

# This presentation premiered at WaterSmart Innovations

[watersmartinnovations.com](http://watersmartinnovations.com)

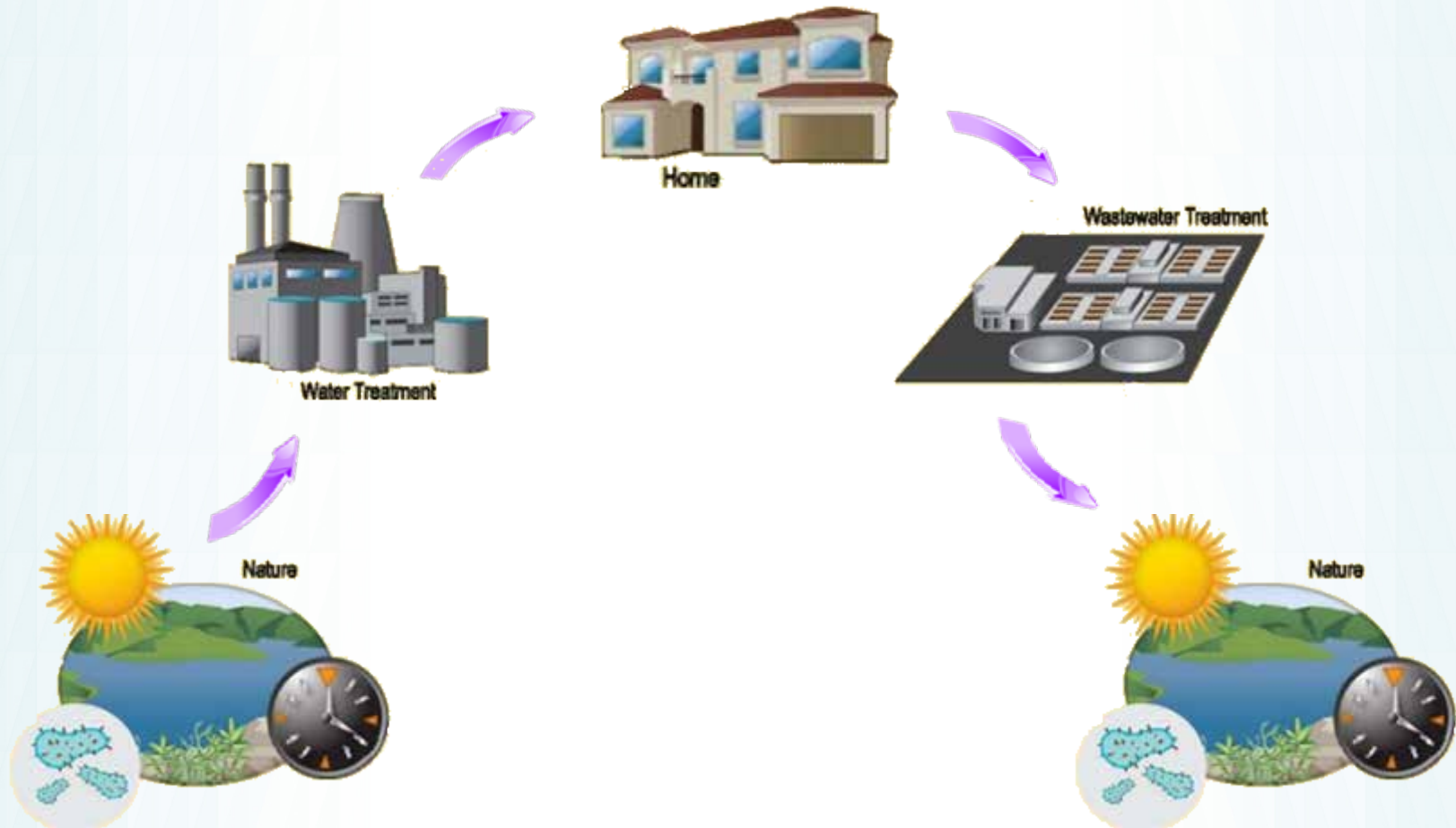


# **Does *On-Site Direct Potable Reuse* Have a Role in Water Sustainability?**

10<sup>th</sup> Annual WaterSmart Innovations Conference and Exposition  
October 5, 2017

