

WATER IS WATER

REGARDLESS OF SOURCE, WE MUST TREAT ALL WATER AS A CRITICAL RESOURCE AND WATER SUPPLY ISSUES ARE SERIOUS CONCERN FOR COMMUNITIES, REUSE IS A TOOL

Arizona's Continued Commitment:

Enhance our current waterconservation , reuse and infrastructure projects . Arizona 's water planning leaders are committed to continuing to be proactive in developing and enhancing conservation and reuse opportunities... Acquiring these supplies will require new infrastructure and bold investments which are essential to Arizona successfully securing its water supplies for the future .

www.azwater.gov/azDWR (Arizona Vision with Action)

WATER IS WATER

Among all our uncertainties, weather is one of the most basic. We can't control it. We can only live with it, and now we have to live with a very serious drought of uncertain duration.

Right now, it is imperative that we do everything possible to mitigate the effects of the drought. I have convened an Interagency Drought Task Force and declared a State of Emergency. We need everyone in every part of the state to conserve water. We need regulators to rebalance water rules and enable voluntary transfers of water and we must prepare for forest fires. As the State Water Action Plan lays out, **water recycling**, expanded storage and serious groundwater management must all be part of the mix. So too must be investments in safe drinking water, particularly in disadvantaged communities. We also need wetlands and watershed restoration and further progress

on the Bay Delta Conservation Plan.

It is a tall order.

But it is what we must do to get through this drought and prepare for the next.

Edmund G. Brown Jr.

