

Water-Energy Nexus:

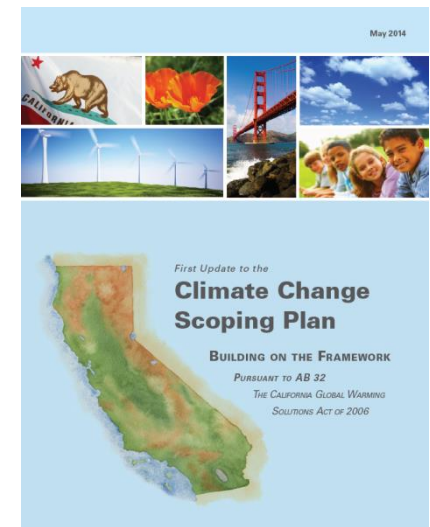
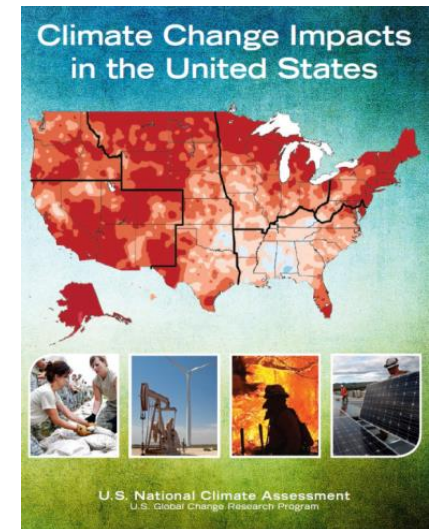
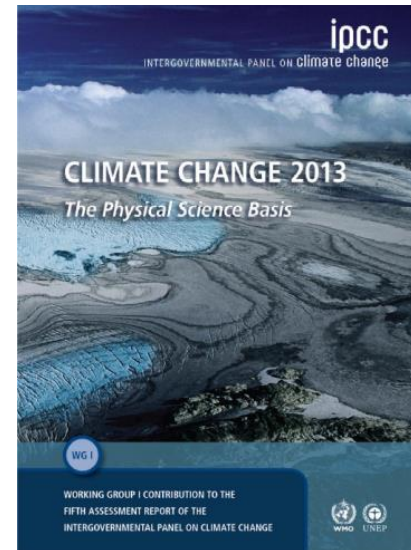
Strategies and Initiatives



Climate Assessments



- Projected Climate Change Impacts
 - Water Resources
 - Water Quality
 - Energy
- California AB32 – Global Warming Solutions Act

