



## On-Site Direct Potable Reuse: A New Approach for Improving Groundwater Sustainability

2017 NGWA Summit  
December 5, 2017

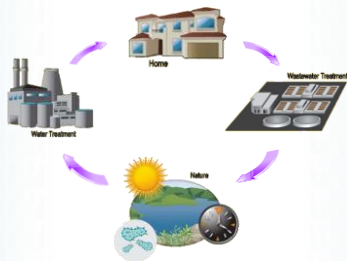
Adam J. Arnold and Philip J. Schmidt

### TRADITIONAL WATER MANAGEMENT



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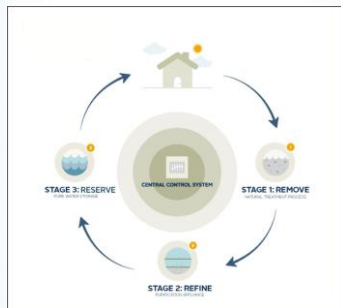
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### DIRECT POTABLE REUSE (DPR)



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### ON-SITE DPR



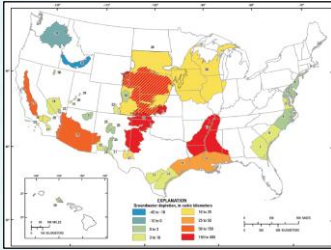
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### MOTIVATION FOR ON-SITE DPR

- In the U.S. ~ 25% of rural and suburban homes, and many businesses, rely on private water systems
  - Centralized infrastructure not available/too costly
- Most common private water system
  - Well for water supply
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- Paradigm is complicated by:
  - Limited water availability
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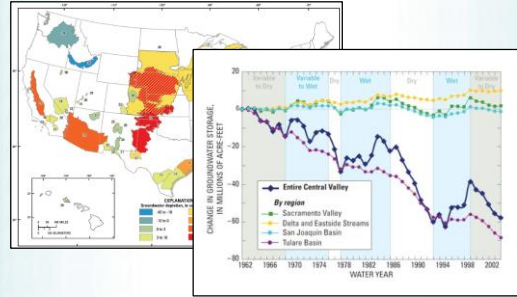
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MOTIVATION FOR ON-SITE DPR



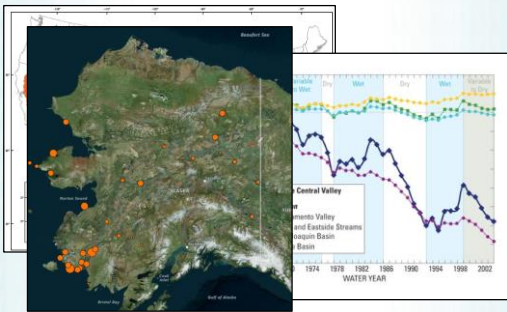
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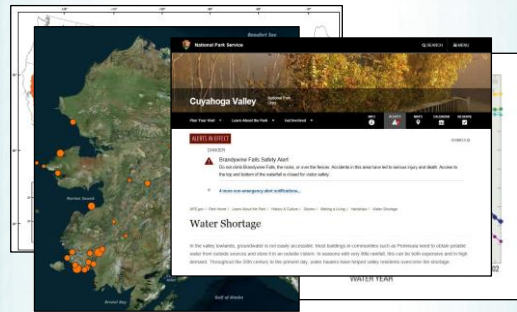
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MOTIVATION FOR ON-SITE DPR



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MOTIVATION FOR ON-SITE DPR

Environ Health Perspect. Jun 2007; 115(6): 856-864. Published online Feb 6, 2007. doi: 10.1289/ehp.9530  
 Research  
 PRICID: P10182145

**Massive Microbiological Groundwater Contamination Associated with a Waterborne Outbreak in Lake Erie, South Bass Island, Ohio**  
 Thong-Theng Fung<sup>1</sup>, Linda S. Mansfield<sup>2</sup>, David L. Wilson<sup>3,4</sup>, David J. Schwab<sup>5</sup>, Stephanie L. Mellow<sup>6</sup>, and Joann B. Rose<sup>1,6</sup>

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**Ohio EPA**  
 Report of Findings  
 Cuyahoga Water Quality Investigation  
 Waterloo Township, Wayne County  
 December 2006  
 Ohio EPA  
 1000 East Broad Street  
 Columbus, Ohio 43260