State of the State Speech, January 22, 2014

Potable Water

Reuse Water

Wastewater

Groundwater

Stormwater

WATER

Non-potable Water

Roof Water

Gray
Water

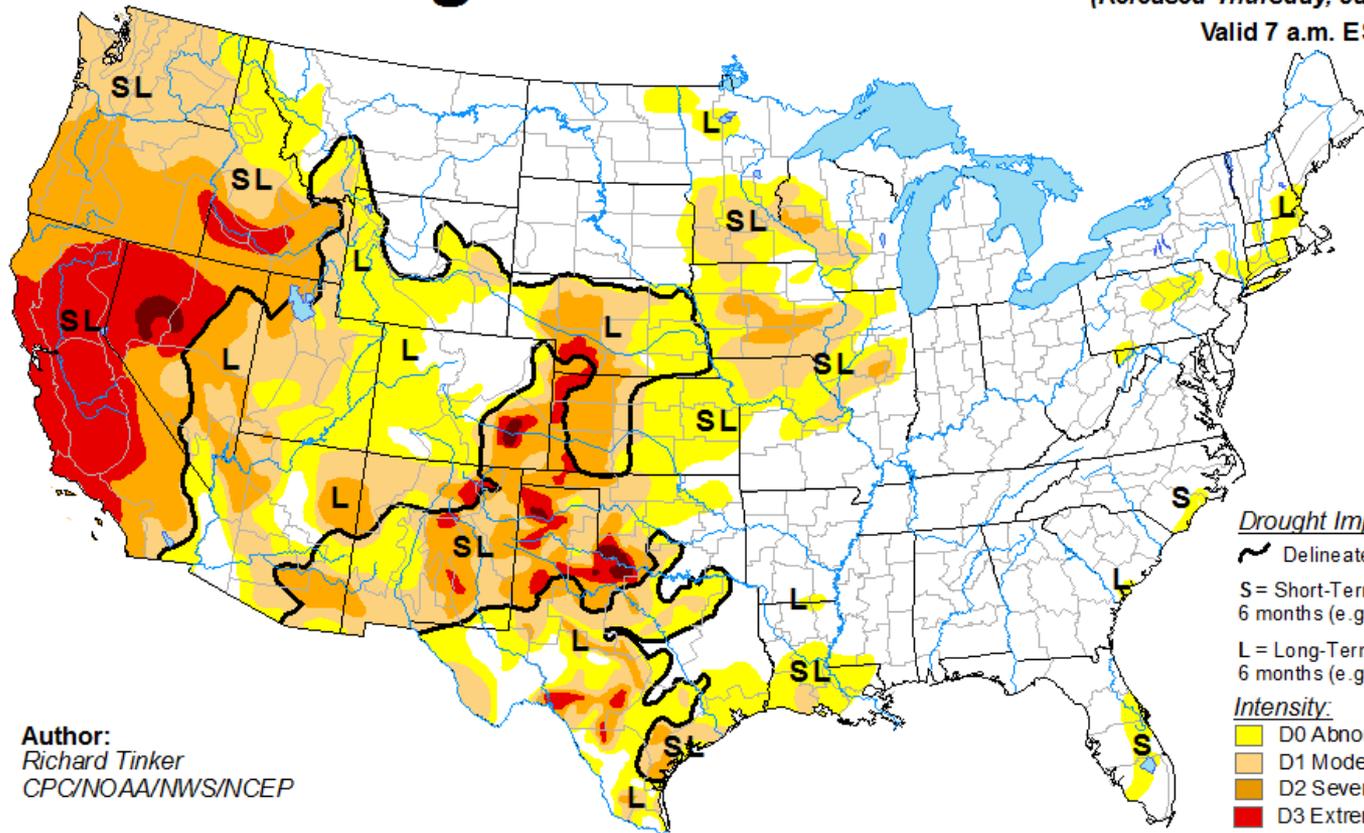
Reclaimed Water

Rainwater

Surface Water

U.S. Drought Monitor

January 21, 2014
 (Released Thursday, Jan. 23, 2014)
 Valid 7 a.m. EST



Author:
 Richard Tinker
 CPC/NOAA/NWS/NCEP

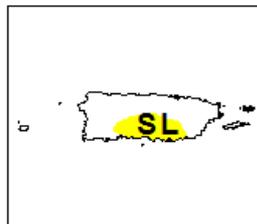
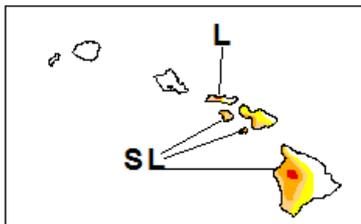
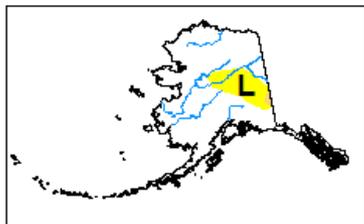
Drought Impact Types:

-  Delineates dominant impacts
- S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

Intensity:

-  D0 Abnormally Dry
-  D1 Moderate Drought
-  D2 Severe Drought
-  D3 Extreme Drought
-  D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.



<http://droughtmonitor.unl.edu/>

Challenges for Reuse in Decentralized Systems

Presentation to
Southwest Onsite Wastewater Conference, January, 2014

Robert Rubin
Professor Emeritus, NCSU-BAE

Myth, mandate or science

- Mandate
- “have a place away from camp and take that which comes from thee and place it on the land”
- Deut: 23 12-14
- Myth
- Herculean tasks – clean the stables which had accumulated manure from thousands of animals... diverted the river... didn’t pay the bill... severe consequences...

RECLAIMED WATER SYSTEM PLANNING

Supporting pillars of a sustainable reuse program:

Sound robust technologies,

Competent personnel at all levels of program,

Management programs,

Ordinances / regulations to enable reuse,

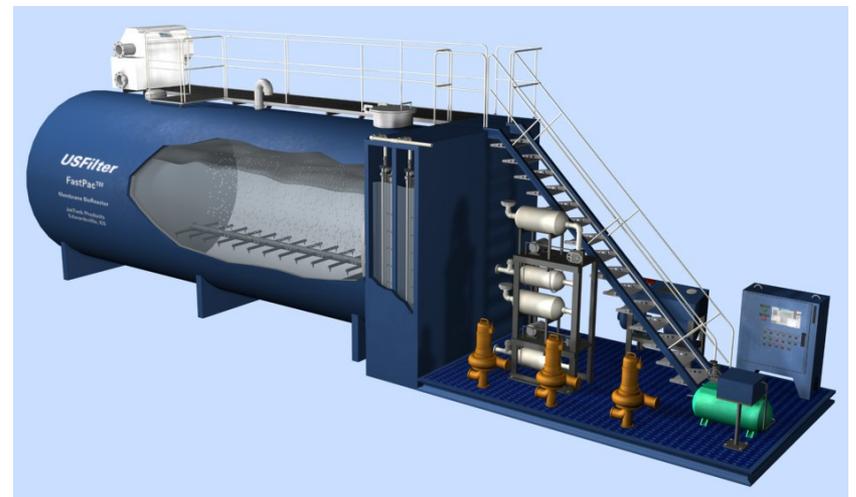
Publics who support.

Is it time for NEWS paradigm?

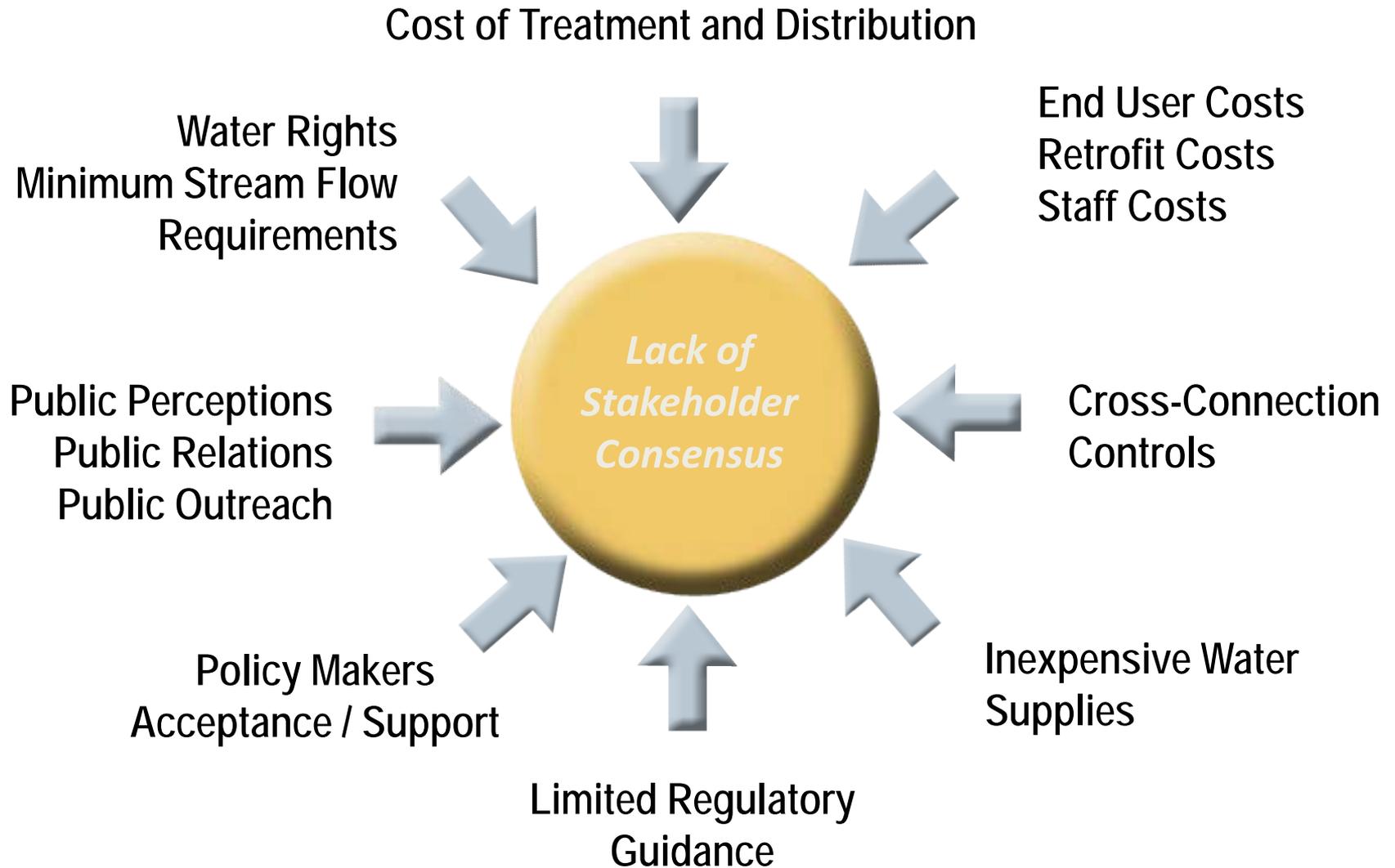
- Nutrients
- Energy
- Water
- Sustainability

