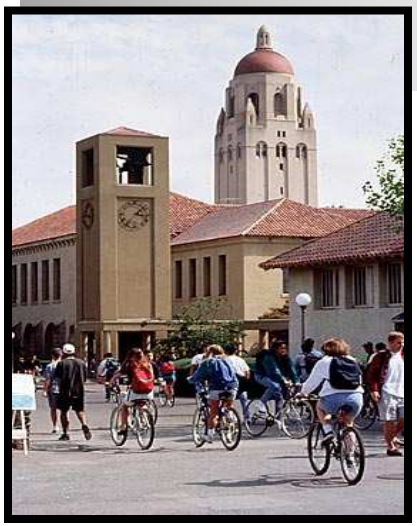
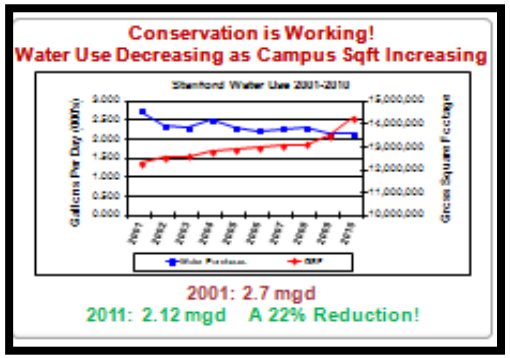
Seizing Opportunities and Developing Metrics Using Real-time Water Use Monitoring at

Stanford University



College Water Efficiency Group
SCVWD

September 24, 2012



Marty Laporte, Stanford Utilities

Acknowledgments

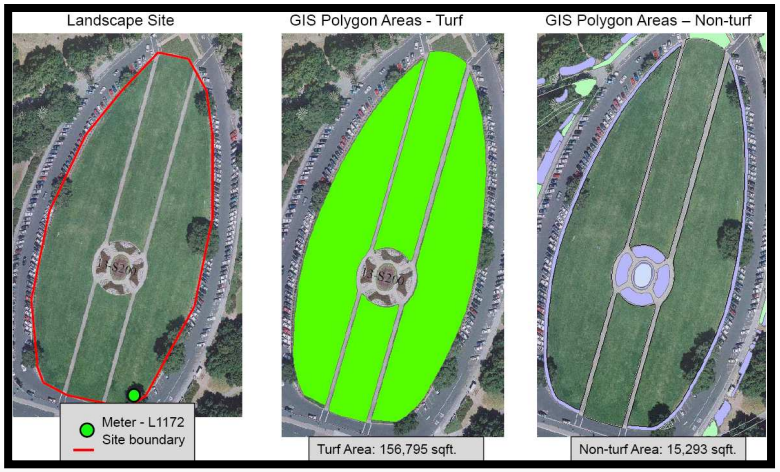
Team working on Seizing Opportunities and Developing Metrics

Stanford University

Utilities, School of Medicine, Grounds, Athletics staff

Maddaus Water Management

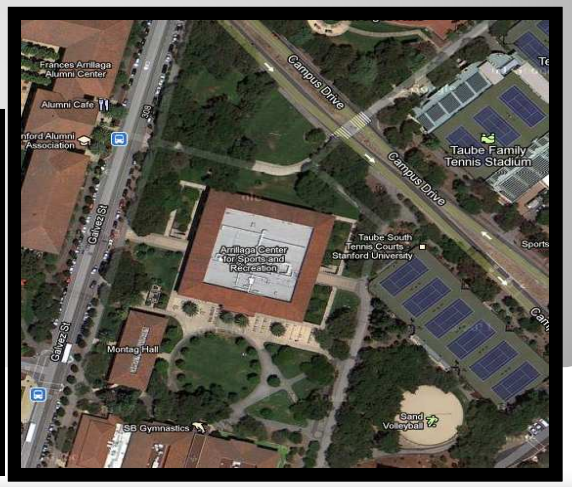
Aquacue Inc. - Barnacles, real-time water use monitoring