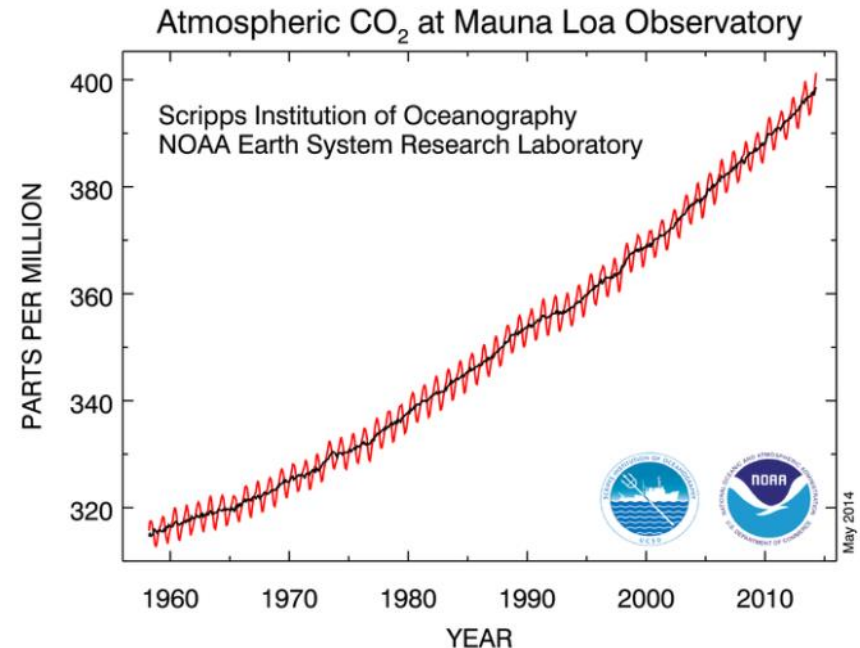


Atmospheric CO₂ Since 1950's

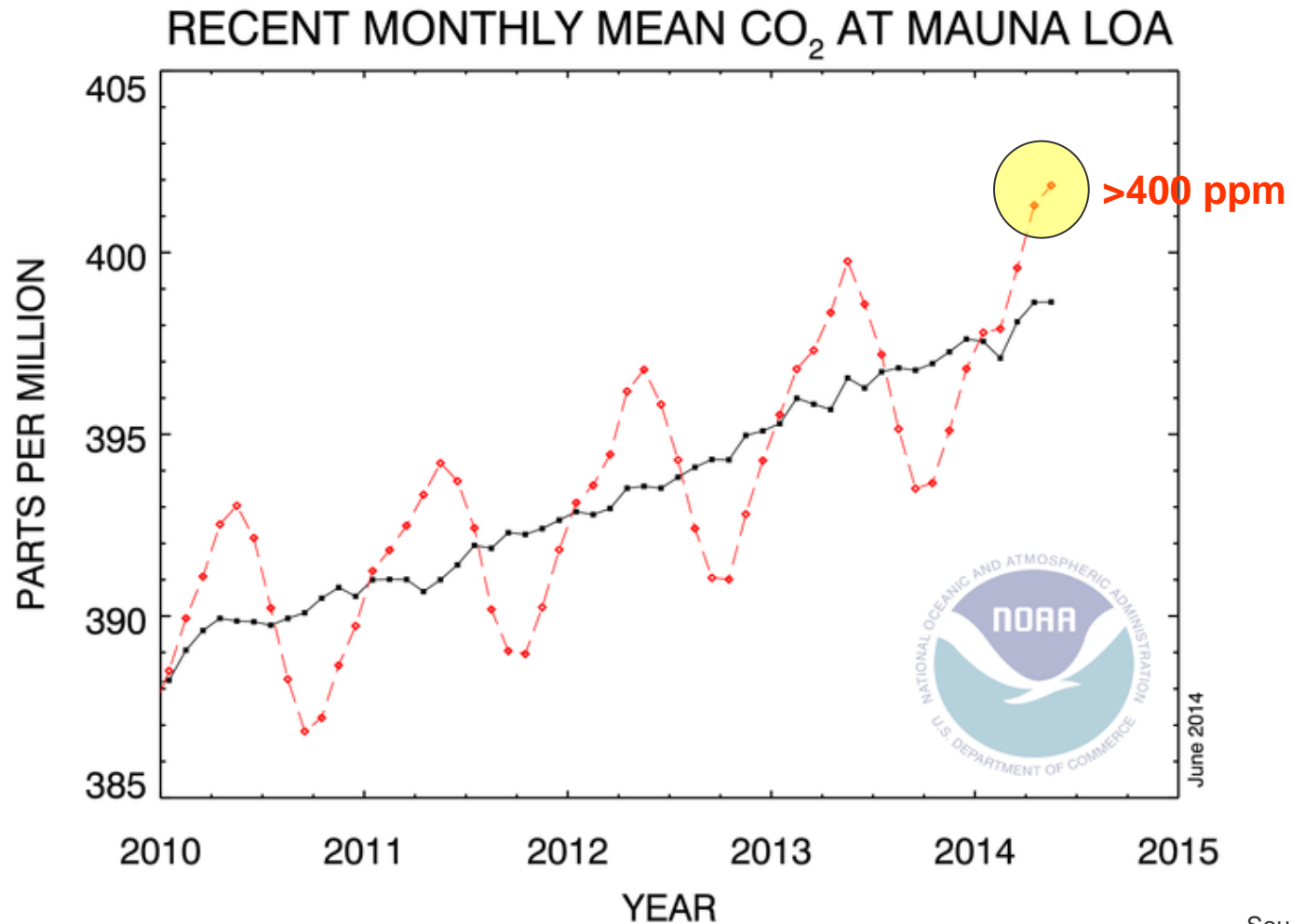


As atmospheric GHG concentrations rise

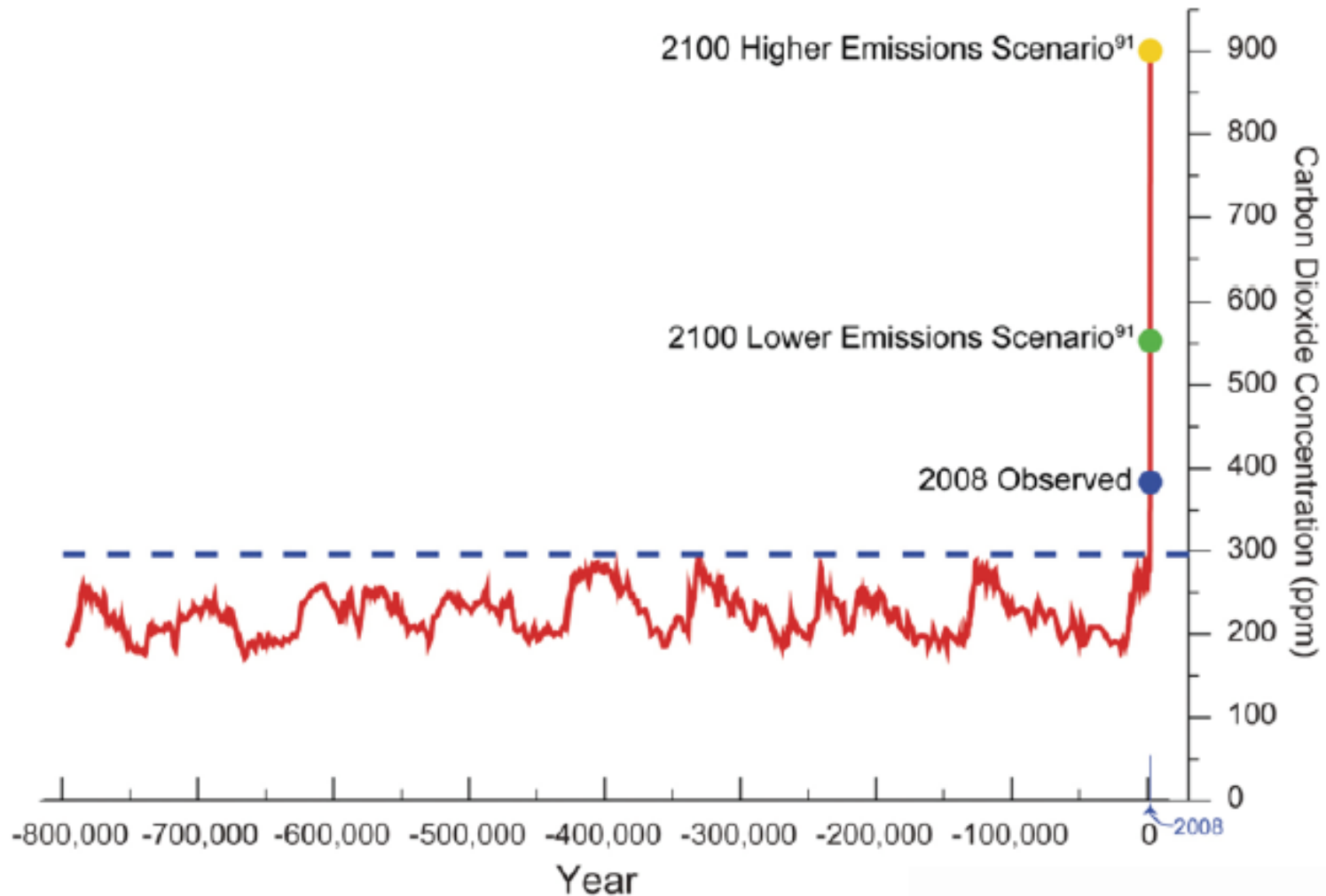
- Average global temperature will rise
- Sea level will rise
- Precipitation patterns will change



CO₂ Increase Not Slowing Down

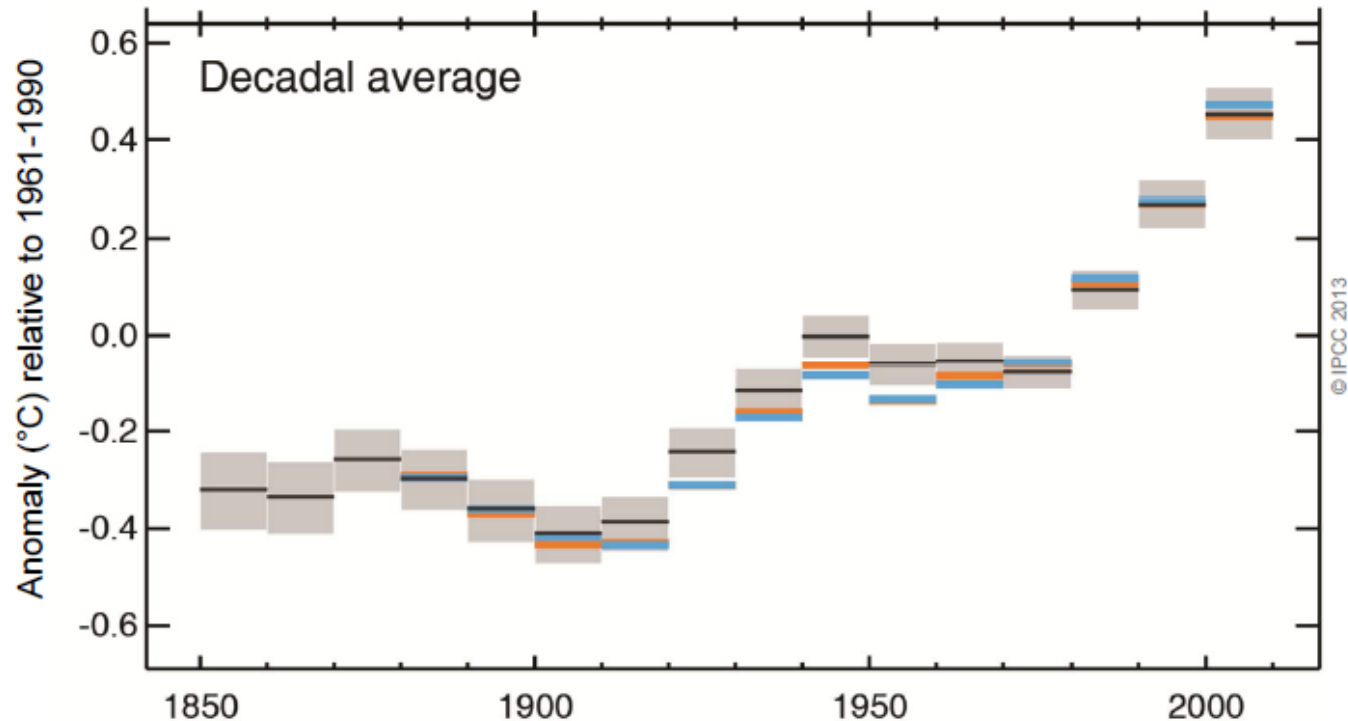


Atmospheric CO₂ over the last 800,000 years



Source: US Global Change Research Program

Observed Temperature Change



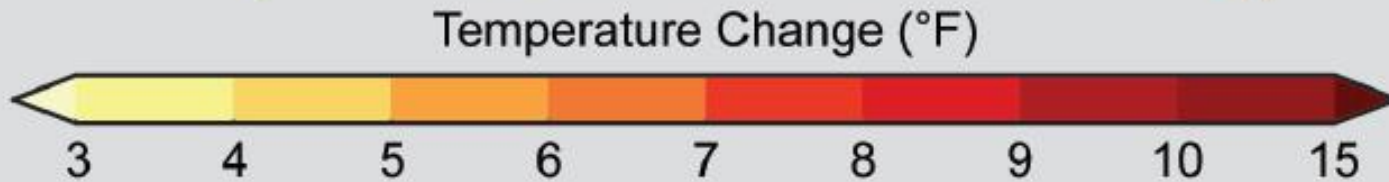
- Each of the **last three decades has been successively warmer** at the Earth's surface than any preceding decade since 1850
- In the Northern Hemisphere, **1983 to 2012** was likely the **warmest 30-year period in the last 1400 years**
- **Rate of increase** since 1970 (compared to 1880) **2.5 times higher** (increase from 0.2°F to 0.5°F per decade)