Sources

- Wastewater and graywater
- Harvested rainwater
- Stormwater
- Drainage water
- Water plant backwash



Water Use Challenges



Why Water Reuse?

Growth / Infrastructure Needs
Major Investments

Limited New
Water Sources

Offers Reliable
Clean Water Supply

Reduces Pollutants to
Rivers and Estuaries

Sustainability

Zero Discharge
or Interbasin
Transfer (IBT)
Requirements

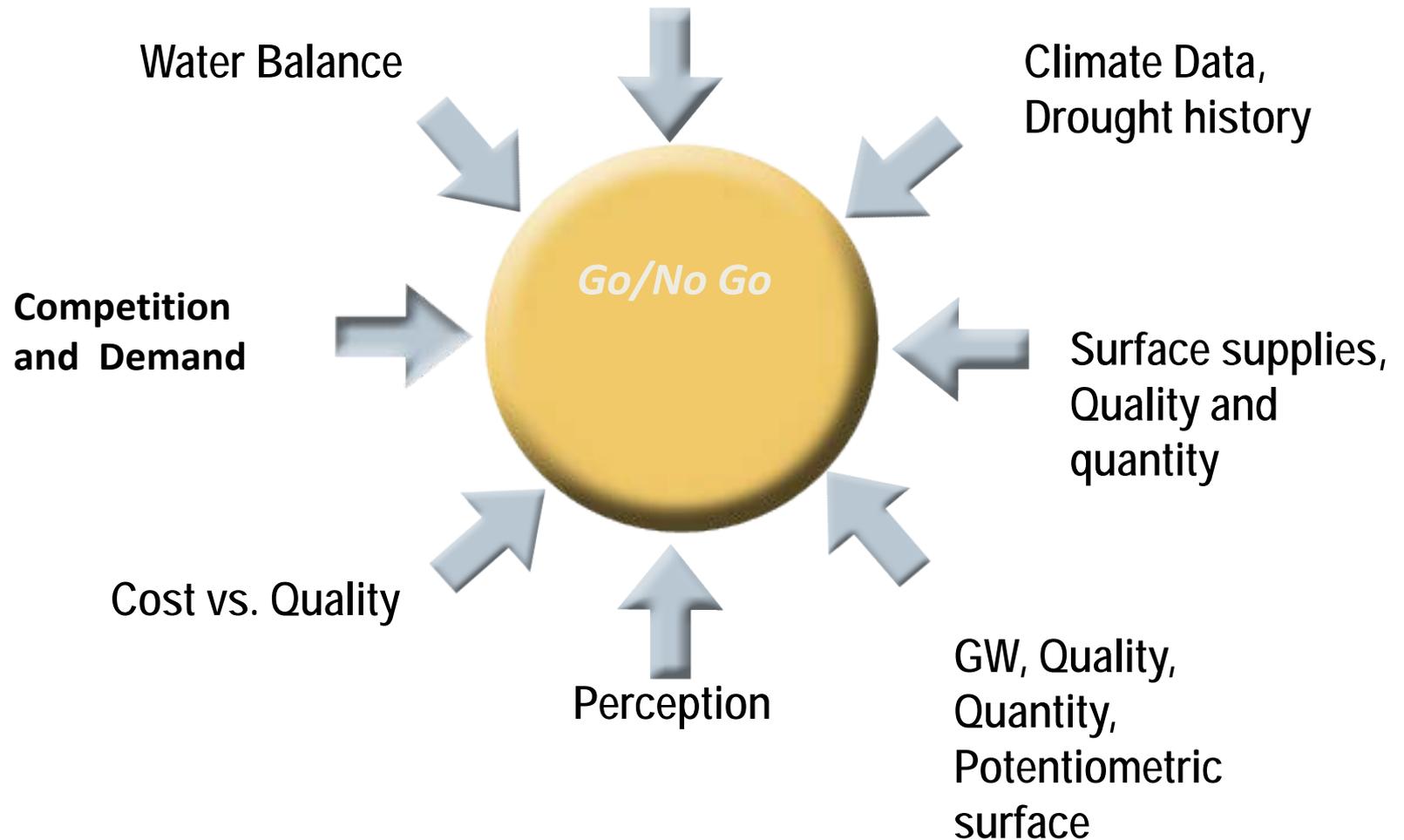
Restores
Groundwater /
River / Lake
Levels