Stanford University Campus, California

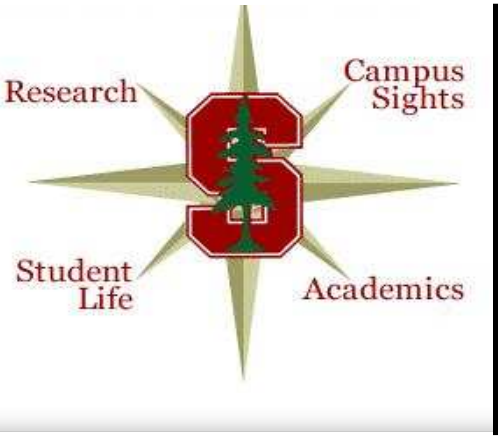
Overview

1. Stanford's Water System & Water Conservation Program
2. Opportunities Abound
   - Find and Seize Opportunities
   - Technology and Tools
3. Metrics Development: Data Collection & Analysis
4. Results & Next Steps
5. Questions



Stanford's Potable & Non-potable Water Systems

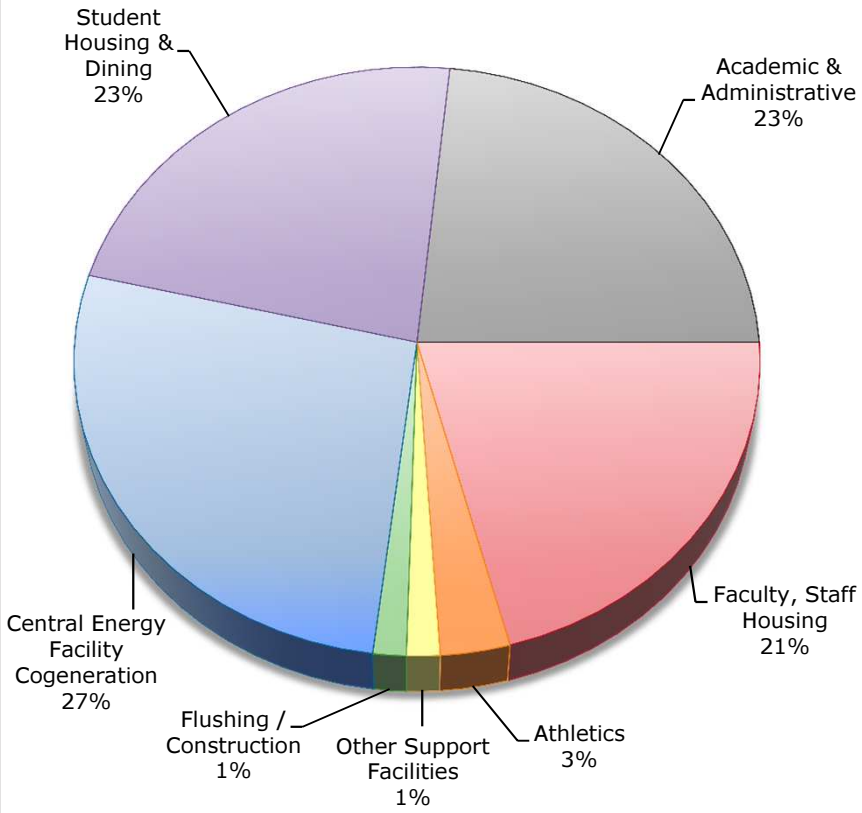
- ✓ **Potable Water: San Francisco Public Utilities Commission (SFPUC), allocation is 3.033 MGD**
- ✓ **Non Potable Water: (used for most campus irrigation)**
  - **1.2 M sqft green areas,**
  - **1 M sqft of shrubs,**
  - **580,000 sqft groundcover**
- ✓ **Water systems serve daily average campus population of 30,000**
- ✓ **Conservation planning provided in 2000 Water Master Plan was just the beginning!**