Projected Temperature Change

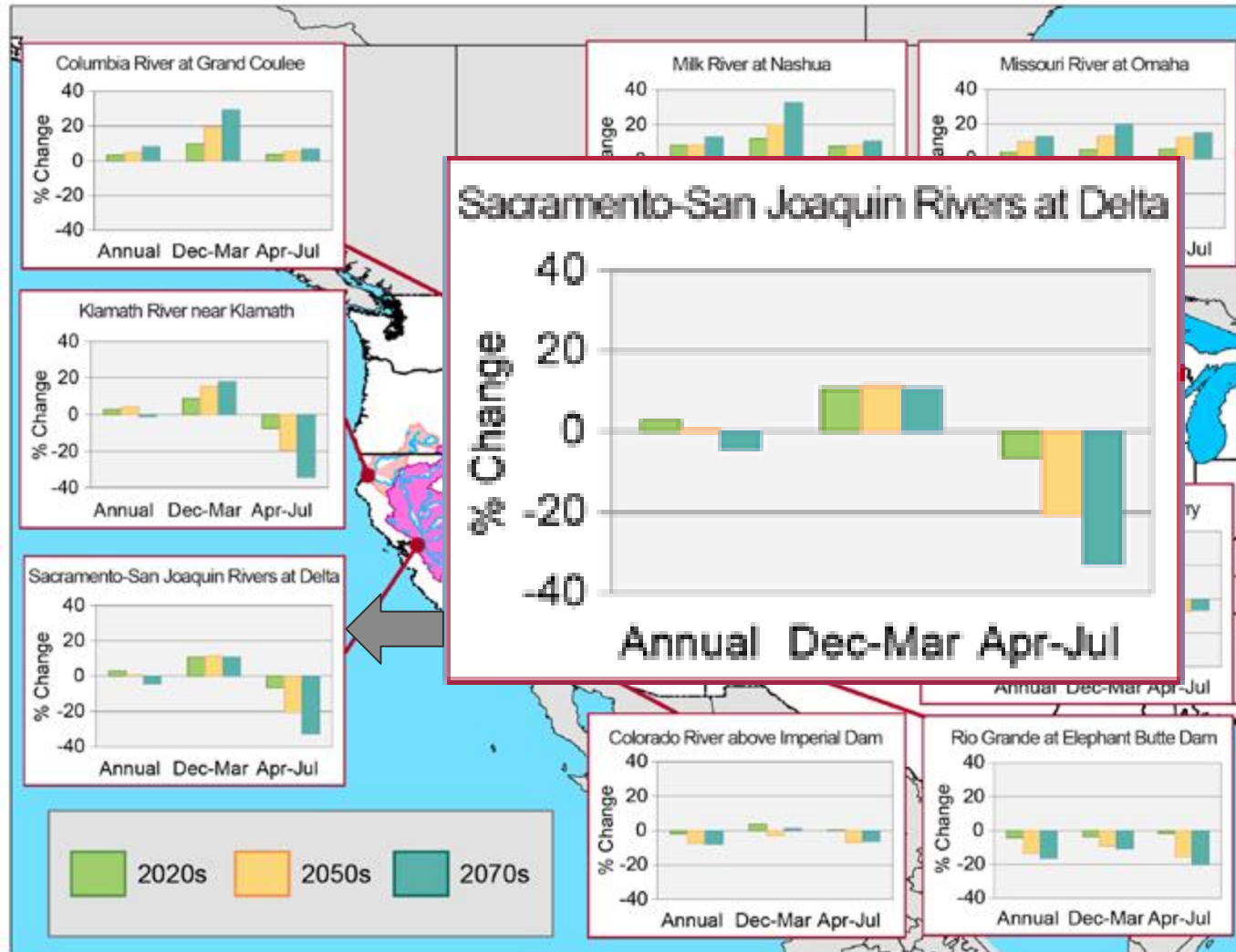


Lower Emissions (B1)

Higher Emissions (A2)



Projected Runoff



EBMUD Energy Strategy



- Minimize energy use
- Minimize energy costs
- Diversify our energy supplies
- Educate our employees and customers



District Power Purchases



- 148,000 MWh in FY2013
- Purchased from
 - PG&E
 - SMUD
 - WAPA
- Self-Supply

Sector	%
Water Treatment	11%
Distribution Pumping	44%
Admin/Raw Water Pumping	11%
Wastewater	34%

Water and Energy Use



- Each year water-related energy use in California consumes
 - 19% of the state's electricity (48,000 GWh)
 - 30% of its natural gas
 - 88 million gallons of diesel fuel
- Of the 19% electricity use
 - 4% used by water utilities
 - 1% used by wastewater utilities
 - 14% used by end users
- Energy use during droughts increases as other supplies are utilized

Energy Use in Perspective



60 watt light bulb for 8 hours = Walking for 82 days



Dell GX280 for 8 hours = Walking for 246 days



Electricity use for water in CA = Walking for 12.5 billion years

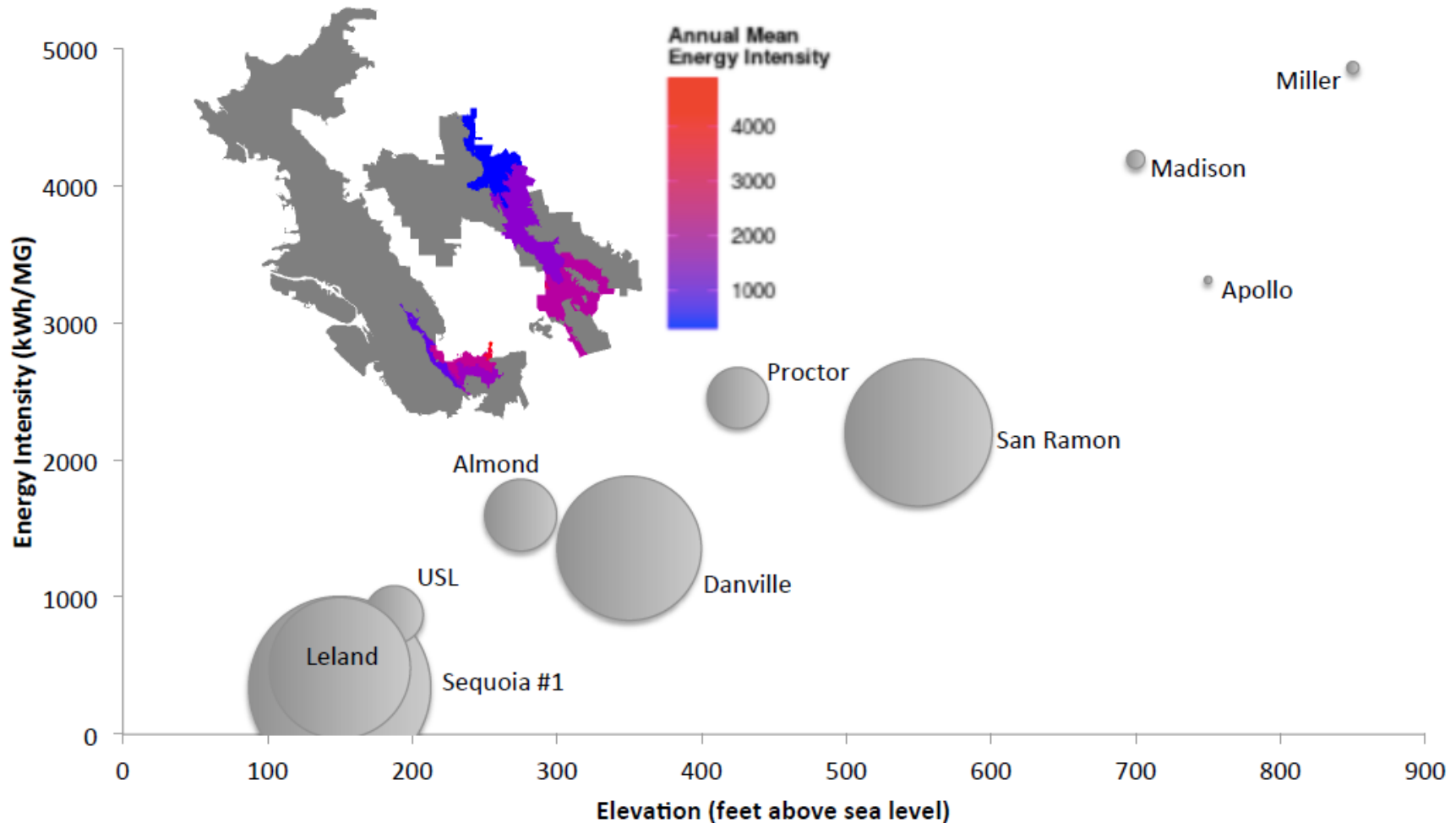
UC Davis Study Project Goals



- Estimate energy intensity (EI) of water
- No one-size-fits all EI number that can be given a gallon of water
- Need to consider seasonal and spatial effects on energy



Spatial Variation in Energy Intensity



Size of the bubbles = relative water consumption by zone

Benefits

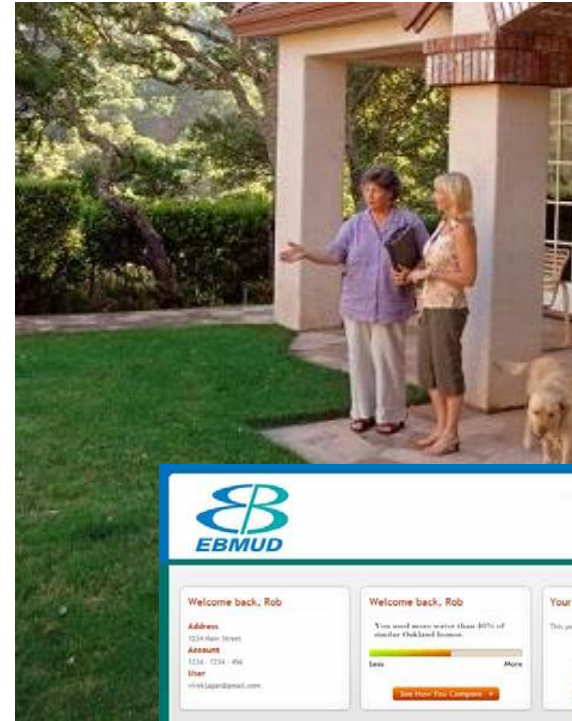


- Developed characterization of when and where energy is being used
- Map of energy intensity enables intelligently targeted conservation efforts and infrastructure upgrades
- Set realistic targets for energy and water conservation
- Enable energy efficiency programs through water conservation

Less Water = Less Energy



- Promote water conservation
- Demand Management
 - Home surveys and rebates
 - Education and information
 - New service regulations
 - Research on technology

A screenshot of the EBMUD website dashboard. The page features the EBMUD logo at the top left. Below the logo, there are several sections: 'Welcome back, Rob' with user information, 'Your Water Savings' showing a savings of \$102, 'Understand Your Bill' with a 'water SMART' logo, and 'Indoor vs Outdoor' with a bar chart comparing water usage. The dashboard is designed with a clean, user-friendly interface in shades of blue and orange.

