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Water Conservation Technology Demonstrations for the Army

WaterSmart Innovations 2017

Conference and Exposition

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US Army Corps
of Engineers®

ERDC

Engineer Research and
Development Center

Outline

- Background
- Demonstration Technologies
 - Commercial Pre-Rinse Spray Valves
 - Portable Acoustic Leak Detection
 - Ultrasonic Smart Water Meters
- Significance



The Army Universe

ARMY VALUES

LOYALTY

DUTY

RESPECT

SELFLESS-SERVICE

HONOR

INTEGRITY

PERSONAL COURAGE

156 Installations

348 Utilities Systems

55,002 km^2 Land

91,292,869 m^2 Buildings

496,876 Soldiers

546,825 Civilians

345,823 Retirees

1,613,349 Family Members

=

**3,002,873 members of our team
supported by installations**



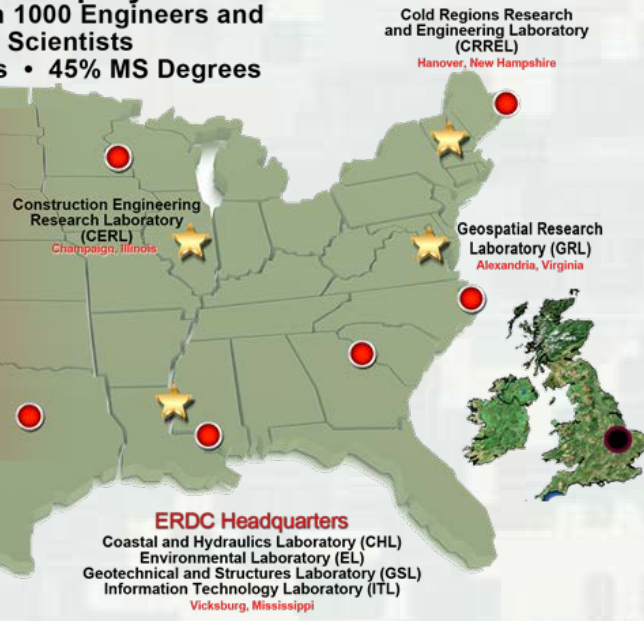
United States Army Engineer Research and Development Center

US Army Engineer Research and Development Center

ERDC

2500 Employees
More than 1000 Engineers and Scientists
32% PhDs • 45% MS Degrees

ERDC helps solve our Nation's most challenging problems in civil and military engineering, geospatial sciences, water resources, and environmental sciences for the Army, Department of Defense, civilian agencies, and our Nation's public good.



ERDC conducts research and development in 5 major areas:

1. Military Engineering
2. Environmental Quality and Installations
3. Water Resources
4. Geospatial Research and Engineering
5. Engineered Resilient Systems



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Major Water Mandates



Net Zero (28Jan2014)

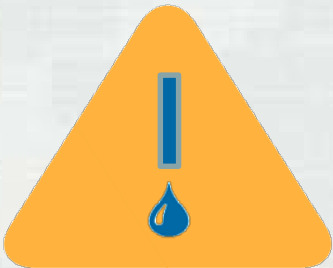
- Addresses water, energy, and solid waste
 - Emphasizes reduction and reuse.
 - Applies to both technology and behavior.
 - Contributes to installation security and resilience.

Sustainable Design & Development (17Jan2017)

- Green Buildings Council **LEED**.
- ASHRAE 189.1 requirements for outdoor water use.
- Encourages alternate water use considering non-market benefits.