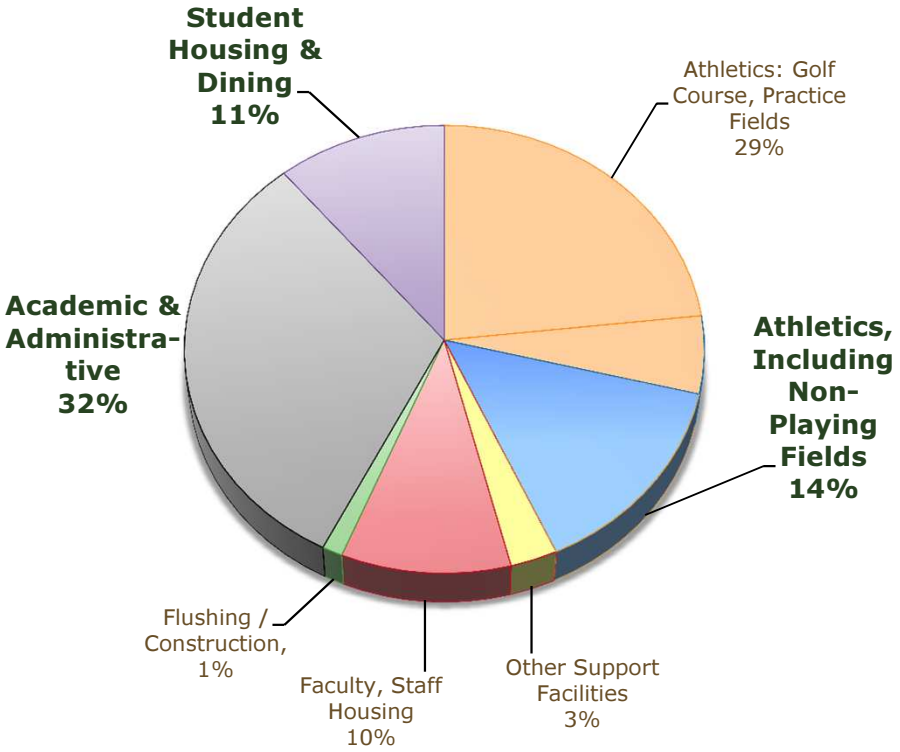
Potable and Non-Potable Water Consumption by Campus Groups

Potable Water Consumption

FY12: 2.16 MGD



Non-potable Water Consumption FY12: 1.18 MGD



Water Conservation Program at Stanford

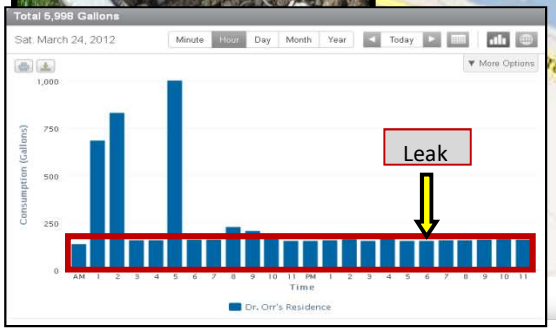
- **Water Conservation & Recycling Master Plan 2001**

Goal	Water Savings 2001- 2010	Cost
Planned	0.58 MGD	$5.14M
Actual	0.59 MGD	$2.3M + Rebates from SCVWD

- **20 Different Measures 2001-2012:**

Device	Number
Toilets, Showers, Faucets, Urinals	12,093
Clothes Washers	485
Spray Valves	74
Steam Sterilizers (For research equipment sterilization)	66
Various Projects: Vacuum Pump Replacement, Energy Facility Blowdown Reuse, Once Through Cooling Retrofits	Numerous
Landscape – Retrofits to Efficient landscape, ET Controllers, Faculty / Staff Home Landscape Audits, Demo Garden	Numerous

Stanford University Water Efficiency Projects 2000 to 2012



NEW CONSTRUCTION

RENOVATIONS

OPPORTUNITIES

EXISTING INEFFICIENT EQUIPMENT

EXISTING INEFFICIENT PROCESSES

Establish
Water Efficiency Goals and
A Demonstration Program
e.g.,
http://lbre.stanford.edu/sem/sites/all/lbre-shared/files/docs_public/we_performance_goals_10.20.10.pdf

Work with
Design Team
Project Managers

NEW CONSTRUCTION

Review Plans
Comment, Suggest
e.g., standardize plans reviews;

Make it Easy!