Welcome back, Rob

Address: 1234 Main Street
Accounts: 1234 - 1234 - 456
User: user@ebmud.com

Welcome back, Rob

You used more water than 80% of similar Oakland homes.

Less More

[See Your Bill Compare](#)

Your Water Savings

This year you could save...

\$ 102

[See Your Bill Compare](#)

Understand Your Bill
HOW MUCH YOU PAY FOR WATER

EBMUD reads your water meter every two months to determine how much water has been used by your home in that period. Sewer charges are based on the amount of water used indoors vs. outdoors.

Your Bill Detail

Your current bill reflects your water use for the period August 13 to October 15, 2016.

In 61 days you used 12,000 gallons of water.

Water Usage	\$234.00
TOTAL	\$234.00

Your home used 48.2 gallons per person per day. On average this cost \$48.2 per day.

See how this compares to your historical usage and find out how you can save money on your bill.

water SMART

Indoor vs Outdoor

Indoor	Outdoor
<div style="width: 80%; height: 20px; background-color: red;"></div>	<div style="width: 40%; height: 20px; background-color: red;"></div>

[Compare Your Use](#)
HOW YOUR WATER USE STACKS UP

[Ways To Save](#)
WAYS TO SAVE MONEY AND WATER

Water: Purity | Water: Usage | Low | Comparison | Water: Saving Actions
Copyright 2016 Improvement Solutions. All Rights Reserved. | Privacy Policy | Terms & Conditions

Steamer Field Study Cost Comparison



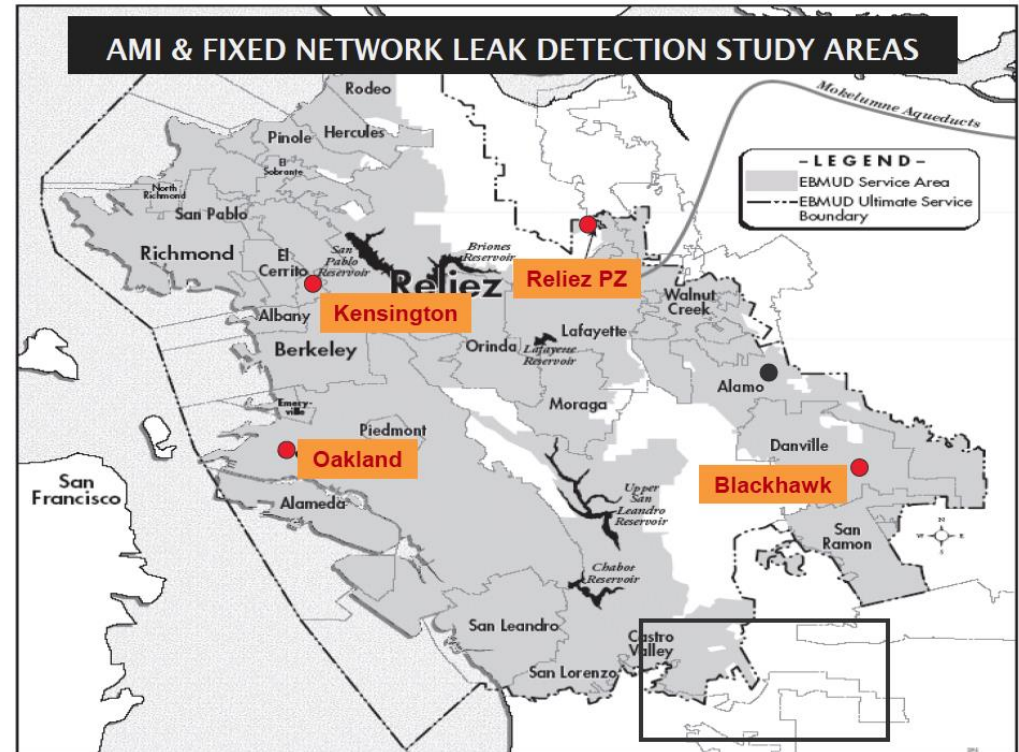
Steamer Type	Boilerless Steamer (single compartments)	Boiler-Based Steamer (single compartments)
Annual Energy	\$912	\$4,822
Annual Water	\$33	\$979
Total Costs	\$945	\$5,801
Savings	\$4,856	

Based on monitoring 12 steamers with an average daily use of 6.5 hours
360 days/yr operation at \$0.13/kWh & \$5.00/100 cu.ft. water/sewer

A Multi-Scalar Approach





- Infrastructure-wide
 - SCADA system data
 - Asset data
 - Energy data
- Four Pressure Zones
 - Water meter data
 - Energy meter data



Advanced Metering Infrastructure Projects



Website Features	 <p>Blackhawk</p>	 <p>Reliez</p>
Historical Use	Previous 10-years	NA
Water Use Data	Yearly, monthly, daily, hourly	
Data Units	Billing units, cubic feet, gallons, dollars	
Customized Alerts	Potential leaks, daily water budget	
Notifications	Email, telephone, postcards	
Customer Reports	Graphical and Excel	
Admin. Reports	Aggregate consumption, leakage, demand profiles	