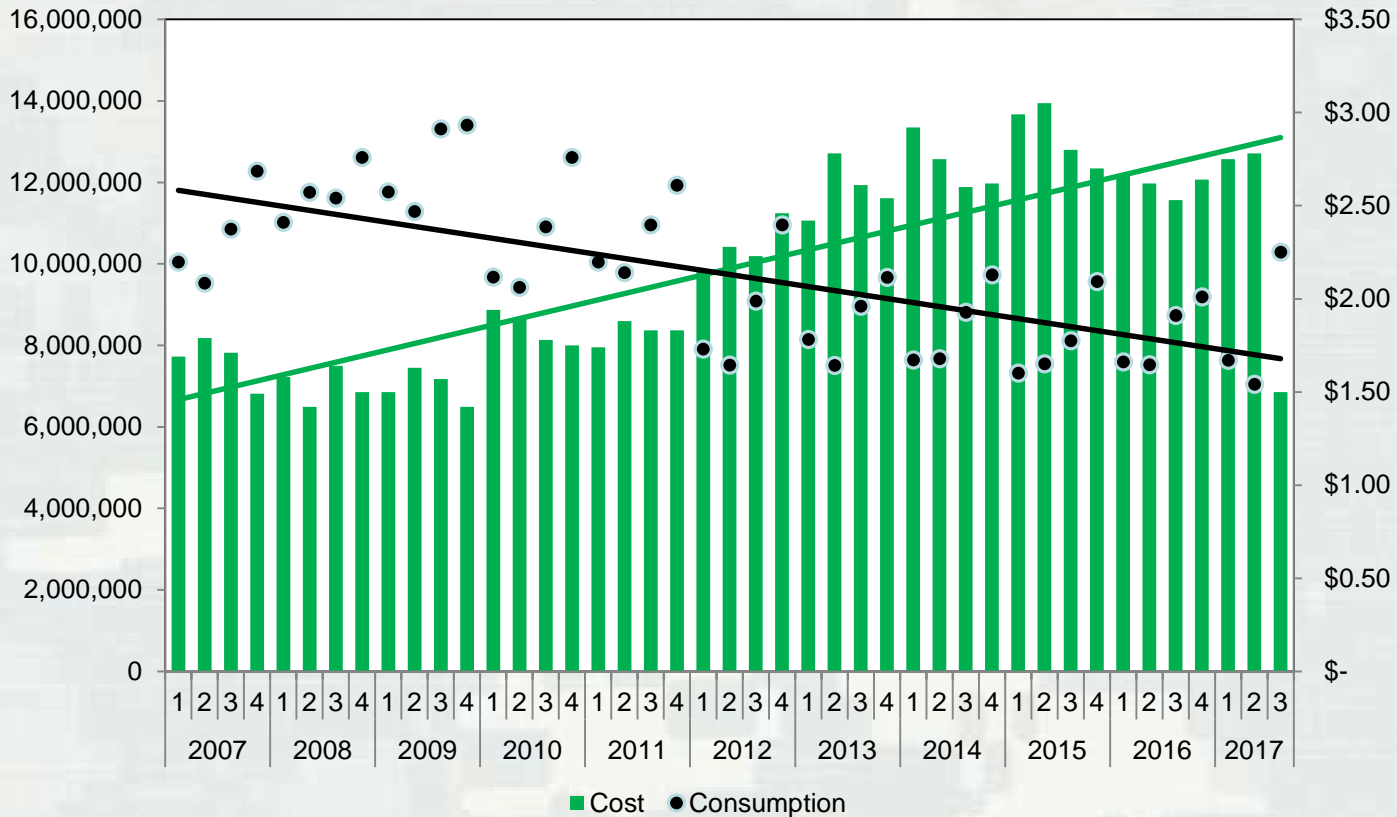
Water Security (23Feb2017)

- **14 day** supply for critical missions.
- Improve resilience: plan for restoration and reduce risk.



The Cost of Water is Rising

Army Water Use and Cost Trends
Quarterly, Active Installations



Traditional water pricing doesn't capture the value of water to the Army: the ability to support mission-critical activities.

Installation Technology Transition Program

- To demonstrate and validate:
 - ▶ The retrofit of existing food service facilities with WaterSense® certified pre-rinse spray valve technologies.
 - ▶ The use of portable acoustic leak detection equipment on potable water distribution systems.
 - ▶ The use of ultrasonic smart water meters as a cost effective alternative to conventional meters.
- These technologies are commercially available and yet are not in widespread use on Army installations.
- Unfamiliarity with these technologies along with the lack of Army success stories have been impediments to increased adoption by installations.



Commercial Pre-Rinse Spray Valves

Dish sink PRSVs are one of the easiest, most cost efficient and effective fixtures an operation can install. The sprayers cost around \$50-70 and use between .64 and 1.28 gpm, which can save an organization hundreds of dollars a year. Not only are the sprayers very efficient, but they also provide a superior spray over older units.