Adam J. Arnold and Philip J. Schmidt

# TRADITIONAL WATER MANAGEMENT

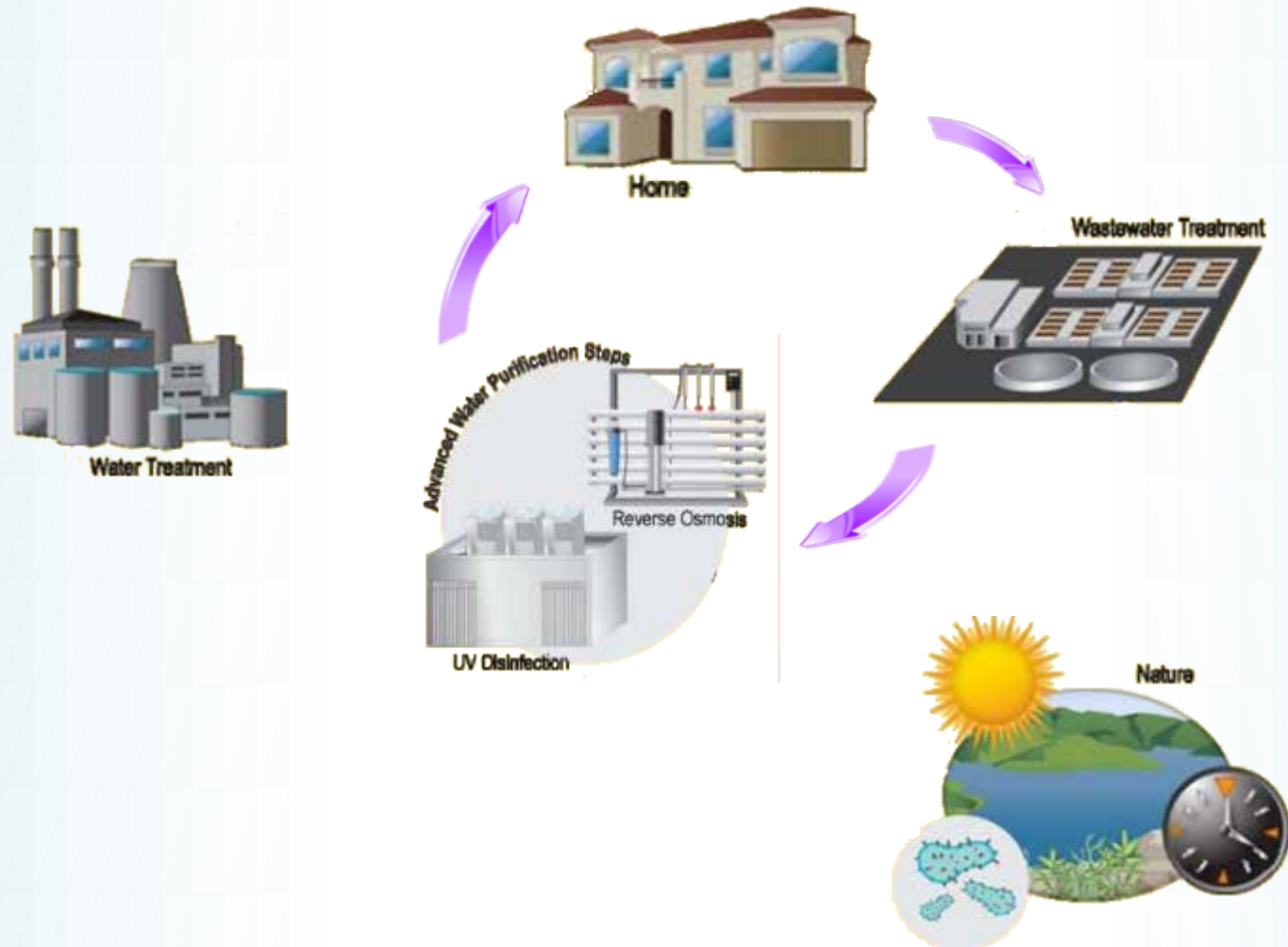


# TRADITIONAL WATER MANAGEMENT

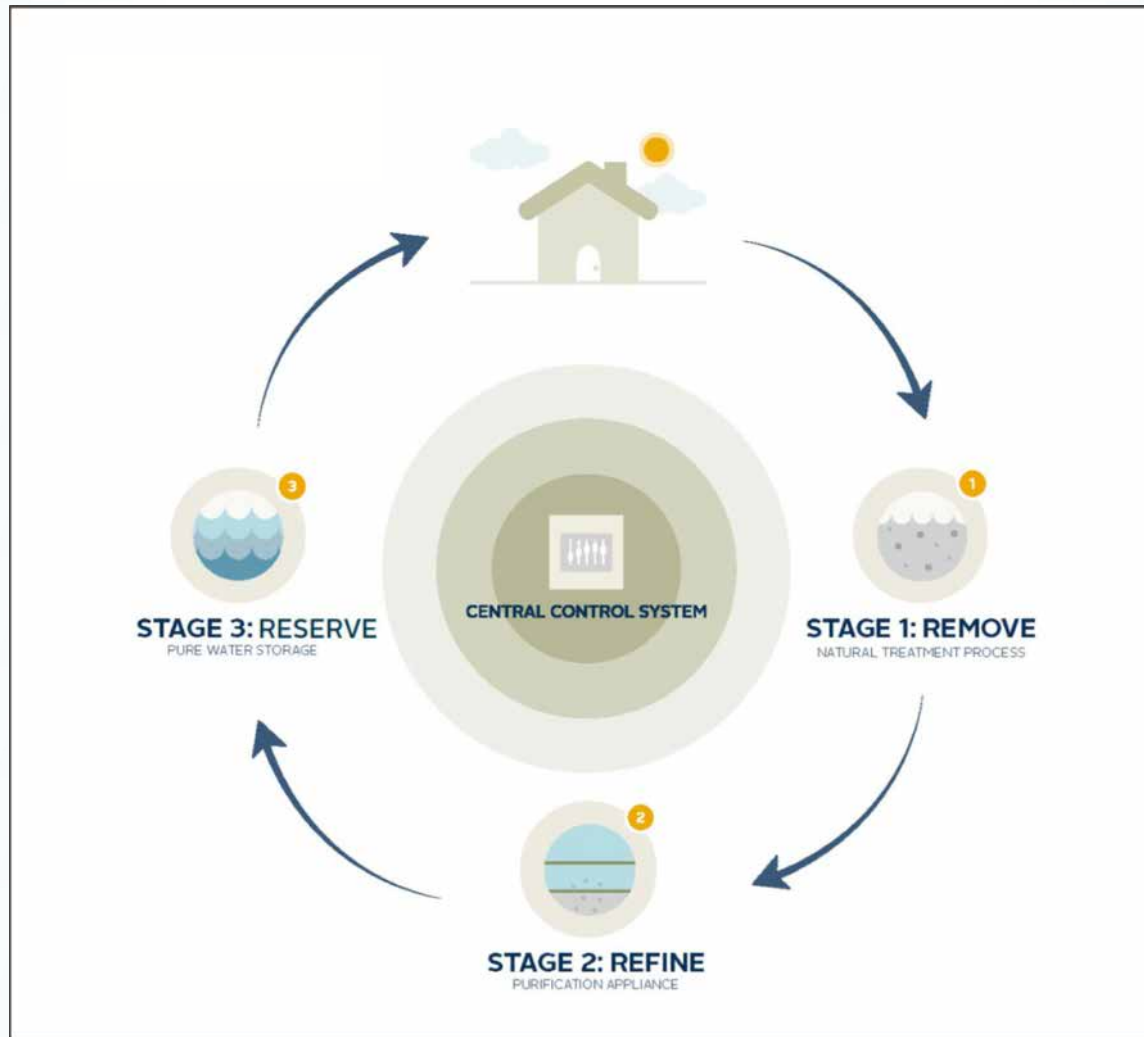
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# DIRECT POTABLE REUSE (DPR)