Know About Renovation Projects in Time to Recommend Efficiency Improvements

Ready and Available: Provide Useful Information About New WE Technologies, Independent Testing;
http://www.map-testing.com/about/maximum-performance/map-search.html

RENOVATIONS, RETROFITS

PERFORM SITE SURVEYS RETROFIT EXISTING INEFFICIENT

EQUIPMENT

Collaborate & Make it Easy!

Know Your Facilities, Processes

Talk & Walk with Facilities Staff, Plumbers, Engineers, Building Managers

EXISTING INEFFICIENT EQUIPMENT and PROCESSES

Prioritize and Focus

Make it Easy!

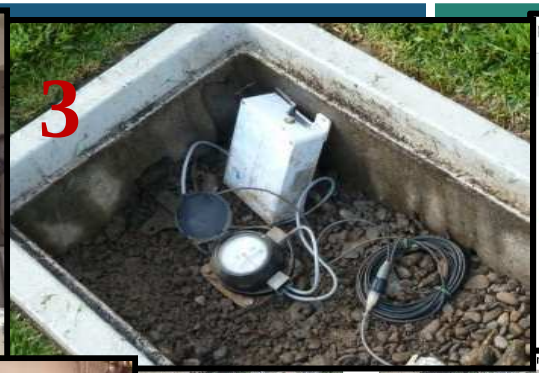
NEW CONSTRUCTION

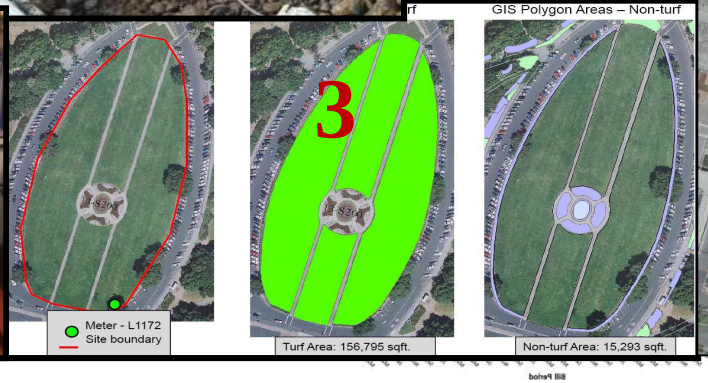
+ Recommended fixtures
+ Provided references for WE options
+ Verified High Efficiency installations (plans reviews)