Potential Cost
Savings to Users



Reuse?

Growth / Infrastructure Needs
Major Investments

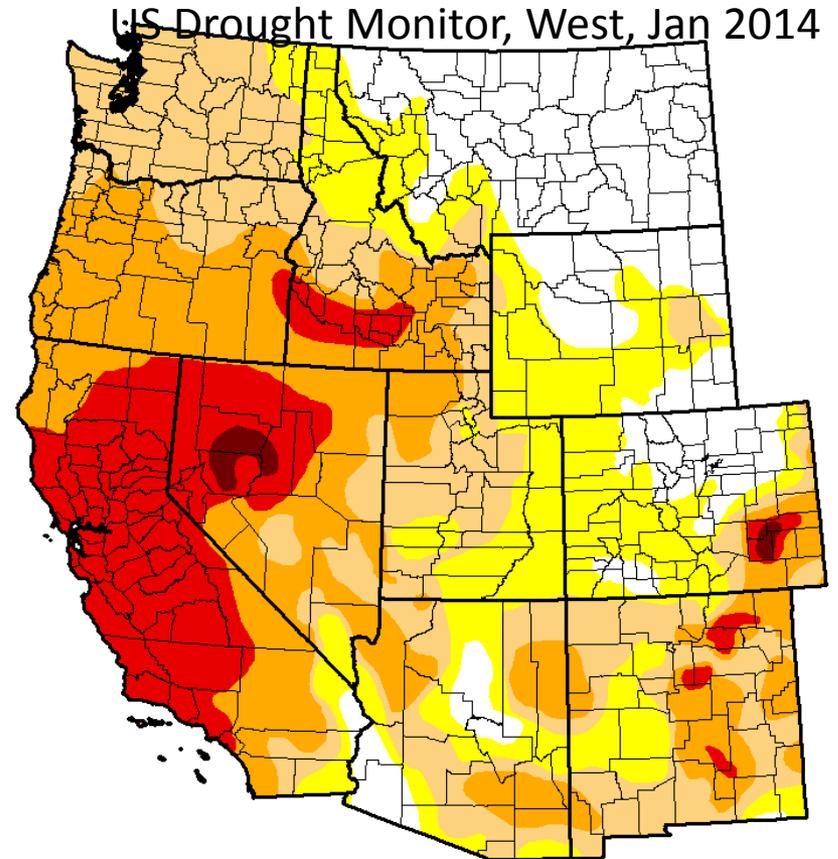


Reuse Implications

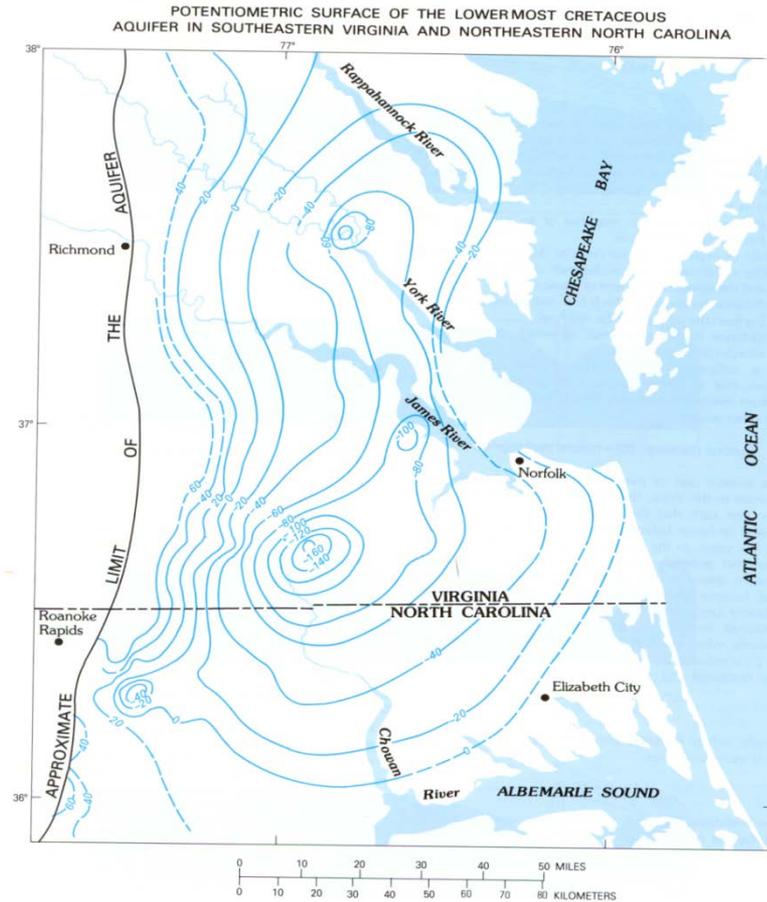
- Environmental and Public Health Consequences
 - Discharge elimination
 - Reliable supply of high quality water-potable demand management
 - LEED
 - Important tool
- Resource Allocation Consequences
 - Extends water supplies
 - Reduces energy demands on potable system
 - Saves Dollars
 - Important tool