# ON-SITE DPR



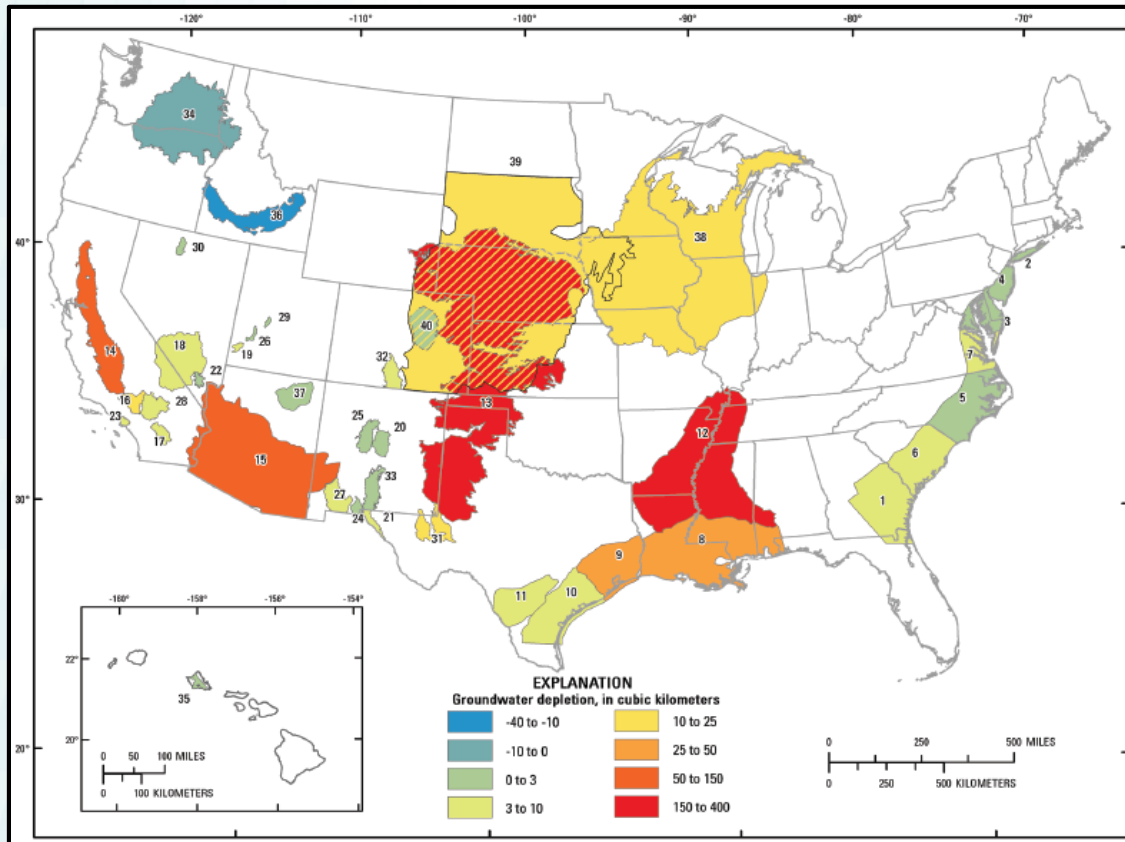
## MOTIVATION FOR *ON-SITE DPR*

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- 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
  - Septic system for sewage discharge
- Paradigm is complicated by:
  - *Limited water availability*
  - *Degraded water quality*
  - *Challenges in sewage discharge*