Chicago 90LABCP



Fisher 2949 Ultra Spray Valve



T&S Brass Equip 5SV



Encore KLP50



Pre-Rinse Spray Valve Technology

- While Federal standard is 1.6 gpm, WaterSense[®] standard is 1.28 gpm, 20% less (since 2013).
- WaterSense[®] PRSVs are independently certified to ensure efficient cleaning while using less water.
- Water savings are estimated at 7,000 gallons/year, cost savings of \$115 to \$240 per year, with paybacks from four to eight months.
- Reduce water use, water heating energy, wastewater discharges, and time required to clean dishes.
- Tested to 1,000,000 uses.



Fort Leonard Wood, MO

Golf Course Cafe



Bowling Alley



Army Club



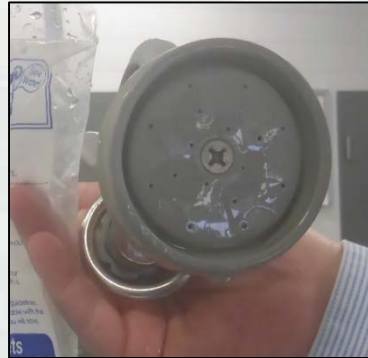
Army Dining Facility

Evaluation Criteria

- Rated gallons/minute.
- Tested gallons/minute.
- Spray Force (ounces-force).
- Cleanability (seconds to clean plate).
 - ▶ Other factors include spray pattern and pulse.
- Operator experience—does it work as intended?
 - ▶ User satisfaction survey
- Operations & maintenance—does it last?
- LCCA: water, energy, and O&M costs.



Site Survey



Pre- and Post-Retrofit Testing



Lessons Learned

- Routine inspections for leaks and broken or loose parts; tighten screws & replace the washer or replace the valve.
- Inspect valves periodically for scale build-up, and use cleaning products designed to dissolve.
- Empower kitchen personnel to change PRSV washers themselves by leaving spare washers near the sinks.
- Establish a system of replacing washers at a regular interval, similar to group relamping.
- Adjust hose height to be comfortable and include tie-back feature so that valve doesn't swing, potentially causing damage.
- Train users in the use of the always-on clamp, only when needed.
- Train users to report leaks, breaks, and incorrect operation; post a sign near the sink/food grinder with O&M contact information.



Impact to the Army

- Retrofitting pre-rinse spray valves with WaterSense® certified models can help meet water reduction goals with added benefits of conserving high cost water heating energy and decreasing wastewater discharges.
- Potential first users include Army installations with large centralized dining facilities.



Portable Acoustic Leak Detection

- Water loss is a common concern, with an acceptable water loss rate of 15%*, though actual values are usually higher.
- Lack of building water meters on Army buildings is a challenge to determining water loss.
- The use of simple, relatively inexpensive technology can empower operations and maintenance staff to conduct regular surveys.