Blackhawk: Aggregate Hourly Consumption Profile



SIMON SAVES

Welcome, admin | Logout

Admin Controls

MANAGE ADMINS

USER LOOKUP

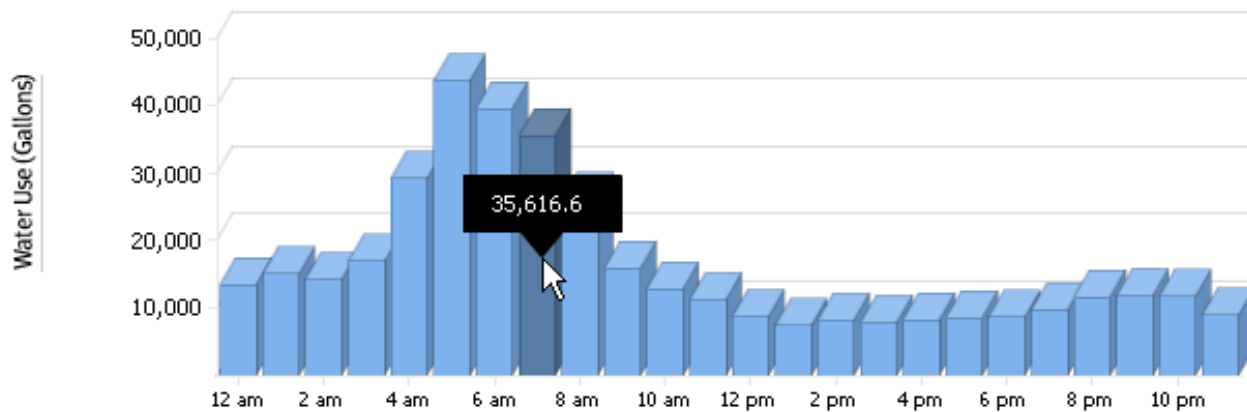
REPORTS

SYSTEM MESSAGES

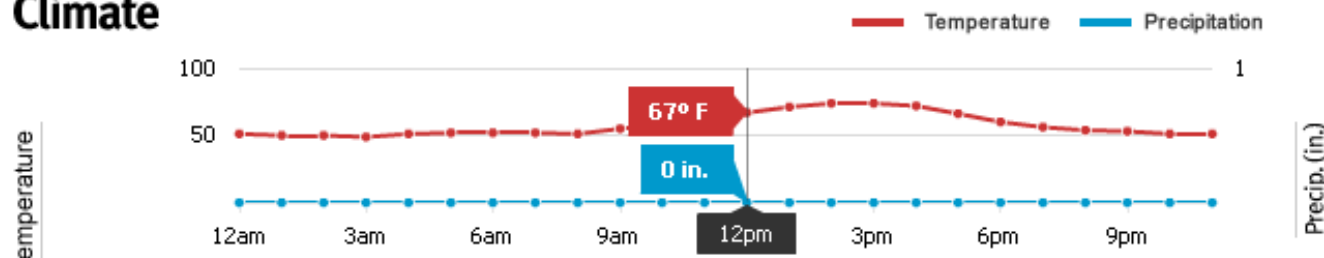
Reports > Water Usage

Hourly Water Usage

Hourly usage for 10/10/2009



Climate



Quick View

Yearly Monthly Daily **Hourly**

Meter Read Report

- Monthly Reads
 Daily Reads
 Hourly Reads

Select Month

DOWNLOAD

Consumption Report

Enter timeframe

Filter: Usage is greater than

Gallons

DOWNLOAD

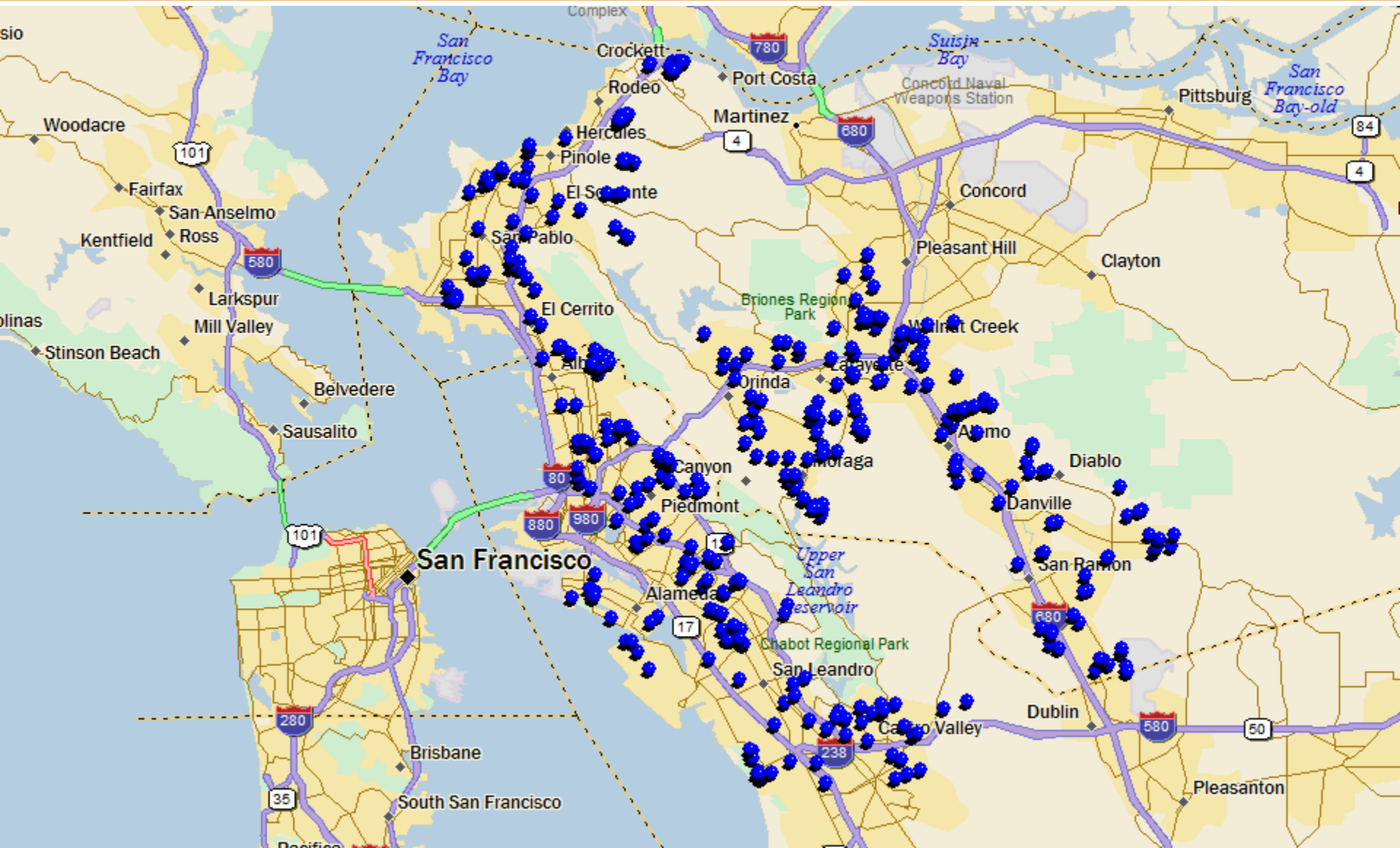
Blackhawk: Automated Reading and Billing Statistics



- >35,000 billing reads October 2011- June 2013
- >18 million hourly reads that customer have access to for 2013
- >100 million hours of consumption data available to conservation staff since 2009



Unmeasured Flow Study



Unmeasured Flow Study



- Replaced approximately 500 meters with Sensus Iperl Mag Meters
- Over 200 pulled meters tested down to 1/32nd gpm
- Iperl Meters remain accurate at 1/37 gpm
- Meter Resolution is 0.001 CF or about 1 ounce of water
- Datalogging at 1 minute intervals
- 60 million meter reads!

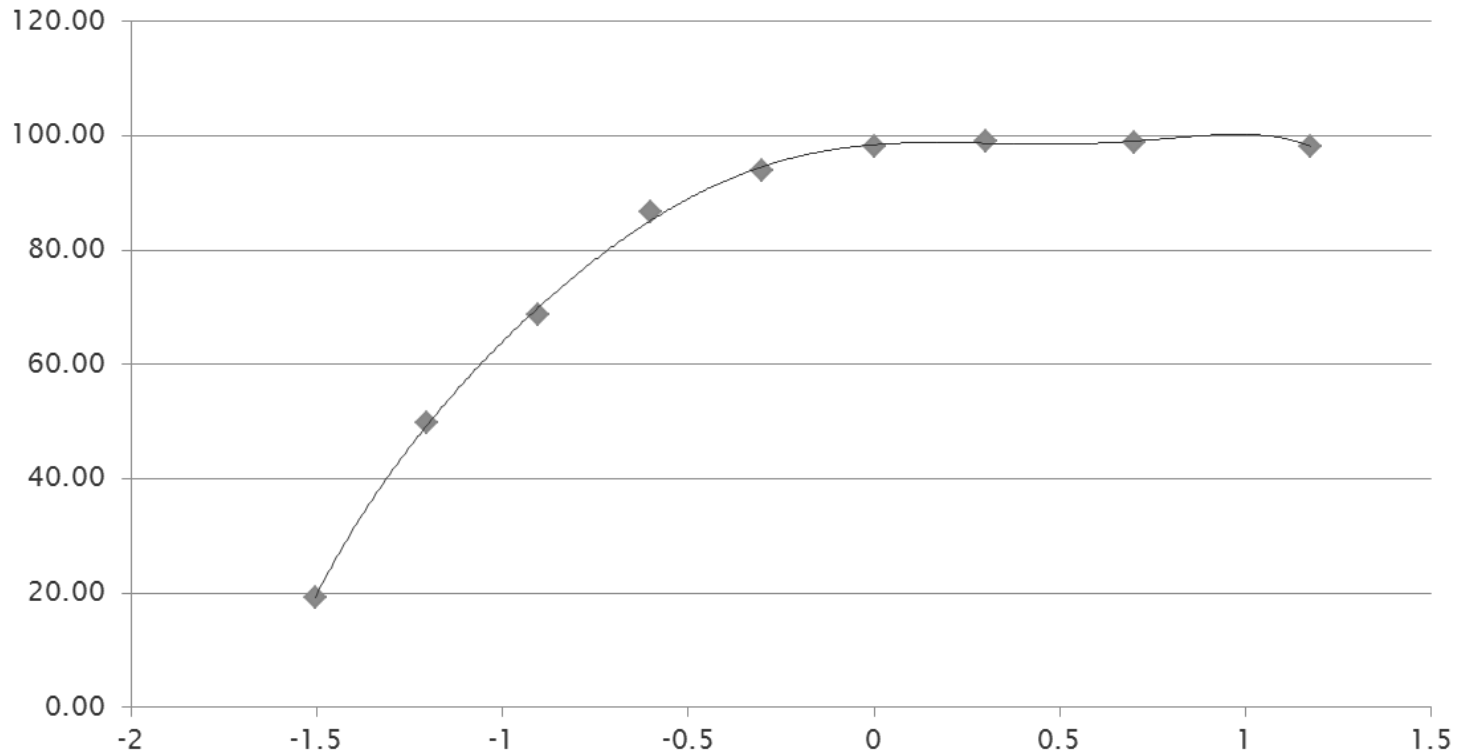


Unmeasured Flow Study Preliminary Results



Flowrate	15	5	2	1	1/2	1/4	1/8	1/16	1/32
% Accuracy	98.2	98.9	99.2	98.1	93.9	86.8	68.7	49.9	19.2