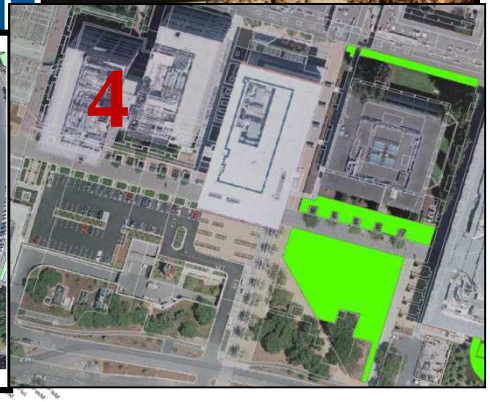
RENOVATIONS RETROFITS for EXISTING

+ Inefficient Equipment
+ Improve Processes

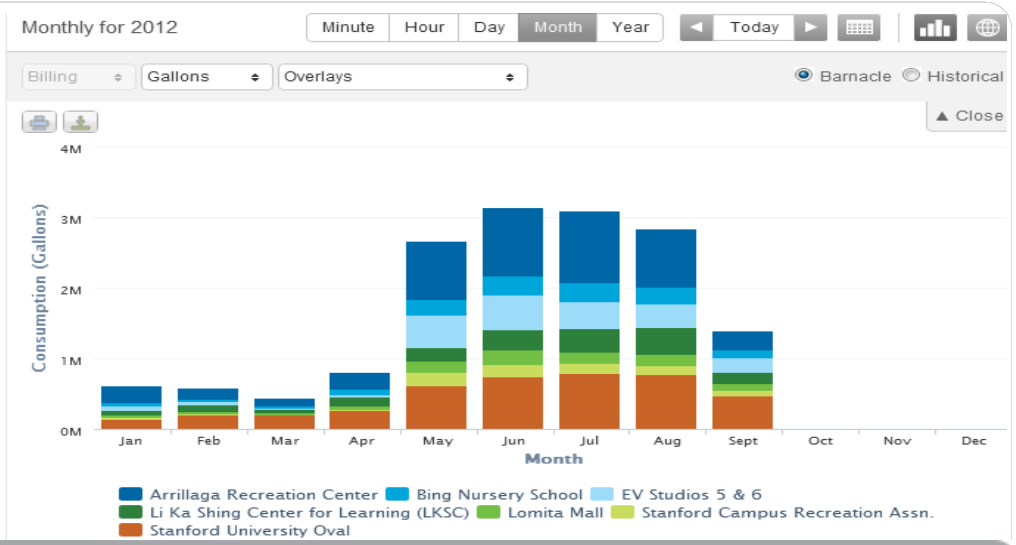
2012 OPPORTUNITIES SEIZED







Real-time monitoring data used to create metrics and BMPs for landscape mangers

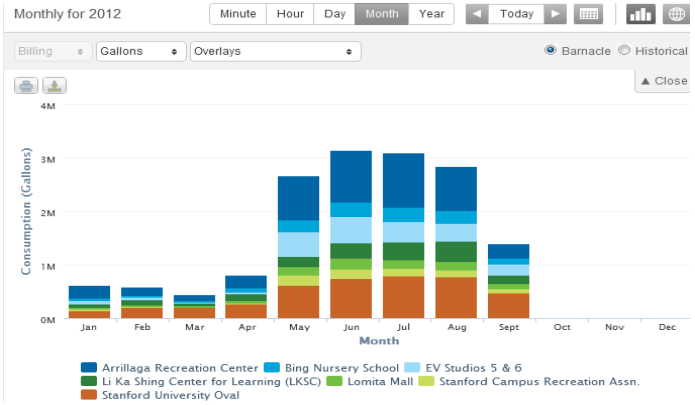


Results

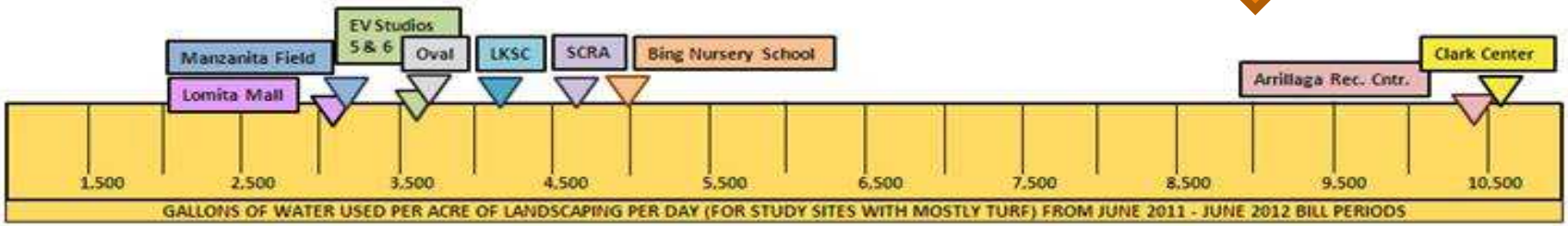
Show Columns

	Location	Alerts	Site	Water	Main Use	Turf Area	Turf Ratio
1	Arrillaga Recreation Center	(1)	Athletics	Lake	Irrigation	1.63	94
2	Bing Nursery School	(1)	Academic (Grounds Dept.)	Domestic	Irrigation	1.01	80
3	EV Studios 5 & 6		Student Housing	Lake	Irrigation	1.94	75
4	Li Ka Shing Center For Learning (LKSC)	(1)	Med School	Lake	Irrigation	1.65	40
5	Lomita Mall	(1)	Academic (Grounds Dept.)	Lake	Irrigation	1.02	85
6	Stanford Campus Recreation Assn.	(1)	Athletics	Domestic	Irrigation	0.77	70
7	Stanford University Oval	(1)	Academic (Grounds Dept.)	Lake	Irrigation	3.95	90

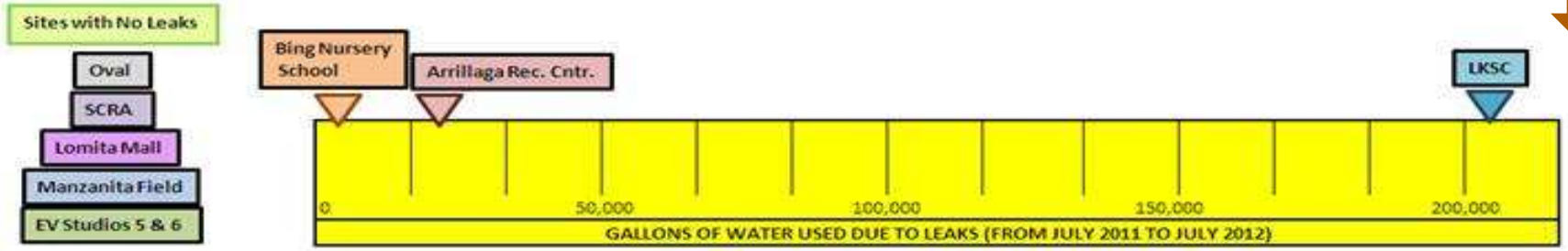
Real-time Monitoring & Reporting Technology



Gallons per acre per day (from June 2011 to June 2012)



Gallons Leaked from July 2011 to July 2012



BMPs and Metrics Developed for Landscape Management

BMPs

- Develop historic base/seasonal record
- Implement PM program
  Automate leak alerts -**YES!**
- Use weather-based controller
- Implement Site audits every 3-5 years
- Develop routine communication about water use, helping customers be more efficient

Metrics

- Update annual base/seasonal use data, send to customers
- Find "invisible" leaks within 48–72 hours
- Responsiveness to weather change within 24 hours