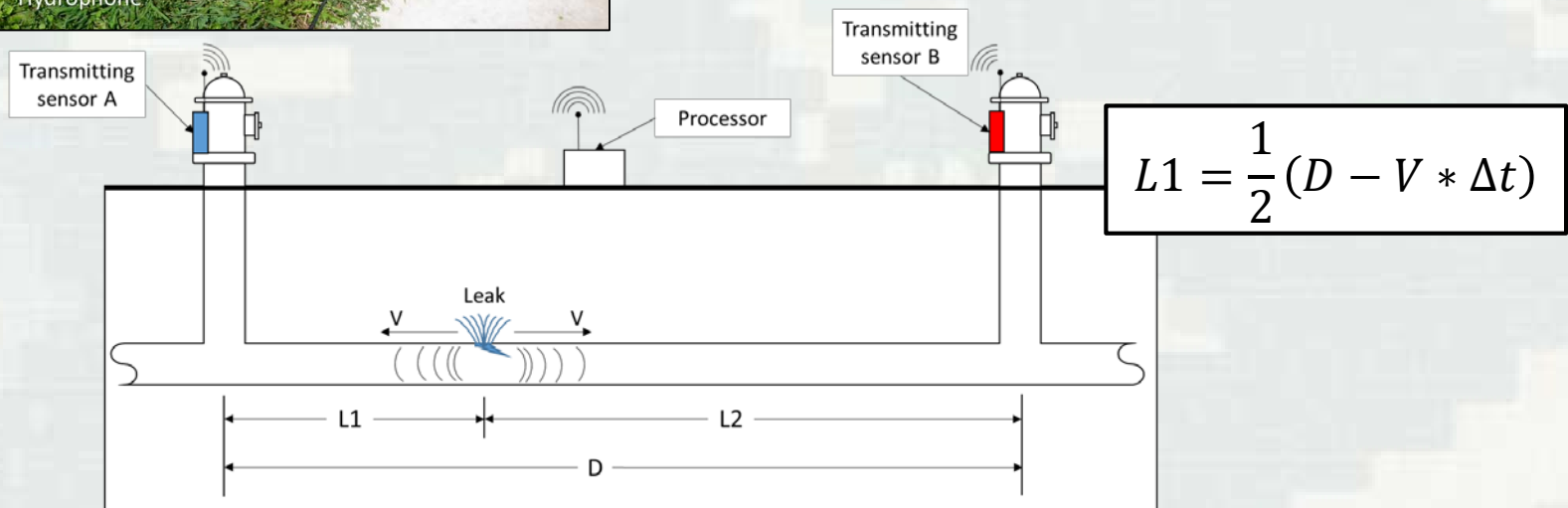


Army History with Portable Acoustic LD

- Tobyhanna Army Depot; 2010; 16 miles
 - ▶ Comprehensive survey at \$60K. [\$1.04/ft].
 - ▶ Installation of leak detection system at \$88K; loggers, leak correlation hardware and software.
- Fort Carson, CO; 2012; 16 miles
 - ▶ Contracted survey only at \$42K. [\$0.49/ft].
- Anniston Army Depot; 2015
 - ▶ Leak loggers, correlators & microphone (\$38K).
- Fort Leonard Wood; 2016
 - ▶ Microphones and leak correlator at \$26K.
 - ▶ Surveyed 8K feet of mains. [\$0.42/ft].



Principles of Acoustic Leak Detection



FLW Acoustic Leak Detection

Table 3-1. Age of water mains by type of pipe.

Construction Era	AC (mi)	DI (mi)	CI (mi)	PVC (mi)	Total (mi)	Percent of Total
1940-1959	0.98	1.59	32.10	0.64	35.31	32.45
1960-1969	21.27	0.02	12.12	0.25	33.66	30.93
1970-1979	2.52	0.66	12.31	0.45	15.94	14.65
1980-1989	0.68	0.01	0.80	0.00	1.49	1.37
1990-1999	1.72	2.87	6.75	1.96	13.30	12.23
2000-2009	0.16	1.80	2.49	3.93	8.37	7.70
2010-2013	0	0.21	0.53	0	0.74	0.68
Total (mi)	27.32	7.15	67.10	7.23	108.80	100.00
Percent of Total	25.11	6.57	61.67	6.65	100	