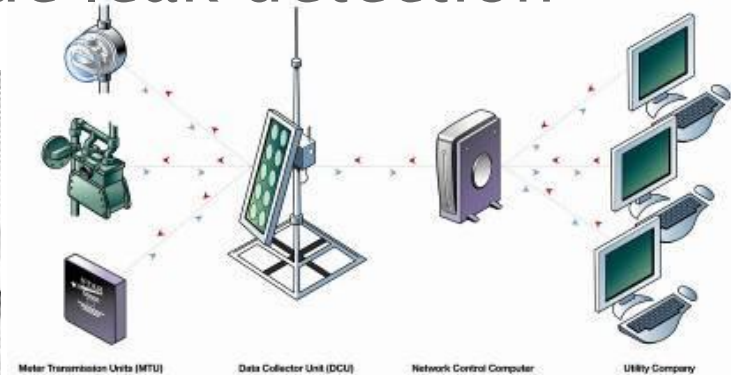
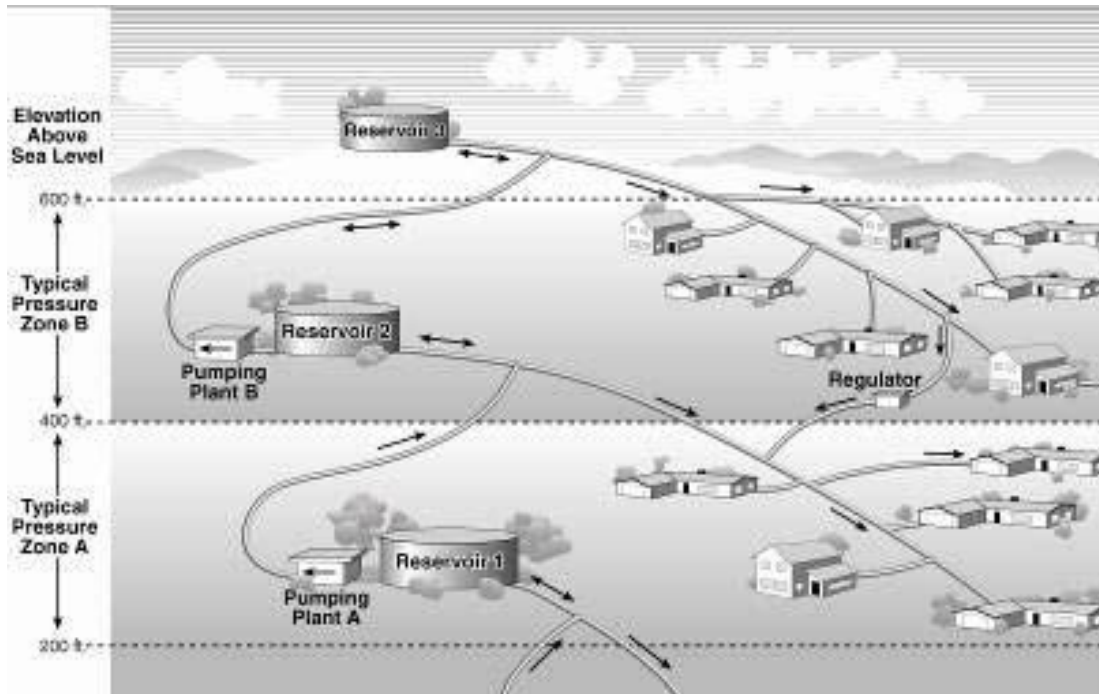
Meter Accuracy vs. Log Flowrate



Water Balance – Leak Detection



Concept: Real-time, spatially derived water balances to enhance system wide leak detection

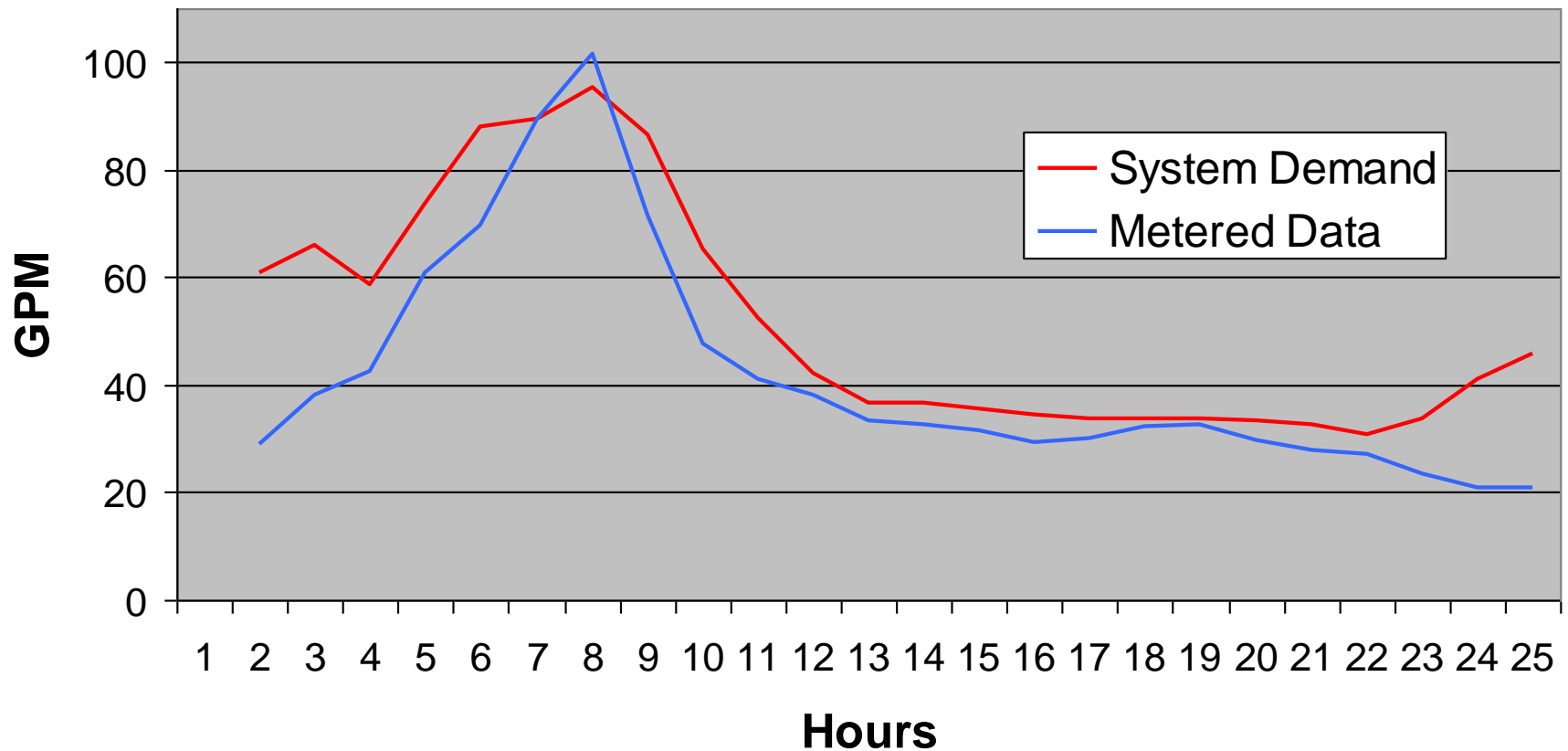


Impact: Accelerate leak detection to reduce water loss and minimize potential pipe damage and service interruption.

Pressure Zone Balancing



**Round Hill Diurnal Curve December
(Pumped vs. Metered)**

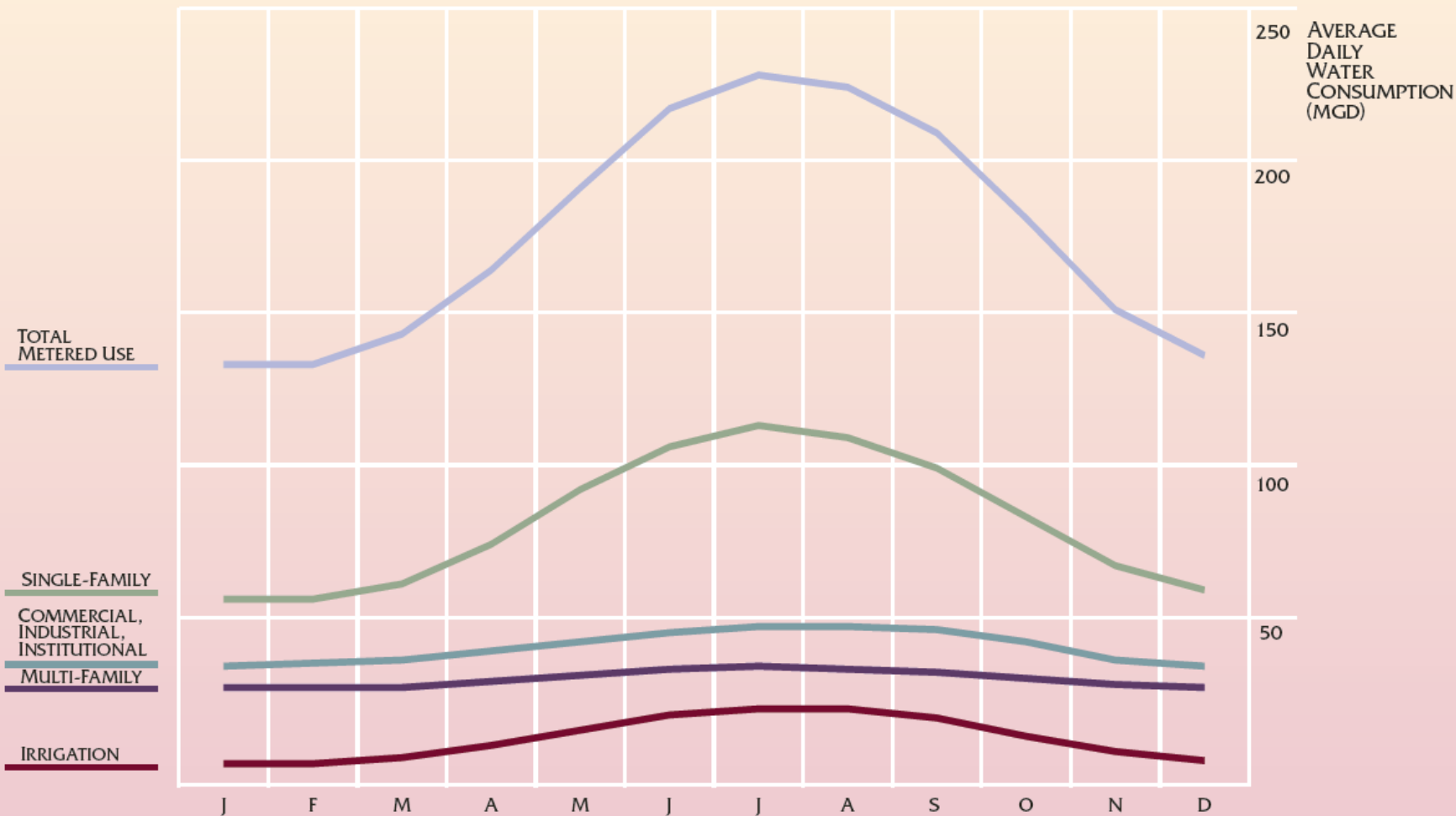


Seasonal Use by Customer Category



FIGURE 6-4

MONTHLY WATER USE BY CUSTOMER CATEGORY



NOTES:

1. Based on Calendar Year 1975-2010 consumption data.
2. Total metered use Includes water, fire and hydrant use by all customer categories, including petroleum.