- Compare water use to audit recommendations
- All sites: compare water use/acre.
  Each site: compare monthly water use with monthly water use for previous year.

Summary and Results

1. **Long-term success requires seizing opportunities and an integrated approach:**
   - ✓ **Collaborating with facilities, project management, contractors' staff**
   - ✓ **Opportunities for improving efficiency exist: new buildings, retrofits, existing inefficient equipment and processes**
   - ✓ **Test new technology and use real-time monitoring to identify specific water use, leaks, and verify water savings,**

2. **Real-time monitoring technology & water budgets provide factual information for successful changes in irrigation management.**
   - ✓ **Hourly water use data is a good tool for identifying/verifying leaks.**
   - ✓ **Daily water use data illustrates ET controllers respond faster to weather events than manually operated controllers.**

3. **Continuity is important: weekly reports, other communication about site water use is helpful to keep priming managers to take action. Small steps are most successful.**

Summary and Results, Cont.

4. **Development of useful metrics, BMPs require persistence, iterative verification:**
   - ✓ **using real-time water use data**
   - ✓ **understanding site characteristics**
   - ✓ **collaborating with site managers & customers**
   - ✓ **fine-tuning the irrigation to local conditions.**

Questions?

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Stanford Water Conservation Website:
http://lbre.stanford.edu/sem/water_conservation