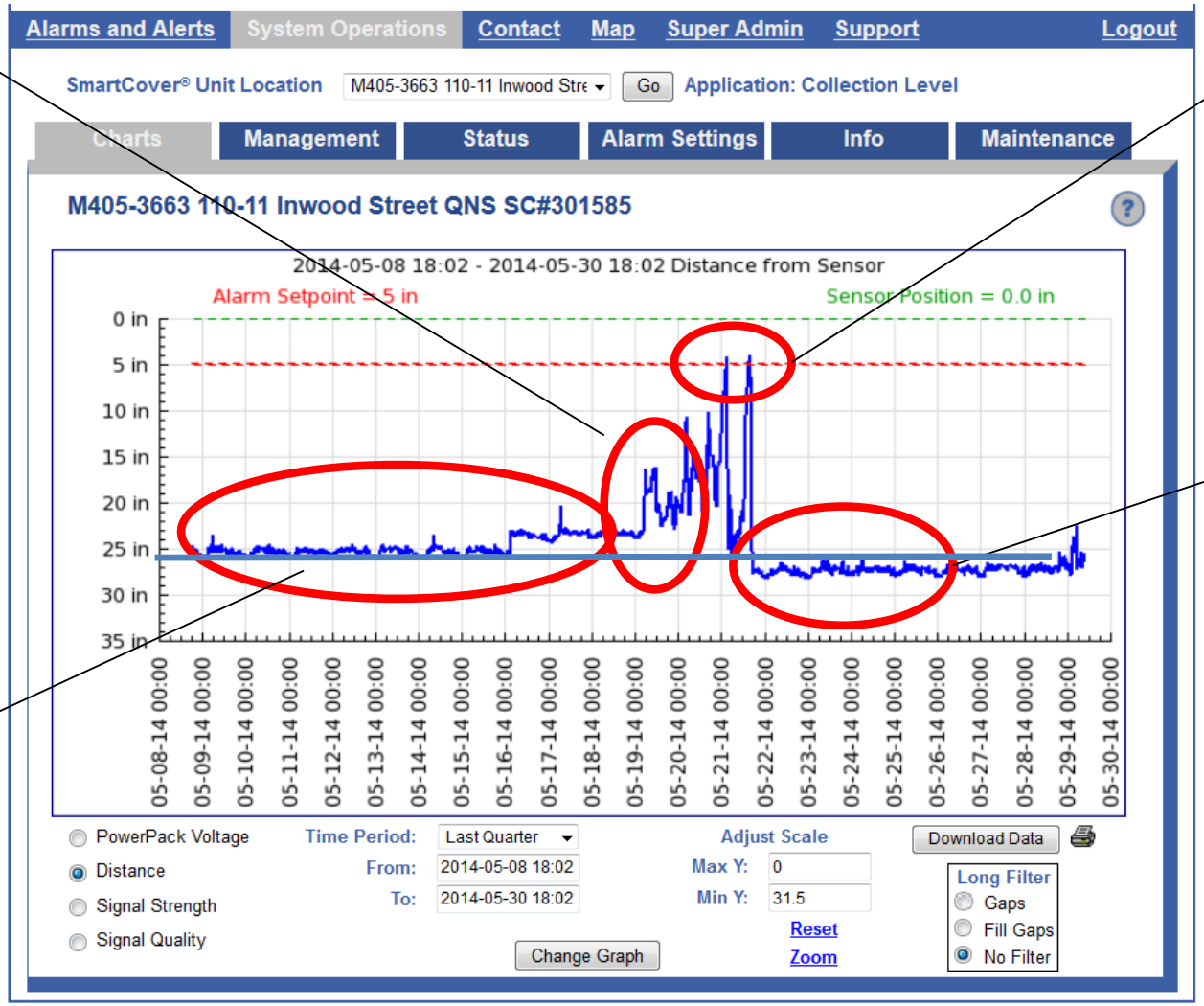
- **Accelerates wear on pipes**

***And the cycle never ends…***

# Without Automatic Trending Software

2. Rapidly increased levels

3. Alarm occurs at 3am



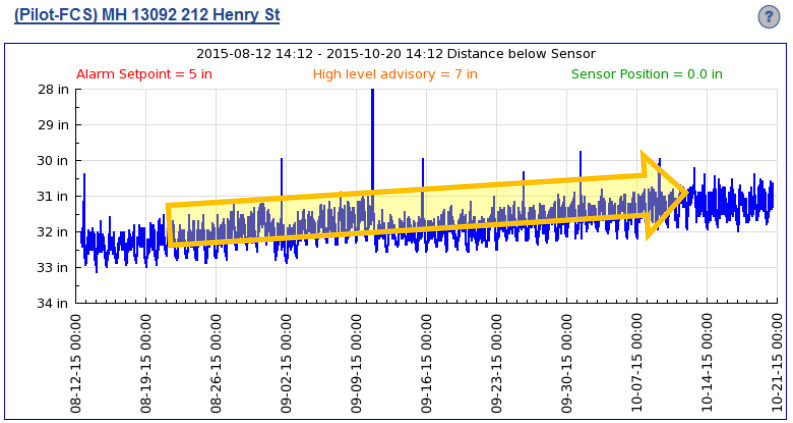

1. Pattern of increased water levels

4. Post maintenance levels lower than pre-surcharge levels

# Trend Analysis Breaks the Cycle

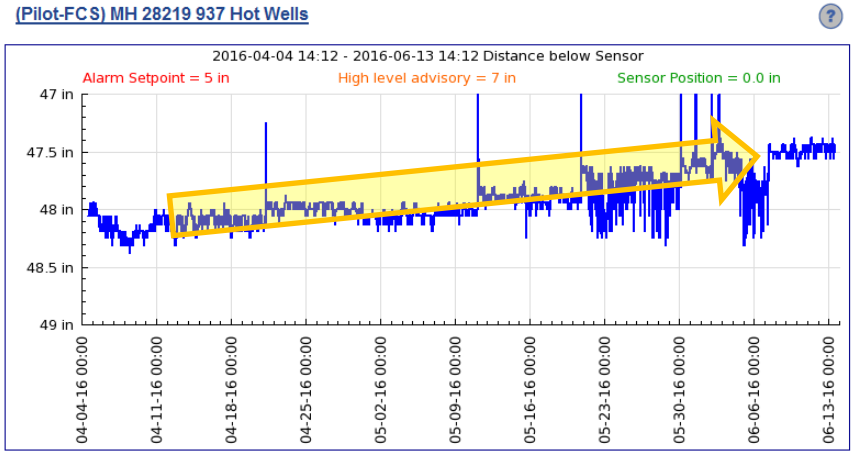
## New Protocol using Monitoring and Data Trend Analysis

- Scans and detects of level/flow *changes*
- Identifies anomalous level/flow change
- Automatically sends email “Advisory”
- Enables prioritized focus and action




## Transformational Effect

- PREDICTIVE: Transforms response from *reactive* to *planned*
  - Drives maintenance based on real-time data
  - Lowers frequency of cleaning
  - Reduces risks of cleaning



# Pilot: ROI with Optimized Cleaning

## Real-Time Condition Assessment Pilot:

**SAWS** (San Antonio Water System)

10 HFC sites scheduled at once/month cleaning

Result: 94% reduction of cleaning = savings

**Estimates of savings (SAWS):**
***$2.5K – 4.0K/year/site (net)***

**Decreased visits mean:**

- ***decreased fuel and time***
- ***decreased staff risk e.g., time in traffic***
- ***decreased carbon footprint***