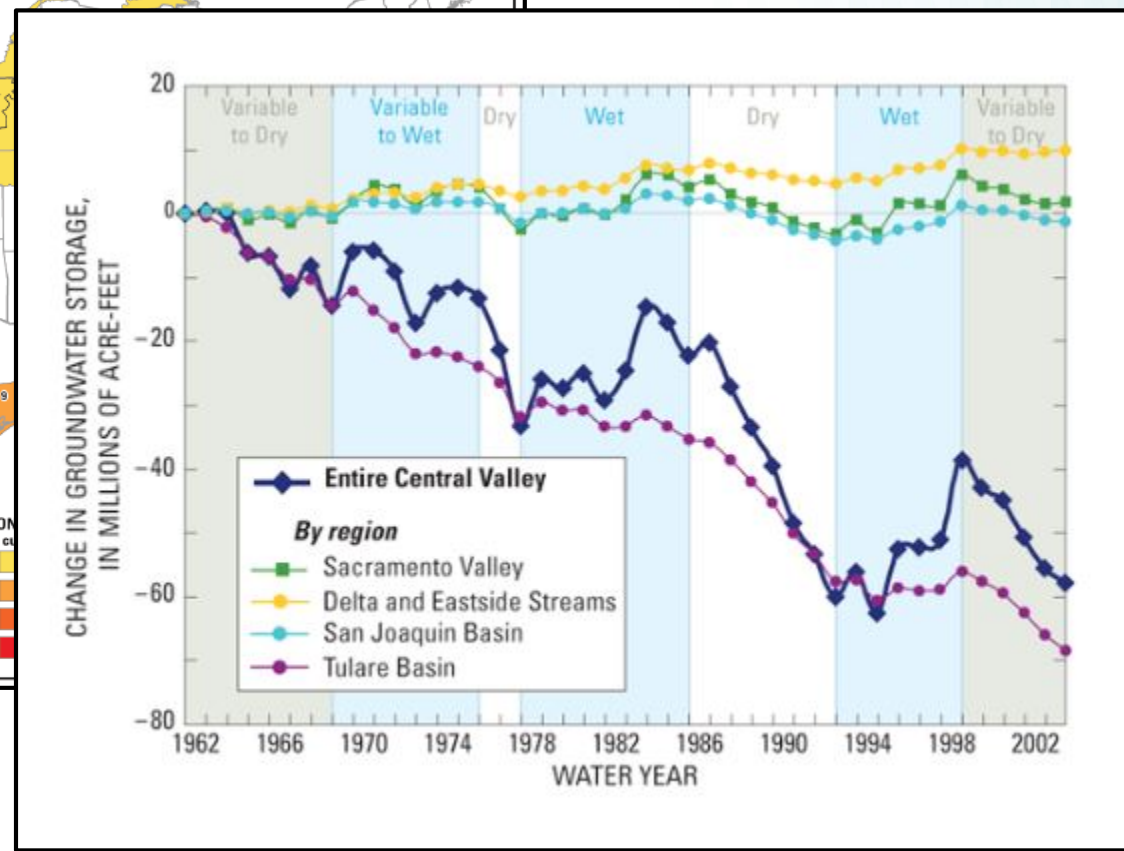
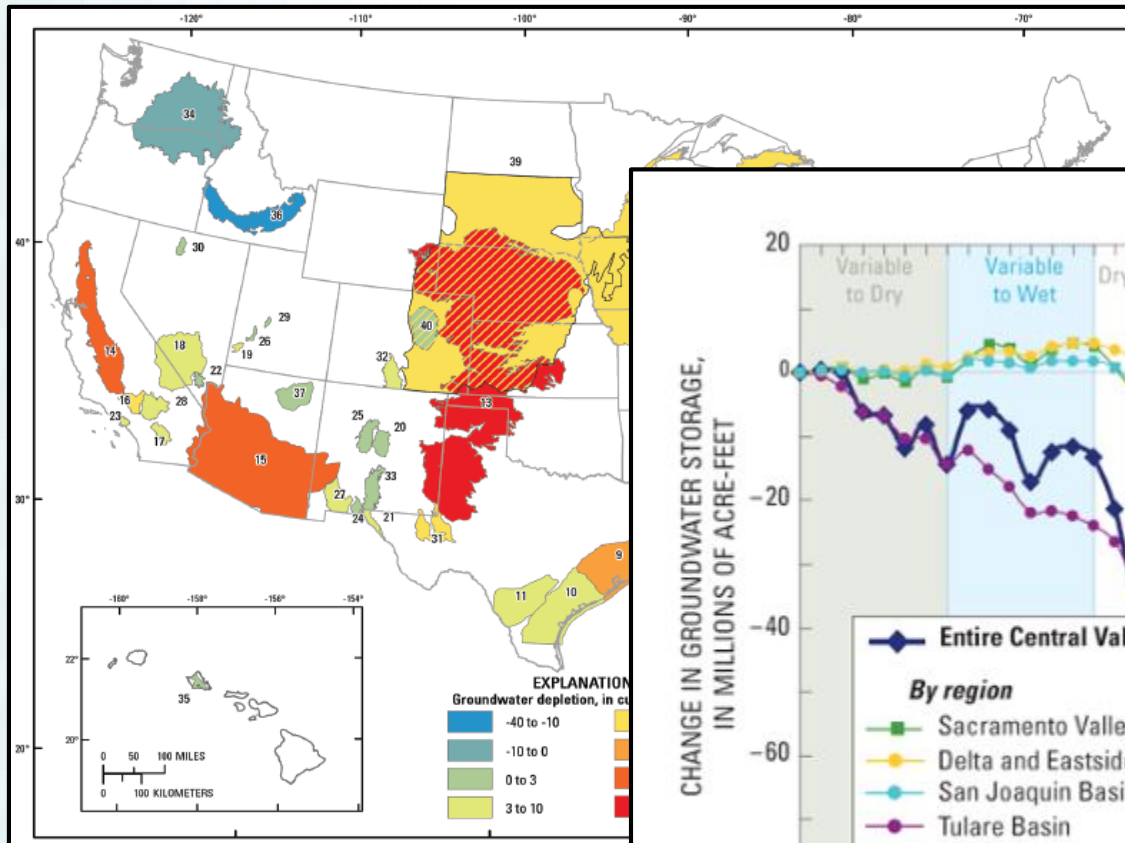