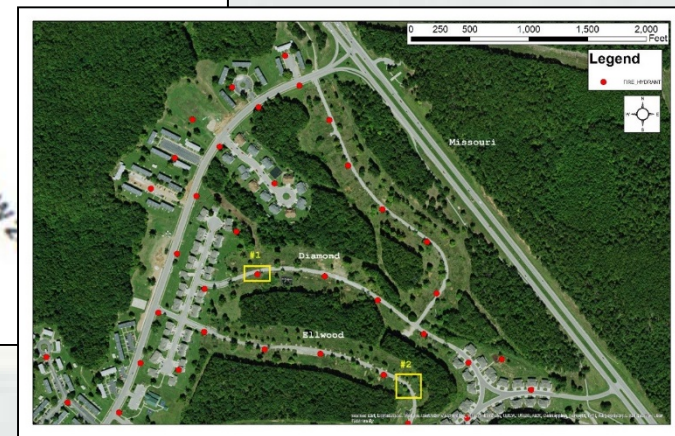
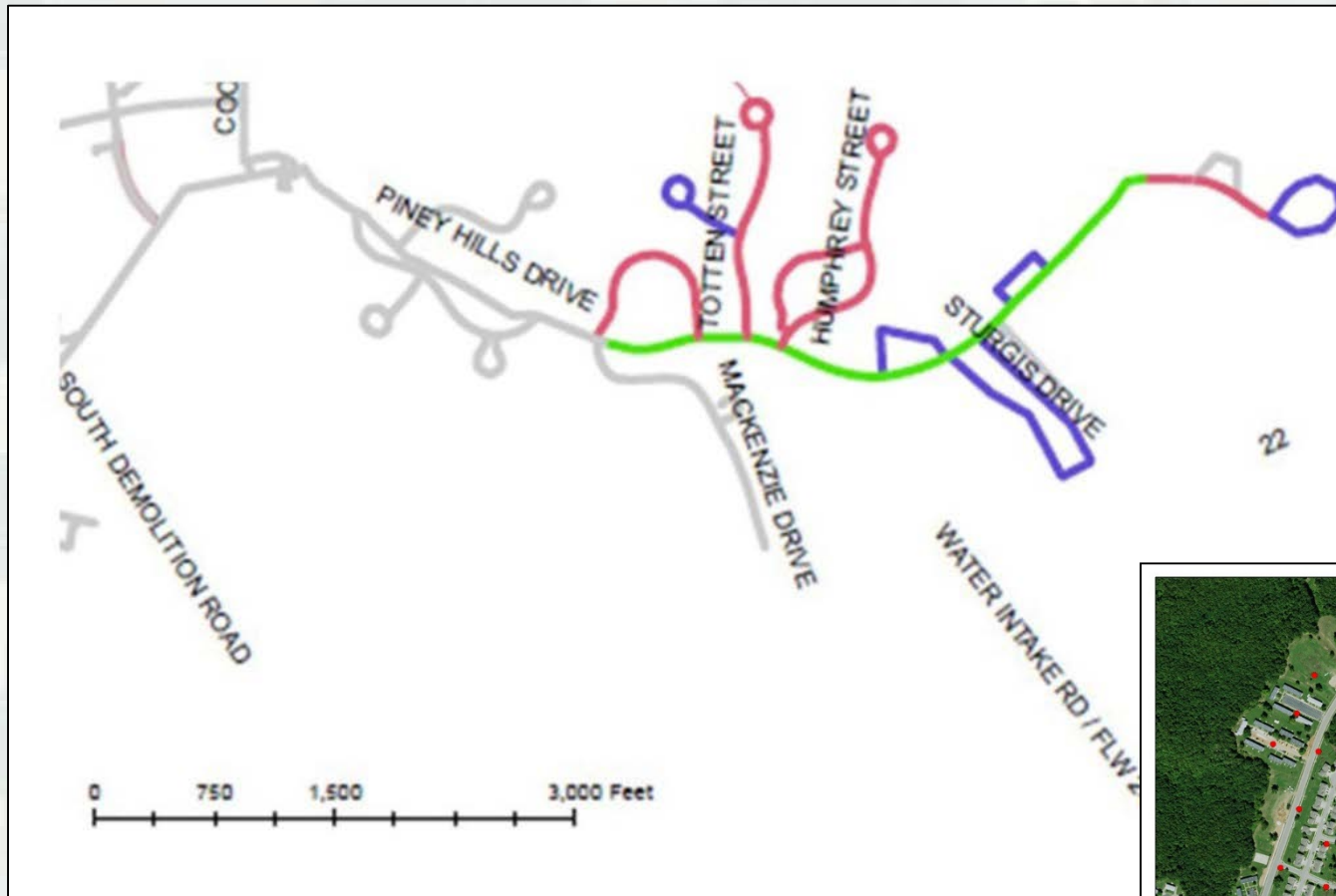
Table 3-2. Length of water mains by size and type of pipe.