**Results to be presented at WEFTEC**

weftec 2016
the water quality event™

**A New Way to Do the Same Old Thing: Using the Internet of Things for Maintenance Optimization**

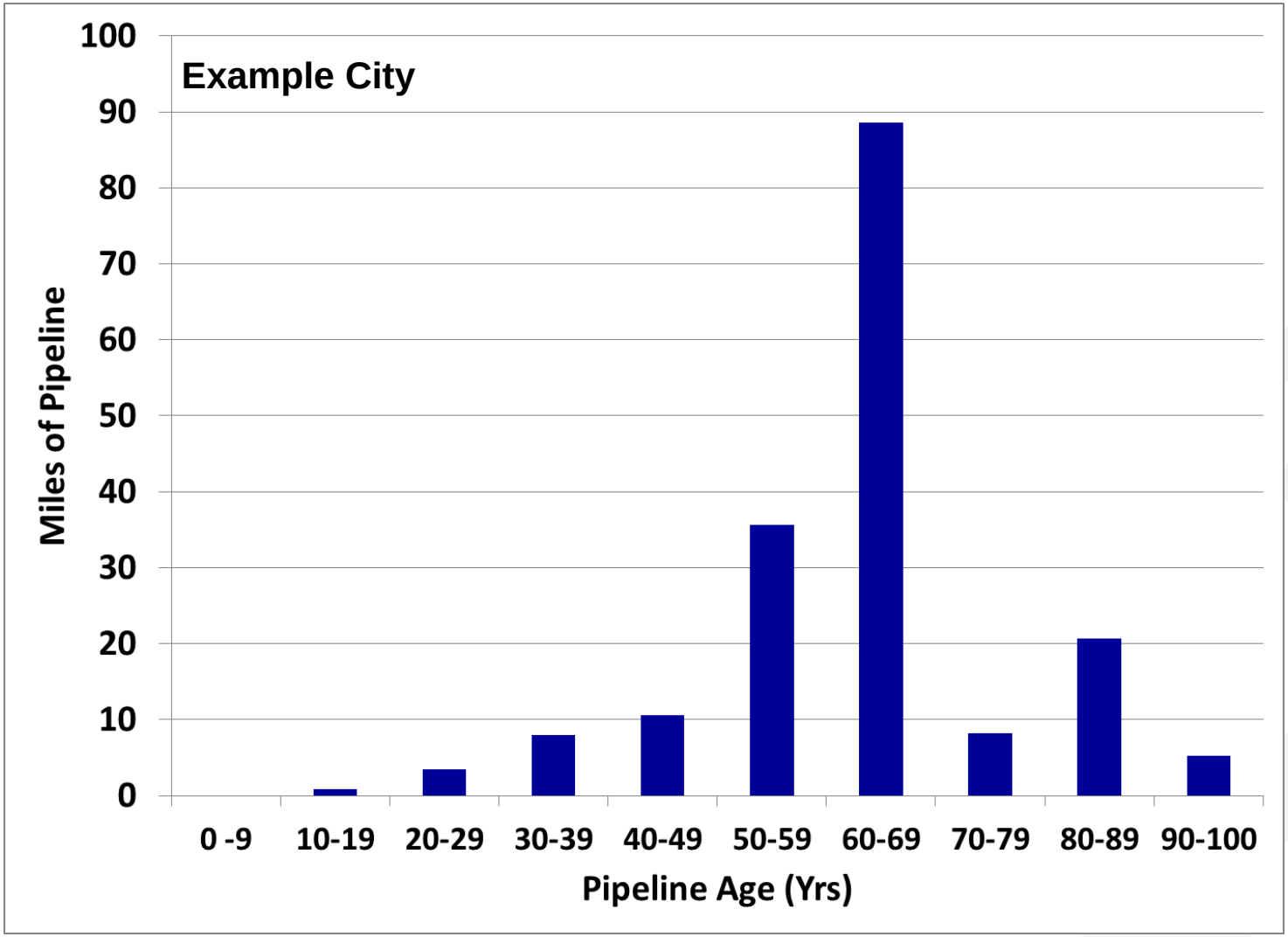
Tamsen McNarie[1], Stanley Griffith[2], Gregory Quist[3], Keith Lewinger[3]