# MOTIVATION FOR ON-SITE DPR

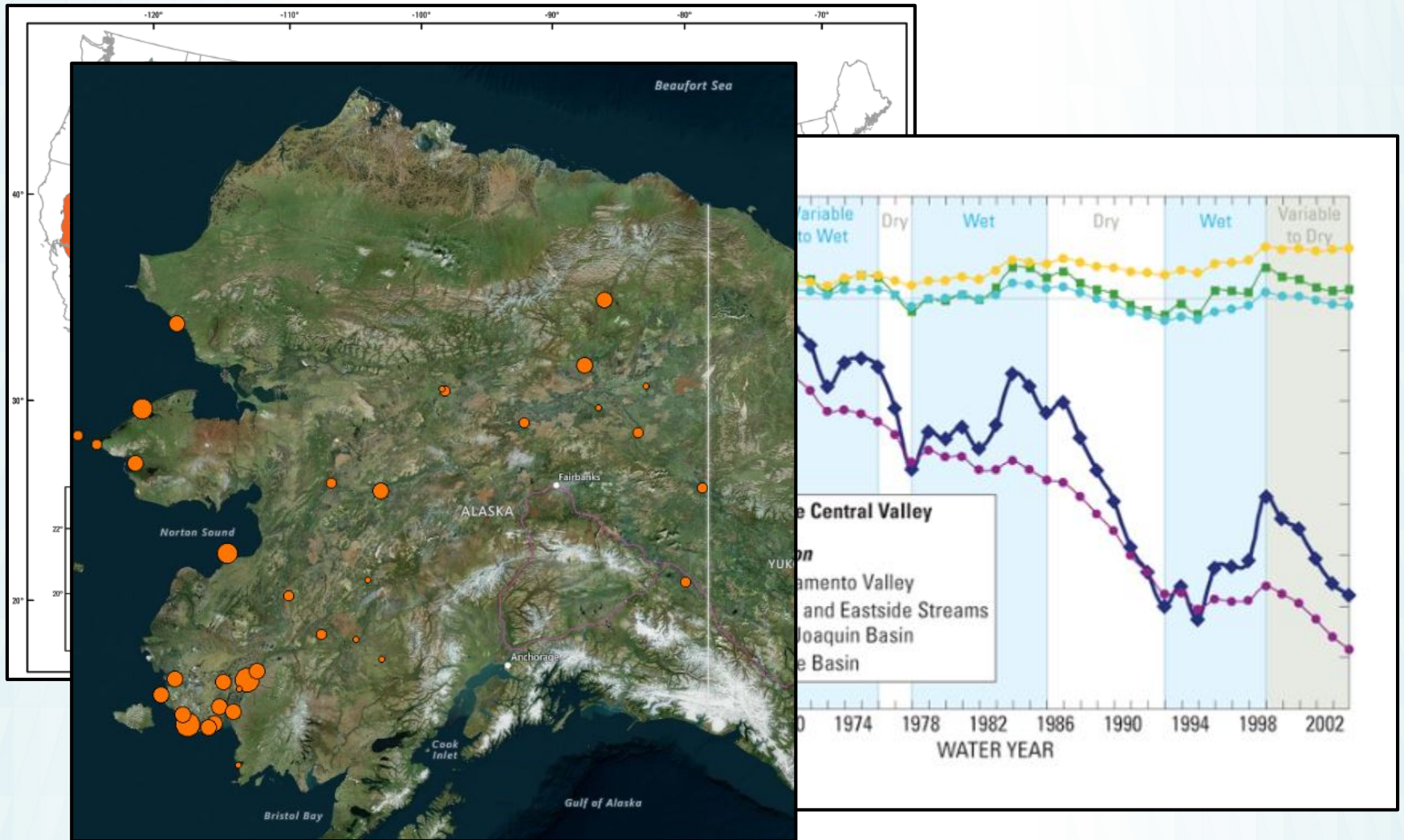




# MOTIVATION FOR ON-SITE DPR



# MOTIVATION FOR ON-SITE DPR



# MOTIVATION FOR ON-SITE DPR

The image is a composite of three main elements:

- Map:** A topographic map of the Cuyahoga Valley National Park region in Ohio. It features latitude and longitude markings (120°W to 70°W and 20°N to 40°N). Key geographical features labeled include Beaufort Sea, Norton Sound, Bristol Bay, and Gulf of Alaska. Numerous orange circular markers of varying sizes are scattered across the landmass, indicating specific locations of interest.
- Website Screenshot:** A screenshot of the National Park Service website for Cuyahoga Valley National Park. The header includes the NPS logo, the park name, and navigation links for 'Plan Your Visit', 'Learn About the Park', and 'Get Involved'. A navigation bar contains icons for 'INFO', 'ALERTS', 'MAPS', 'CALENDAR', and 'RESERVE'. The 'ALERTS' icon is highlighted in red. Below the navigation bar, a red banner reads 'ALERTS IN EFFECT' with a 'DISMISS' button. The main alert is titled 'DANGER Brandywine Falls Safety Alert' and includes a warning icon and text: 'Do not climb Brandywine Falls, the rocks, or over the fences. Accidents in this area have led to serious injury and death. Access to the top and bottom of the waterfall is closed for visitor safety.' Below this, there is a link for '4 more non-emergency alert notifications...'. At the bottom of the alert section, there is a breadcrumb trail: 'NPS.gov / Park Home / Learn About the Park / History & Culture / Stories / Making a Living / Hardships / Water Shortage'. Below the breadcrumb trail is a section titled 'Water Shortage' with a paragraph of text: 'In the valley lowlands, groundwater is not easily accessible. Most buildings in communities such as Peninsula need to obtain potable water from outside sources and store it in an outside cistern. In seasons with very little rainfall, this can be both expensive and in high demand. Throughout the 20th century to the present day, water haulers have helped valley residents overcome the shortage.'
- Vertical Chart:** On the right side of the map, there is a vertical axis with a scale from 0 to 100. It features several colored data points: yellow, green, blue, and purple. A label '02' is visible at the bottom of this axis.



# MOTIVATION FOR *ON-SITE DPR*

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Environ Health Perspect. Jun 2007; 115(6): 856–864.

PMCID: PMC1892145

Published online Feb 6, 2007. doi: [10.1289/ehp.9430](https://doi.org/10.1289/ehp.9430)

Research

## **Massive Microbiological Groundwater Contamination Associated with a Waterborne Outbreak in Lake Erie, South Bass Island, Ohio**

[Theng-Theng Fong](#),<sup>1</sup> [Linda S. Mansfield](#),<sup>2</sup> [David L. Wilson](#),<sup>3,4</sup> [David J. Schwab](#),<sup>5</sup> [Stephanie L. Molloy](#),<sup>6</sup> and [Joan B. Rose](#)<sup>1,6</sup>

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**OhioEPA**

State of Ohio  
Environmental Protection Agency

Division of Drinking and Ground Waters

Report of Findings  
Unsafe Water Supply Investigation  
Wooster Township, Wayne County



December 2006

Bob Taft, Governor  
Joseph P. Konecni, Director

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## Massive Microbiological Groundwater Contamination Associated with a Waterborne Outbreak in Lakeside, Ohio

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Rose](#)<sup>1,6</sup>

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State of Ohio  
Environmental Protection Agency

Division of Drinking and Ground Waters

Report of Findings  
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## Health Consultation

(Evaluation of Wells at the Jesse Beer School and Nearby Residential Area)

JESSE BEER / BAHL AVENUE WELLS SITE  
MANSFIELD, RICHLAND COUNTY, OHIO

Prepared by  
Ohio Department of Health

SEPTEMBER 9, 2013

Prepared under a Cooperative Agreement with the  
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Agency for Toxic Substances and Disease Registry  
Division of Community Health Investigations  
Atlanta, Georgia 30333

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Research

PMCID: PMC1892145

## Massive Microbiological Growth and Waterborne Outbreak in Lake

### Meeting tonight on water contamination in Mizer Addition



Thinkstock.com

Tuesday  
Posted Jun 30, 2015 at 11:26 PM  
Updated Jun 30, 2015 at 11:43 PM

Share



The Tuscarawas County Health Department, along with the village of Newcomerstown, Oxford Township and Tuscarawas County officials, will meet with residents of the Mizer Addition east of Newcomerstown, where traces of tetrachloroethene, or PCE, were detected following a series of groundwater tests conducted since January.