How do we size new facilities?



- Statistical analysis of historical peaking factors (peak day/average annual) to determine 1 in 20 year return period (maximum day demand)
- Apply peaking factor to projected future demands from 2040 Demand Study
- Apply Engineering Standard Practice sizing criteria
 - Pumping Plants: 1.5 X Maximum Day Demand
 - Reservoirs: 1.0 X Maximum Day Demand
 - Water Treatment Plants: 1.0 X Maximum Day Demand
 - Pipelines not straightforward (based on level of service) but are influenced by Maximum Day Demand

Water Conservation: Why does it matter?

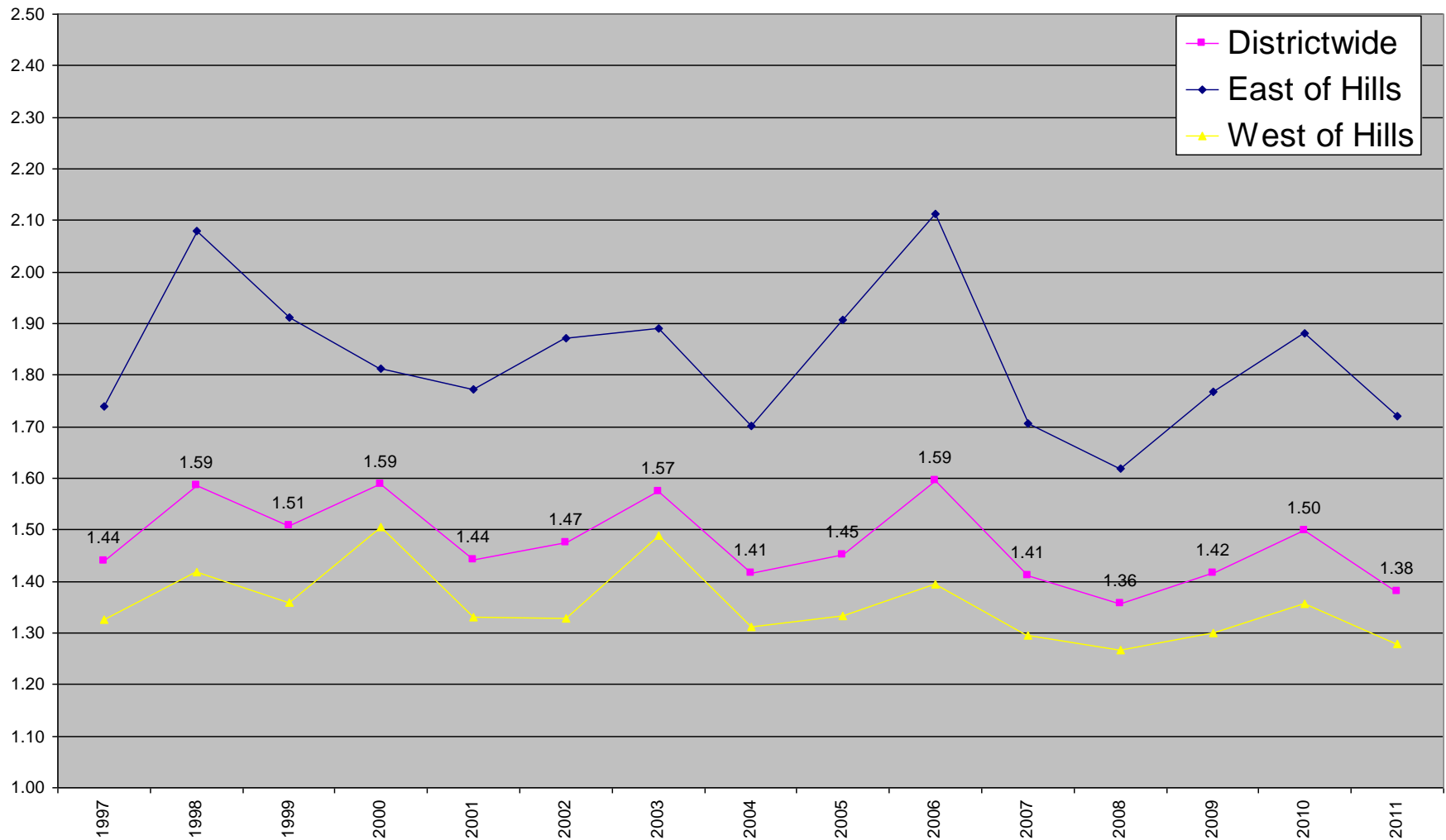


- 44 MGD Districtwide Average Annual Conservation
- 1.59 Districtwide Maximum Day Demand Peaking Factor
- 70 MG Storage, 70 MGD Water Treatment Plant, 105 MGD Pumping Plant, and ??? Pipeline Capacity
- Expand Sobrante WTP Capacity by 25 mgd (55 mgd to 80 mgd)
 - Capital Cost Estimate (2007) = \$72.6M (~\$2.9M/MGD)
- New Wildcat PP at 32 mgd
 - Capital Cost Estimate (2007) = \$9.9M (~\$3.1M/MGD)
- New Highland Reservoir at 2.7 MG
 - Contract* Cost (2010) \$5.7M (~\$2.1/MG)

Historical Maximum Day Demand Peaking Factors



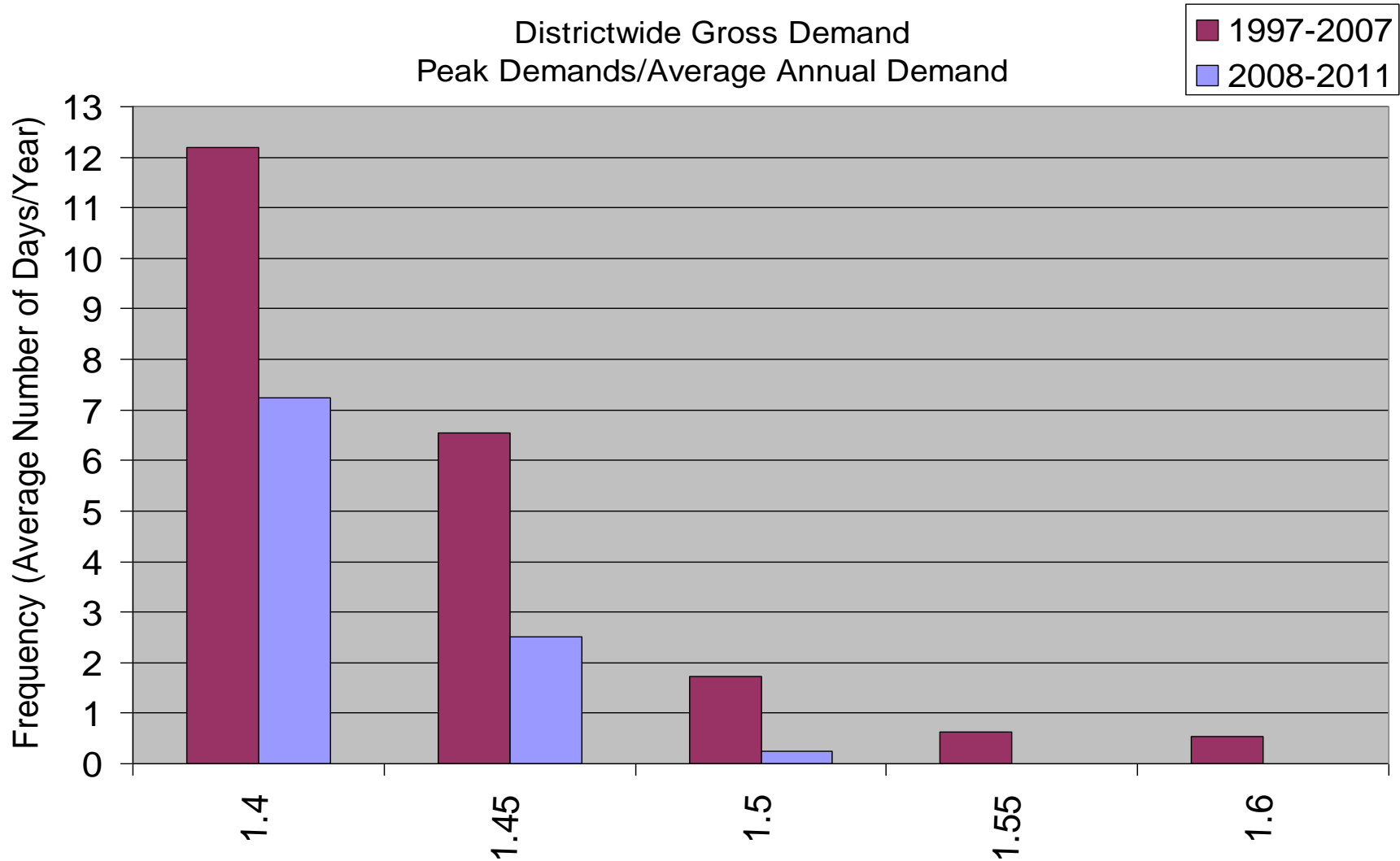
West of Hills & East of Hills Gross Demand
Peaking Factors (Maximum Day Demand/Average Annual Demand)