Diameter	AC (mi)	DI (mi)	CI (mi)	PVC (mi)	Total (mi)	Percent of Total
1-5 in.	0.82	0.42	4.01	0.30	5.55	5.10
6-10 in.	20.15	6.64	55.10	4.88	86.78	79.75
11-30 in.	6.35	0.09	7.98	2.05	16.48	15.14
Total (mi)	27.32	7.15	67.10	7.23	108.80	100.00
Percent of Total	25.11	6.57	61.67	6.65	100	

- Provide FLW with ***technology and training*** to assess water infrastructure leaks
- Evaluate ***technologies***
- Determine parameters for ***leak detection program***



FLW Leak Detection Survey Area



Acoustic Leak Detection Survey



Impact to the Army

- Portable acoustic leak detection equipment, along with a planned program of proactive detection, can eliminate potable water leaks.
 - ▶ Preserve water along with embedded energy and treatment chemicals.
 - ▶ Reduce/eliminate infrastructure failures due to undetected leaks (sinkholes, road collapse).
 - ▶ Detect small leaks thereby eliminating larger and more destructive leaks and commensurate repairs.
- Potential first users include Army installations that retain ownership of utilities (~39 exempted sites).



Mode of Technology Transfer

- Army policy generally includes requirement to conduct leak detection (AR 420-1, Army Facilities Management, 24 Aug 2012).
- Data accrued from leak detection surveys will be used to inform return-on-investment (ROI) calculations.
- Publications:
 - ▶ US Army Corps of Engineers Engineer Technical Letter.
 - ▶ Army Public Works Digest article.
 - ▶ Installation newspaper articles.

e. Water.

- (1) Conduct surveys to check water safety and quality.
- (2) Conduct leak detection tests to identify and repair leaks.
- ~~(3) Increase water efficiency for domestic water consumption by using water saving fixtures and appliances.~~
- (4) Use reclaimed or recycled water for landscape irrigation.
- (5) Develop water management plans to implement best practices for water conservation.

Compact Ultrasonic Smart Water Meter

- These technologies fill a niche for providing quick solutions to water demand data gathering and analysis at a lower cost than conventional meters.



Water Meter Technology

- Water meters at Army facilities
 - ▶ Installation Mgmt Command: 817
 - ▶ Total Army: 1540
- Meters must be cost-effective
- New buildings contain meters, but . .
- Advanced meters
 - ▶ Electronic meters w/ability to measure & record data at regular intervals and communicate with MDMS.
 - ▶ Must comply with defense guidance on cybersecurity.



Ultrasonic Smart Water Meter

- COTS technology with integral data analysis/alert interface.
- Smart monitoring device that is empowered by machine learning software.
- Records water flow using ultrasonic transducers.
- Learns a structure's water usage and, when there is an anomaly or deviation from the norm, sends notifications through a smart phone app.