## Consultation

Beer School and Nearby Residential Area)

HL AVENUE WELLS SITE  
CHLAND COUNTY, OHIO

Prepared by  
Department of Health

EMBER 9, 2013

Cooperative Agreement with the  
HEALTH AND HUMAN SERVICES  
Substances and Disease Registry  
Community Health Investigations  
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State of Ohio  
Environmental Protection Agency

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## Massive Microbiologic Waterborne Outbreak

### Meeting tonight on water c



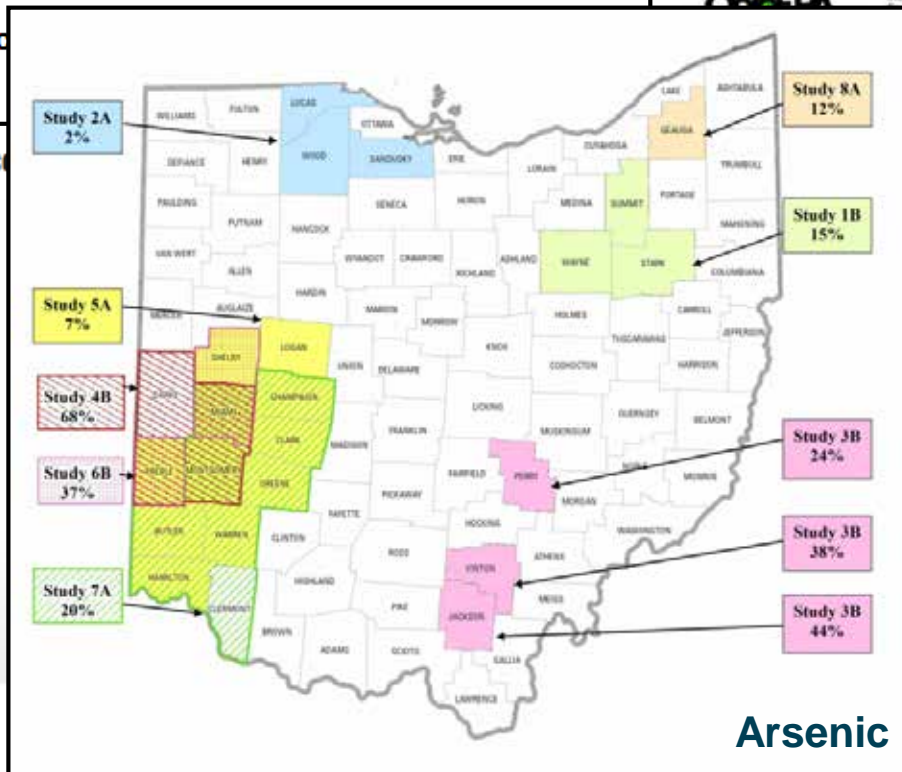
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HEALTH AND HUMAN SERVICES  
 Substances and Disease Registry  
 Community Health Investigations  
 Atlanta, Georgia 30333



State of Ohio  
 Environmental Protection Agency

Division of Drinking and Ground Waters

Report of Findings  
 Safe Water Supply Investigation  
 Foster Township, Wayne County



September 2006

State Governor  
 R.P. Kocetek, Director

# MOTIVATION FOR *ON-SITE DPR*

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

(December 15, 2010-revised)

# MOTIVATION FOR *ON-SITE DPR*



**Summary Report  
of  
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(December 15, 2010-revised)



## Household Sewage Treatment System Failures in Ohio



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

January 2013

Ohio Department of Health  
Bureau of Environmental Health  
Residential Water and Sewage Program

# MOTIVATION FOR *ON-SITE DPR*



Ohio

Environmental  
Public Health  
Division

Summary  
of  
Sample Results  
under  
Household Sewage  
General National  
Elimination System

(December 15, 2014)



Ohio Department of Health  
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# MOTIVATION FOR ON-SITE DPR

Ohio

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Summary

Sample Results  
under

Household Sewage  
General National Plan  
Elimination System

(December 15)



## Carroll Township's scare with toxin a 'wake-up call'

### Water plant shut over lethal microcystin from algae

BY TOM HENRY  
BLADE STAFF WRITER

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Henry Biggert is confident he 'made the right call' to shut down the Carroll Township Water Plant when he detected microcystin, a potentially lethal toxin.

THE BLADE/JETTA FRASER

Enlarge | Buy This Photo

OAK HARBOR, Ohio — They got lucky.

The 2,000 residents of Ottawa County's Carroll Township who were told to avoid their tap water last weekend can thank one person — not any one of America's thousands of state and federal health laws — for sparing them from sickness, possibly even death.

Henry Biggert, the township's water plant superintendent since it went online in 1998, knew he had to act fast when he saw microcystin, the potentially lethal toxin in Lake Erie's harmful, blue-green algae known as microcystis, spike to a level

beyond plant capability Sept. 5.

## MOTIVATION FOR ON-SITE DPR

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- 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
  - Septic system for sewage discharge
- Paradigm is complicated by:
  - *Limited water availability* ← reduce water withdrawals
  - *Degraded water quality* ← provide safe and consistent water supply
  - *Challenges in sewage discharge*
    - ↑ reduce waste and nutrient loading

## TAKING ACTION IN OHIO





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## TAKING ACTION IN OHIO

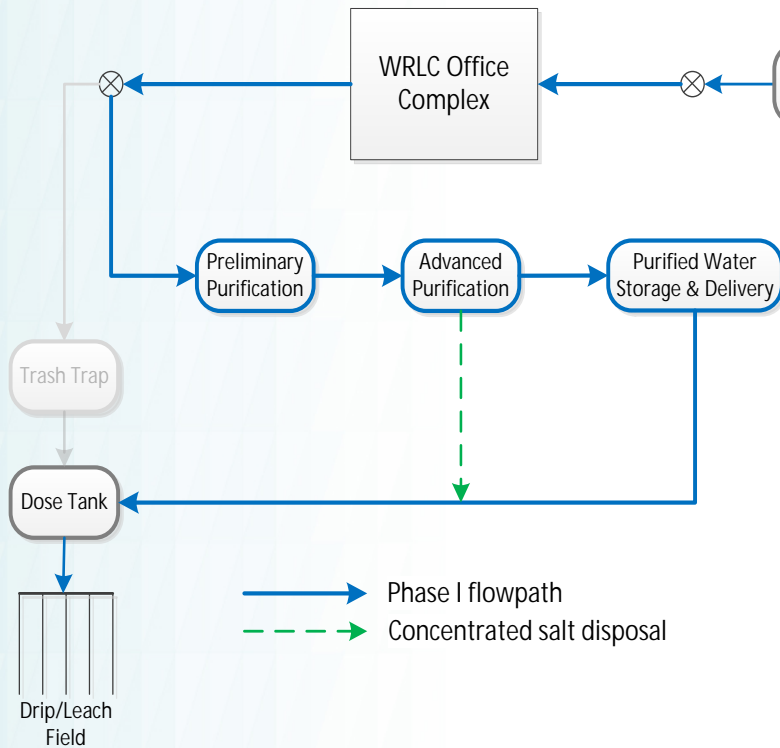


## TAKING ACTION IN OHIO

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- **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**