Frequency of High Demand Day Factors



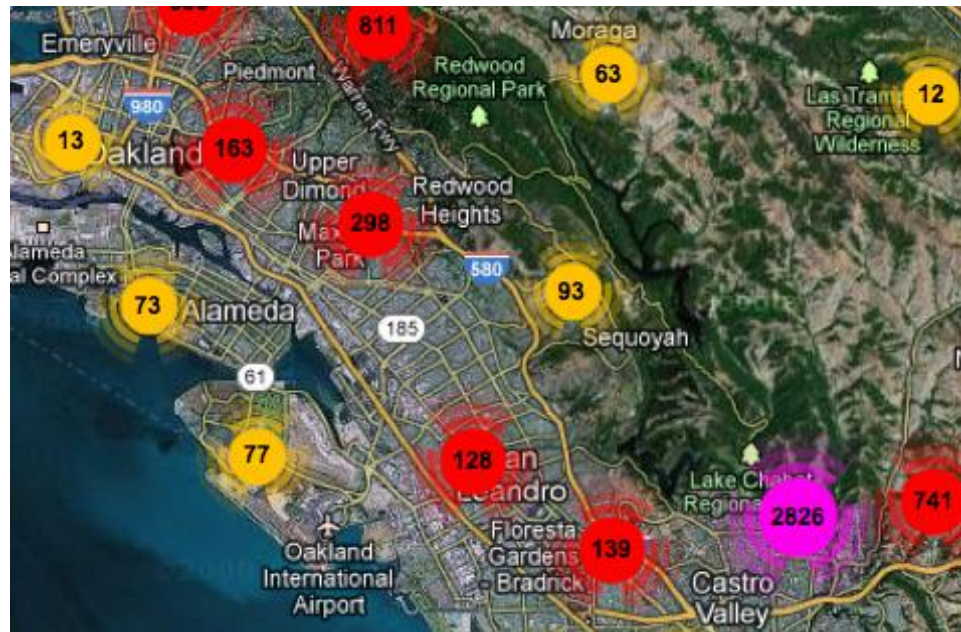
Districtwide Gross Demand
Peak Demands/Average Annual Demand



Home Water Report Pilot Study Participants



City	No. of Participants	Control Group	Total
Castro Valley, CA	8,000	-	8,000
Oakland, CA	-	3,500	3,500
Random	1,500	1,500	3,000
Total	9,500	4,000	14,500



EBMUD-PG&E Joint Water-Energy Report Pilot Proposal



- Evaluate parcel-level energy savings achieved through water reports
- Estimate system-level energy savings achieved through water reports (embedded energy)
- Develop template for combined water-energy report
- Test combined report format with focus group
- PG&E funding through *Emerging Technologies* program w/potential for future resource programs

Home Water Report
 Hi, Salvador! Thanks for taking time about your water and ways to save it.
 Your household uses 181 gallons of water per day.
 Take Action
 You used 3,270 more gallons than the average 25,000 homes in a similar-sized property. It's time to change the number of gallons you estimate for your household. Go online or give us a call.
 Visit www.ebmud.com/mywater
 Registration Code: GAC775

Your WaterScore
 You: 181 gpd
 Average Households: 127 gpd
 Efficient Households: 84 gpd

3 Suggestions For You
 Stop a Leaking Toilet, Seasonal Irrigation Tune-up, Choose Plants Wisely

Your Home Energy Report
 Account number: 06/22/13-07/23/13
 This report gives you context on your energy use to help you make smart energy saving decisions. For a full list of energy saving products and services for purchase, including rebates from PG&E, visit pge.com/moneysaver

Last Month Household Comparison | You used 4...
 Efficient Similar Homes: 818
 YOUR HOME: 771
 Similar Homes: 771

Last 12 Months Household Comparison
 Electricity: 34% more electricity than efficient similar homes

Business Energy Report
 Reporting period: Account #: 012 2012 - Sep 2013 2504321798
 ATTN: GENERAL MANAGER
 ADDY, PAT
 7316 PINE ST
 PASO ROBLES CA 93444-2244

Annual energy cost comparison
 THE COWGIRL CAFE: \$10,120
 Average restaurants: \$7,688

Annual energy cost comparison
 You spend \$2,432 more on electricity than average restaurants.
 Your electricity costs over the last 12 months are compared to the average energy costs of restaurants with similar characteristics.

Annual energy cost comparison
 This comparison is based on your utility rate, climate, and the following details:
 [] You operate a restaurant
 [] You are normally open 70 hours per week
 [] This occurs about 2,000 sq ft
 [] You are located in a warm summer, cool winter climate.

Annual energy cost comparison
 To improve the accuracy of the comparison, please visit www.pge.com/ber or call 1-877-647-6437

Annual energy cost comparison
 We want to help you lower your energy bills
 In the coming months, you will receive a series of reports that focus on the different ways your business uses energy.

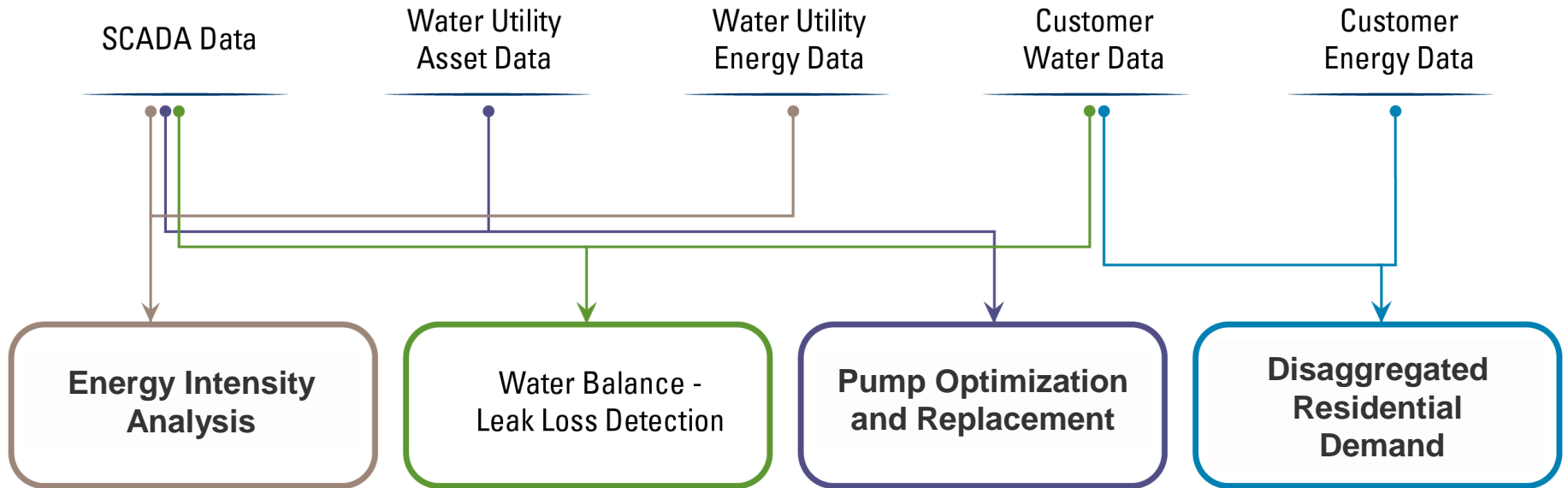
Annual energy cost comparison
 DID YOU KNOW?
 Restaurants use 5 to 7 times more energy per square foot than other commercial businesses.
 Source: 2002 Commercial Buildings Energy Consumption Survey (CBECS) data

Annual energy cost comparison
 34
 ©2013 PG&E Energy Inc.

Foundational Data Analytics



Concept: Integrating existing data and enhanced analytics to design and demonstrate cloud computing



Impact: Deeper energy & water savings, better monitoring & performance verification, and new revenue streams

W-E Challenges & Opportunitites



Challenges

- Need additional water and energy use data
- Need new methodologies to address efficiency gains and GHG/carbon credits and avoid double counting
- Differential in water and energy costs and ROI

Opportunities

- Advance utility, market and consumer awareness
- Improve and expand on W/E data collection and metrics
- Analyze and promote incentive funding for cold and hot water efficiency programs that save energy
- Expand public-private efficiency partnerships