Water Scarcity

- National drought data
- Frequent updates
- Forecast
- Water management tool

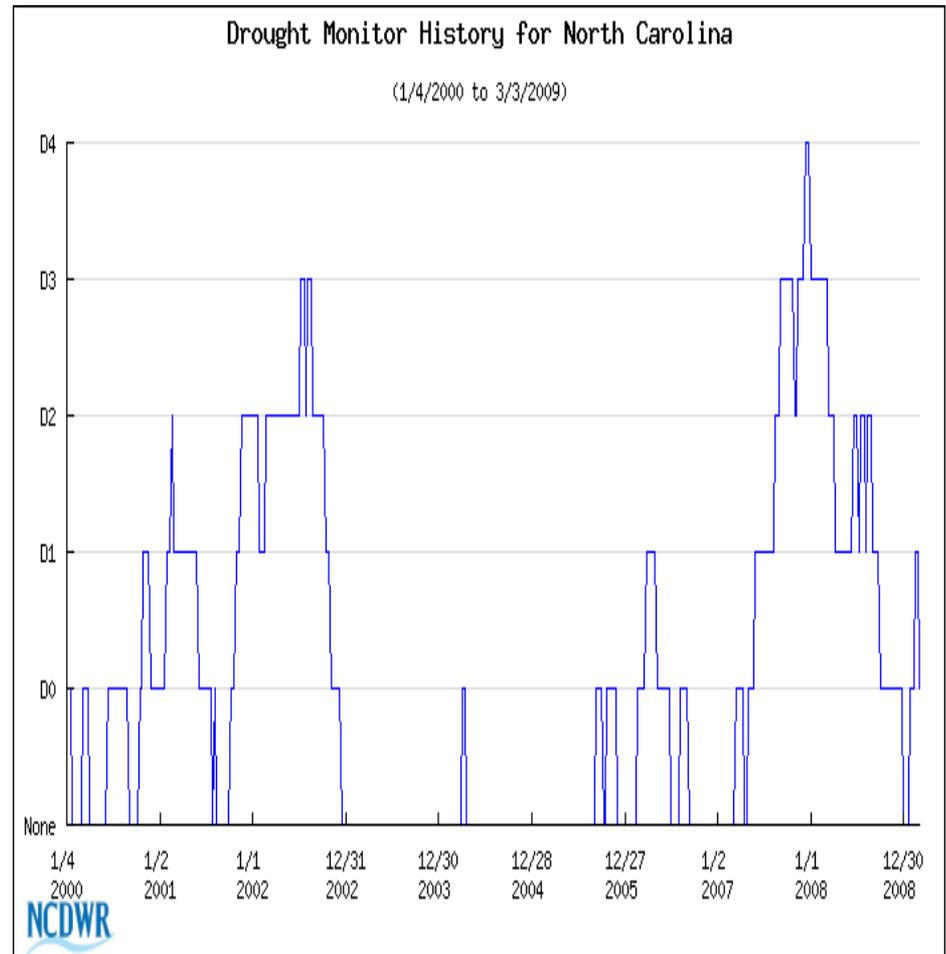


Groundwater Potentiometric Surface Data – Dwindling Supplies



Drought History

- Significant stress on water systems through decade
- Increasing population pressures expected