# TAKING ACTION IN OHIO



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

**April 2013 through  
July 2014**

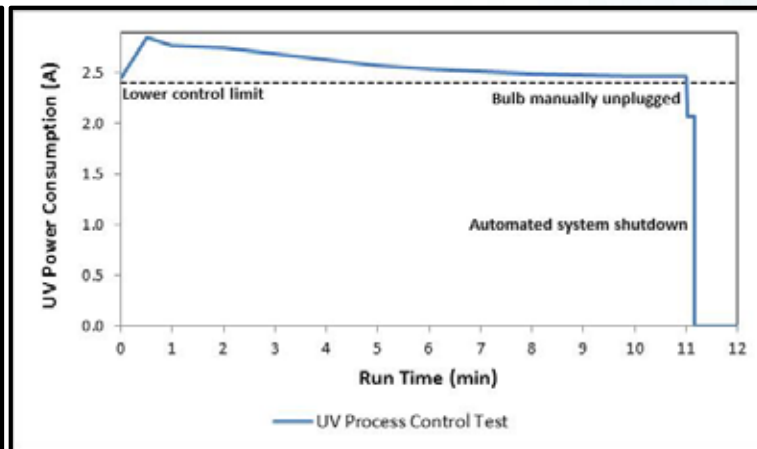
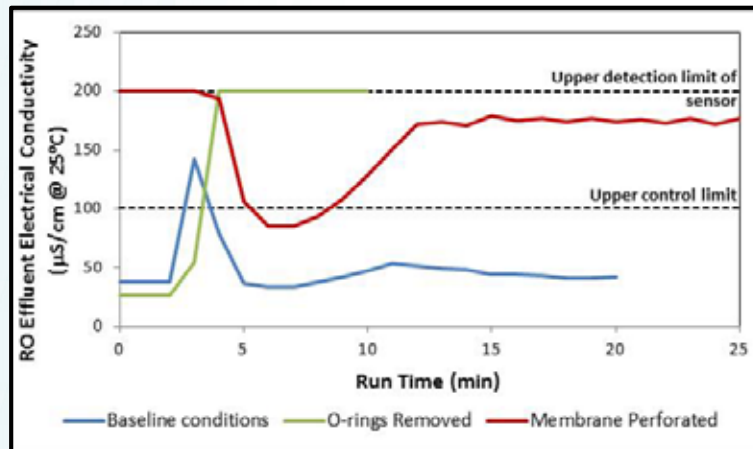