1. San Antonio Water System (SAWS), TX
2. City of San Diego, CA
3. SmartCover Systems, Escondido, CA

**Summary of the Project**

A common means for reducing sanitary sewer overflows (SSOs) is performing high frequency cleaning (HFC) in areas having a history of spills or otherwise identified as high risk locations. High risk locations

# Status of Pipe Life



# Condition Ranking System

Table 8. Condition state and rehabilitation priorities

| Condition state | Implication | Impact rating | Rehabilitation priority |
|---|---|---|---|
| 5 | Failed or imminent failure | 1 to 5 | Immediate |
| 4 | In bad condition, high structural risk | 5 | Immediate |
| | | 1 to 4 | High |
| 3 | In poor condition, moderate structural risk | 4 to 5 | Medium |
| | | 1 to 3 | Low |
| 2 | In fair condition, minimal structural risk | 5 | Medium |
| | | 1 to 4 | Low |
| 1 or 0 | In good or excellent condition | 1 to 5 | Not required |

McDonald and Zhao (2001)

# Capital Project Prioritization: Elsinore Valley Municipal Water District

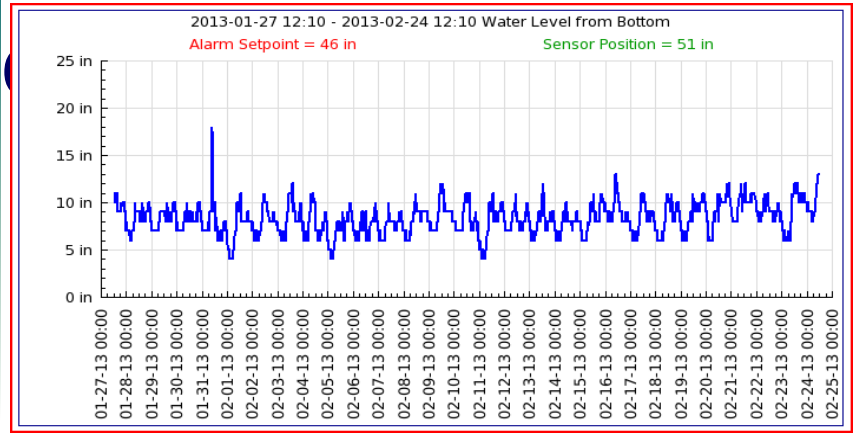
35,000 connections
96 square miles
2 treatment plants
283 miles of sewer line
12 miles of force main
31 lift stations
5,664 manholes