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MOTIVATION FOR ON-SITE DPR

Environment Health Research: Jan 2007; 11(6): 886-894  
 Published online Feb 8, 2007; doi: 10.1080/08916150601053333

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**Health Consultation**  
 (Statement of Findings on the Ohio River Food and Health Breakdown Area)  
 LANSING, BURLINGAME, WELLSVILLE, SANDFIELD, WILSON COUNTY OHIO

Prepared for:  
 Ohio Department of Health

SEPTEMBER 8, 2011

Prepared under a Cooperative Agreement with the U.S. EPA (EPA/600/R-11/016) and the Ohio Department of Health, Agency for Toxic Substances and Disease Registry, Division of Environmental Health Investigation, Atlanta, Georgia, 2011

OhioEPA  
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December 16, 2011 revised

Ohio Environmental Protection Agency  
 Division of Surface Water

**Arsenic**

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**Summary Report of Sample Results Obtained under the Household Sewage Treatment Systems General National Pollutant Discharge Elimination System Permit**

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**Household Sewage Treatment System Failures in Ohio**

A report on Local Health Department survey responses for the 2012 Clean Waterworks Needs Survey

January 2013

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  - Degraded water quality ← provide safe and consistent water supply
  - Challenges in sewage discharge water supply

↑ reduce waste and nutrient loading

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TAKING ACTION IN OHIO



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TAKING ACTION IN OHIO



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TAKING ACTION IN OHIO

- Three modular components
  - Preliminary Purification ~ Wastewater Treatment
  - Advanced Purification ~ Full Advanced Treatment
  - Purified Water Storage/Delivery ~ ESB/Distribution
- Multi-barrier design philosophy
  - Biological treatment, membrane filtration, RO, UV advanced oxidation/disinfection, chlorination
- Automated system control
  - Over 30 sensors with continuously logged data
  - Immediate recirculation/shut-down in event of anomalous data
  - Operator notification when service needed

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**TAKING ACTION IN OHIO**

**Experimental Concurrence  
OAC 3701-29-20(B)**

April 2013 through  
July 2014

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**TAKING ACTION IN OHIO**

- Purified water met existing drinking water standards
- Challenge testing demonstrated treatment system performance and capabilities
  - Pathogen reduction exceeded even the most stringent requirements
  - Sensitivity of process control verified through intentional ‘failure’ of key process units

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**TAKING ACTION IN OHIO**

**Director's Variance  
OAC 3701-28-19(A)**

August 2014 through  
November 2015  
(limits on drinking/cooking)

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**TAKING ACTION IN OHIO**

**Director's Variance  
OAC 3701-28-19(A)**

December 2015 through  
May 2016  
(unrestricted use)

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**TAKING ACTION IN OHIO**

- Demonstration system continues to supply purified water for unrestricted use
  - > 500,000 gallons of water re-used, to date
  - Purified water analysis of *E. coli*, nitrate and DBPs
  - Regulatory review of all process-related changes
- 2015/16 Private Water System (PWS) Rule Review
  - Included placeholders for “recycled water” rules
- Strategy prior to 2020/21 PWS Rule Review
  - Establish expert panel by end of 2017
  - Develop draft “recycled water” rules by mid-2019
  - Key stakeholder review mid-2019 to end of 2019

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**SUMMARY**

- Where conventional private water system alternatives are unavailable or problematic, *on-site DPR* systems can:
  - reduce withdrawals of water resources from the environment
  - provide a safe and consistent supply of water
  - reduce waste and nutrient loading to the environment
- Pilot project in Ohio successfully demonstrated the above
- As of 2014 there exists a legislative mandate in Ohio to promulgate “recycled water” as an approved water source for private water systems

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**DOES ON-SITE DPR  
HAVE A ROLE IN GROUNDWATER SUSTAINABILITY?**

- Non-potable use of harvested rainwater and recycled greywater is increasing throughout the U.S.
- Dual plumbing for non-potable reuse can be eliminated if water is treated to a potable standard
- Growing momentum for *on-site DPR* across U.S.
  - Operational system and rule-making in Ohio
  - Others are beginning to test *on-site DPR* technology in California and Alaska

***On-site DPR* is an emerging option for groundwater sustainability**

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**ACKNOWLEDGEMENTS**



CUYAHOGA COUNTY  
BOARD OF HEALTH  
YOUR TRUSTED SOURCE FOR PUBLIC HEALTH INFORMATION



Western Reserve  
Land Conservancy  
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