**Joseph Cotruvo & Associates, LLC**  
Water, Environment & Public Health  
Consultants



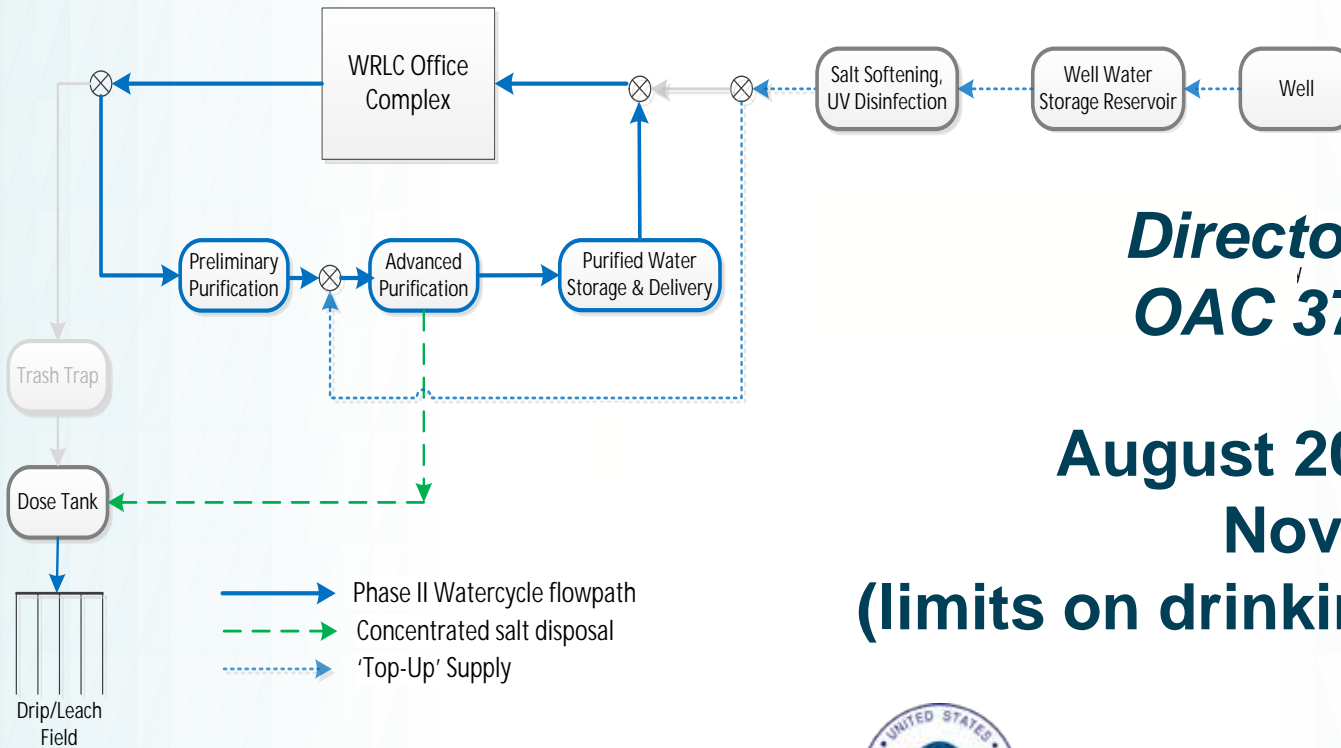
## TAKING ACTION IN OHIO

- 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





# TAKING ACTION IN OHIO



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

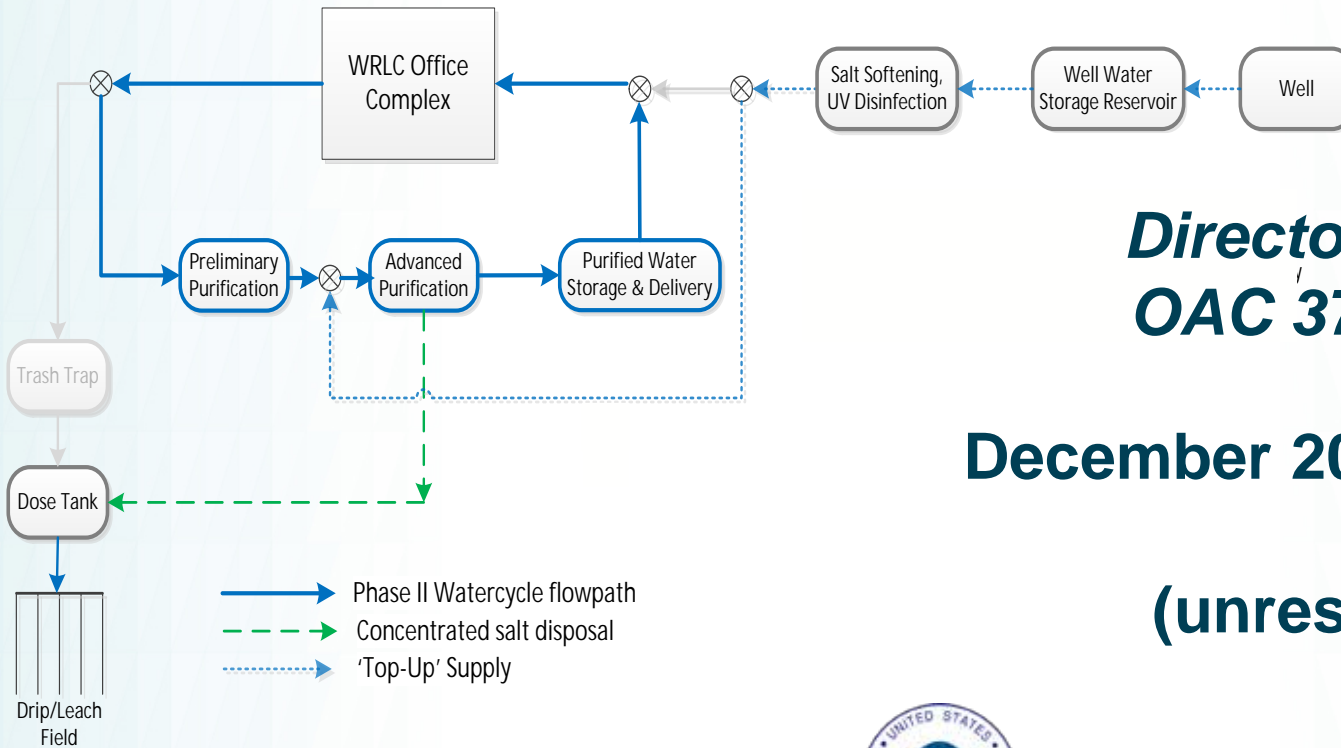
**August 2014 through  
November 2015  
(limits on drinking/cooking)**



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Consultants



# 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

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- **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

## MOTIVATION FOR *ON-SITE DPR*

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## MOTIVATION FOR *ON-SITE DPR*



### Sewer capacity crisis may flush growth plans in Calgary's northwest (with map)

JASON MARKUSOFF, CALGARY HERALD | 06.10.2013 |



Design work has begun to add 6.5 kilometres of new sewer mains and feeder pipes, including a section that runs under the Bow River at Shouldice Bridge, as a key sewer pipe has reached capacity. *STUART GRADON / CALGARY HERALD*



# MOTIVATION FOR ON-SITE DPR



## Sewer overflow contributes toward harmful algal blooms in lake

Written by Kelly Kaczala  
January 19, 2015  
Hits: 1539

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Each year, wastewater is released into Lake Erie from outdated combined sewer systems. These systems collect rainwater runoff, domestic sewage and industrial wastewater in the same pipe that handles wastewater disposal and storm water drainage. Following heavy rains, due to combined sewer overflows, raw sewage and storm water are transported into the lake, bypassing municipal sewage treatment plants. The phosphorus from the waste contributes toward the development of harmful algal blooms.



It is estimated that combined sewer overflows (CSOs) contribute up to 1.5 percent of the total phosphorus load into Lake Erie, according to the Ohio Environmental Protection Agency.

Ohio has 101 CSO communities, 62 of which are in the Lake Erie drainage basin. CSO is the second significant contributor, after agricultural run-off, of phosphorus in the basin, according to a report by the Ohio Lake Erie Phosphorus Task Force II.

Communities with CSOs must address the problem, as required by the Clean Water Act, according to Heidi Griesmer, acting deputy director of communication at the Ohio EPA. Sewer separation, constructing storage basins and expanding wastewater treatment plants are among the options available to communities, she said.



Heavy rains can overwhelm storm water and sewage systems. Pictures: heavy rains caused storm drains to back-up and cause flooding along Miami Street. (Press file photo by Ken Grozjean)

## ay flush growth west (with map)



## SUMMARY

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- **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**
- **In urban communities, *on-site DPR* systems can diversify water supplies and lessen the burden on existing water/wastewater infrastructure**

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

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- **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 San Francisco and Alaska**

***On-site DPR* is an emerging option for water sustainability in both rural and urban settings**



# ACKNOWLEDGEMENTS



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



Western Reserve  
Land Conservancy  
land • people • community





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