# Saving $$ Through On-Going Monitoring

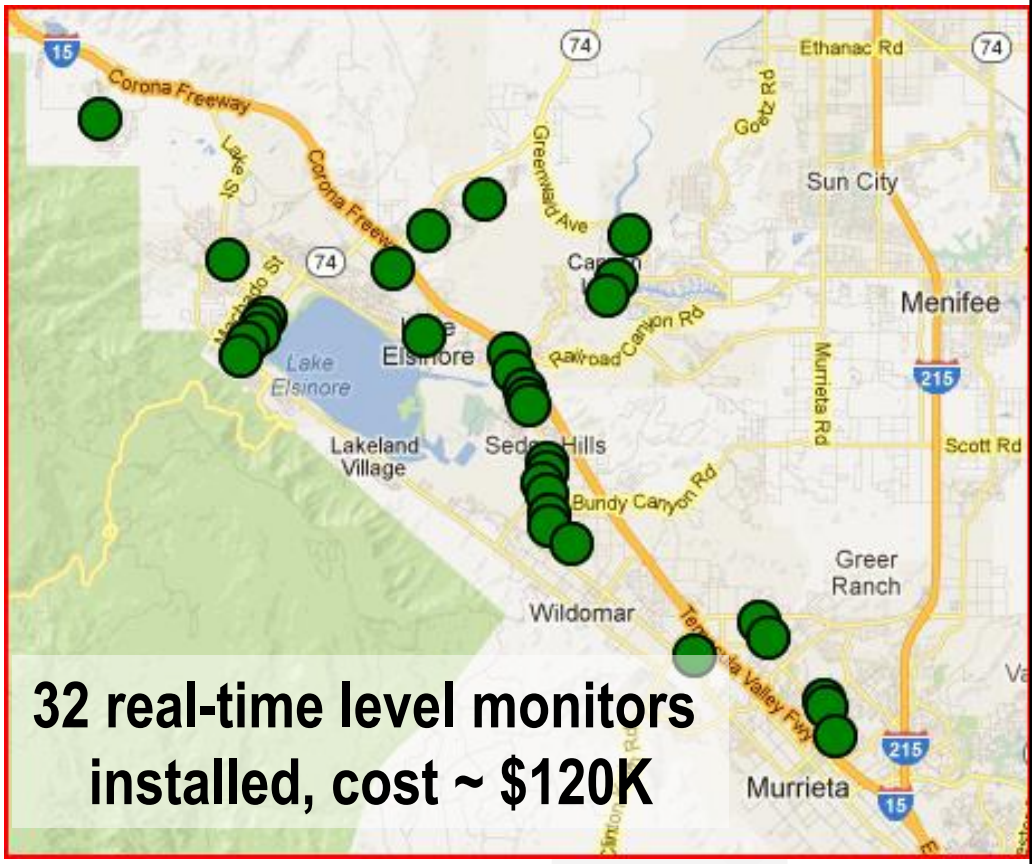
**Consulting engineering capacity study recommends up-sizing pipeline: INSUFFICIENT CAPACITY**

**Project Cost: $29 million**

**Level data collected over several years...**




**& ...NO SPILLS**

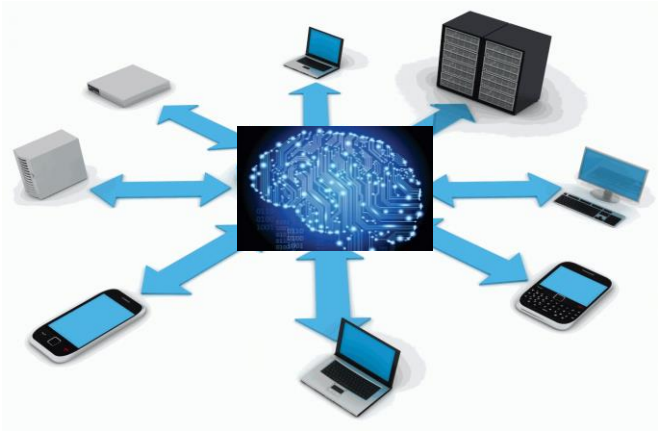


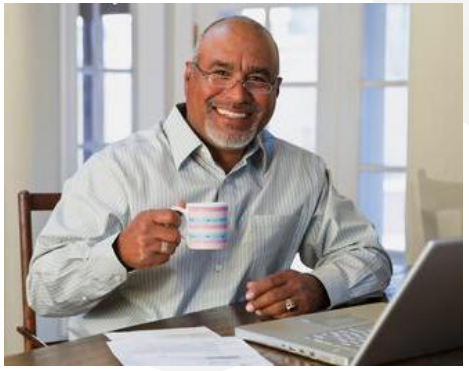

**32 real-time level monitors installed, cost ~ $120K**

# Transformational Change

## Using technology to…

- ***Acquire Real-Time Knowledge*** **versus guessing from history**
- ***Find*** **I&I through less expensive techniques and monitoring**
- ***Optimize*** **processes using data instead of manage by opinion**
- ***Save*** **Sewer spills before they occur**





# Questions?