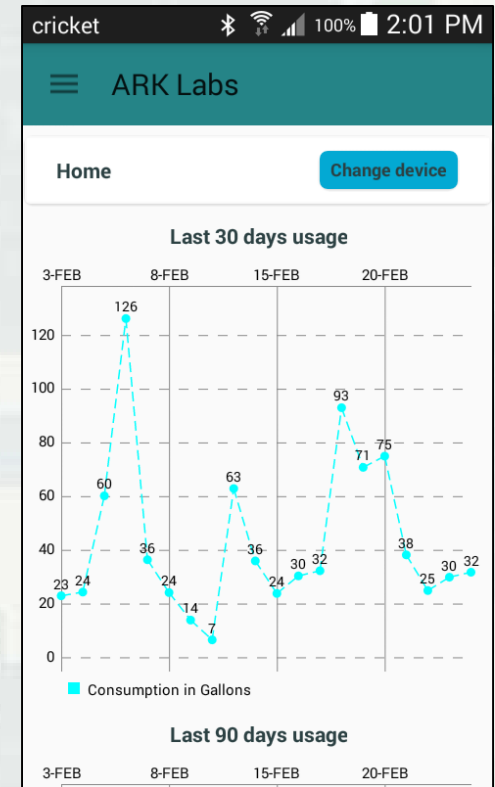
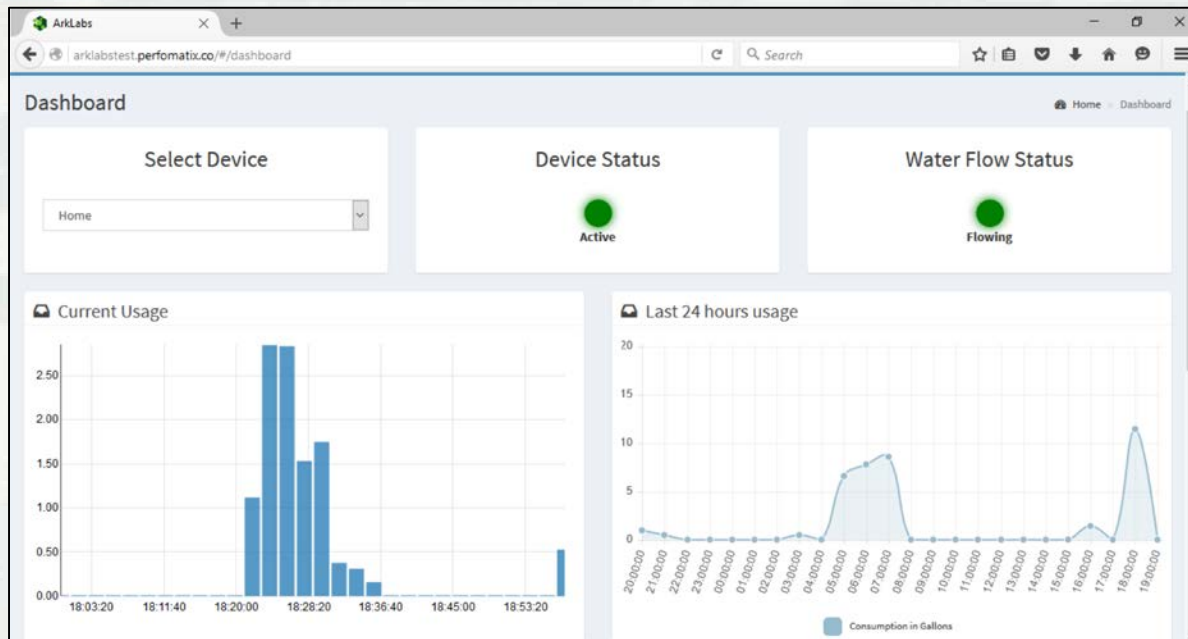
The ARK water monitoring device & mobile data access



Ark Labs DriY

ARK 2" US meter for Army demval

ARK App - 30 days water use



ARK Dashboard showing current usage and last 24 hours water usage

Demonstration Sites

Basic Training Barracks:
renovated & non-renovated

Child Development Center



Water Reuse System



BUILDING STRONG®

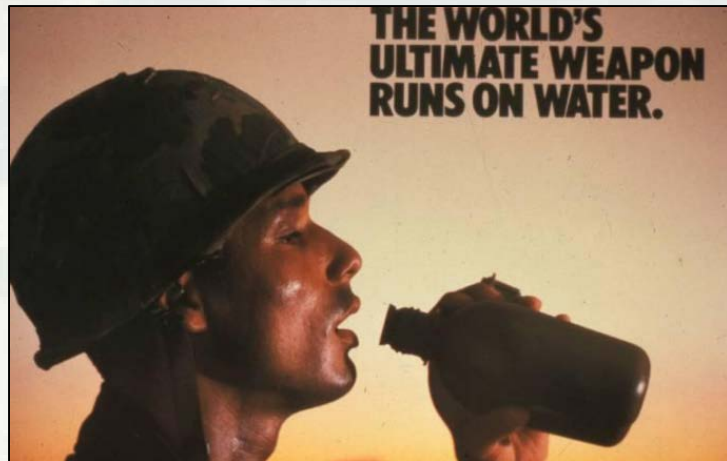
Impact to the Army

- The use of simple, relatively inexpensive ultrasonic water meters can provide timely data and information about building water use trends to:
 - ▶ Support achievement of Army water program goals;
 - ▶ Provide an economical means of benchmarking building water demand and identifying deviations from the norm;
 - ▶ Improve accuracy of water billing to reimbursable customers; and,
 - ▶ Improve operations and maintenance of the water system.
- A successful demonstration will provide data and case studies in support of RMF certification so that this technology can be considered to fulfill Army metering requirements through the Meter Data Management System.



Conclusions and Takeaways

- *Lack of experience/data on water technologies impairs our abilities to invest in water conservation, and to plan for water security.*
- *Resilient water systems are a requirement for mission success.*



BUILDING STRONG®





Questions

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