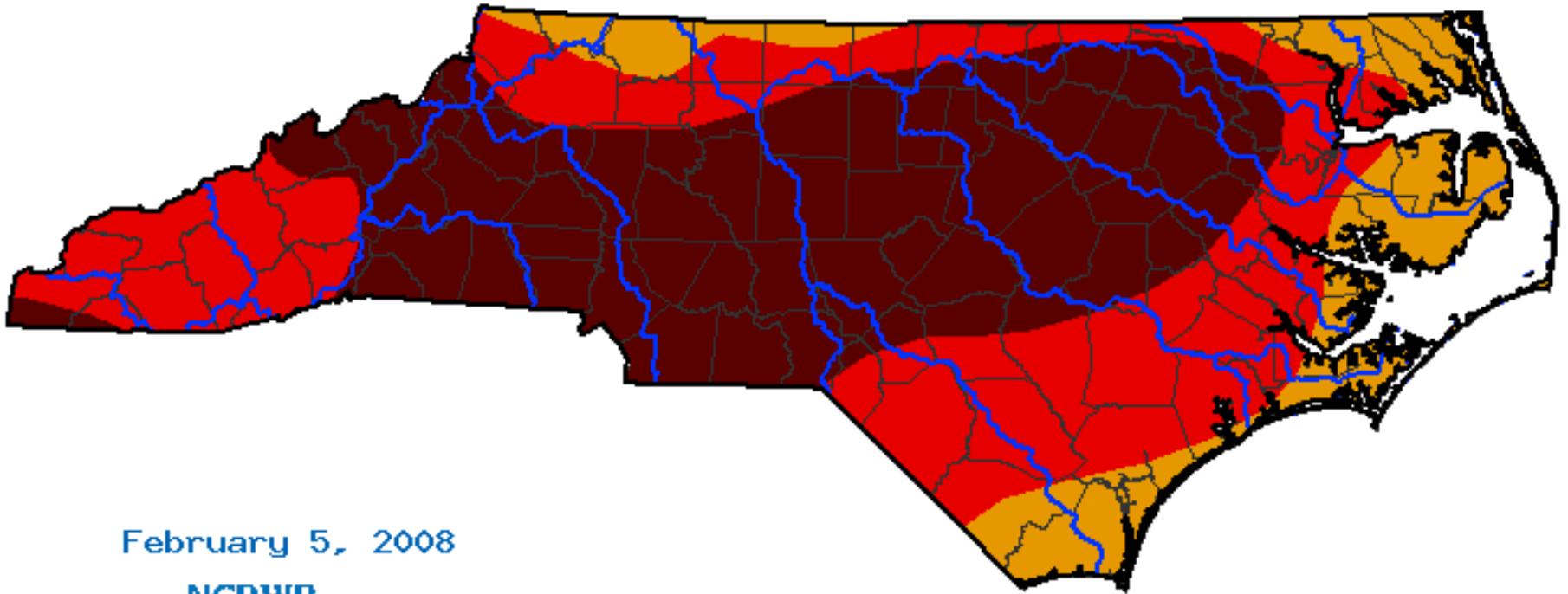
Executive Order 13514

(June 2009)

- 25% improvement in water efficiency
 - Wastewater reuse
 - Stormwater and rainwater harvest
- Net-zero buildings by 2030
- 50% recycle and waste diversion
 - Energy recovery from digestion

A Shift in NC Policy

House Bill 2499 - The Drought Bill



February 5, 2008

NCDWR

Reuse Guidelines

- Guidelines because NO mandate
- Variety of end uses
- Recent interest in direct and indirect potable use
- This document is available via the internet:
- <http://www.waterreuseguidelines.org>

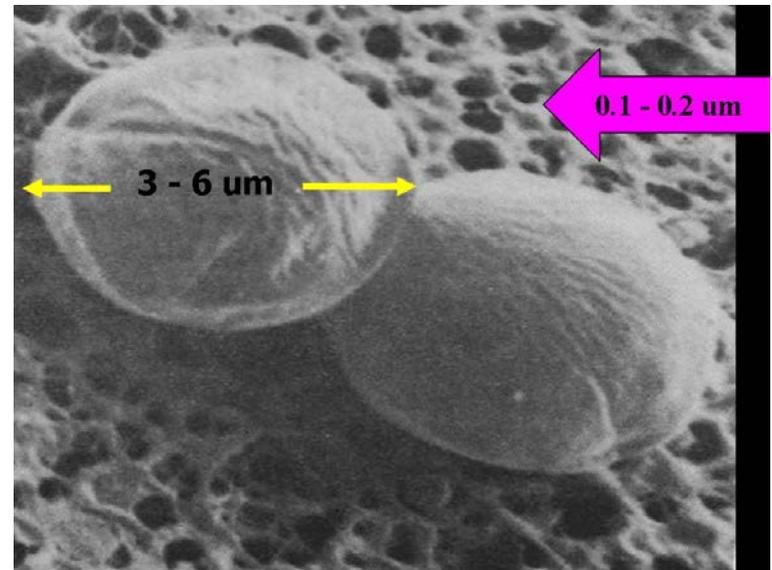


Health Concerns

- Public Health Concerns drive efforts
- Microorganism levels reduced to detection
- Advanced treatment and Multi-barrier disinfection processes where exposure high
 - Chemical (chlorine, ultraviolet light, Peracetic acid)
 - Barriers (microfiltration)

Create Multiple Barrier Process

- Organic Contaminants
 - ✓ Biological Treatment
- Nutrient Removal
 - ✓ BNR Anaerobic/Anoxic/Aerobic
- Colloidal Particulate Removal
 - ✓ Microfiltration Membranes
- Pathogen Removal
 - ✓ Biological Treatment
 - ✓ Microfiltration Membranes
 - ✓ UV Irradiation
 - ✓ Chlorine Residual



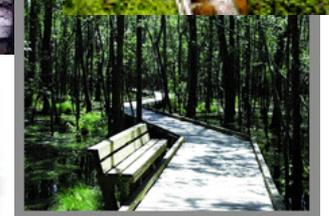
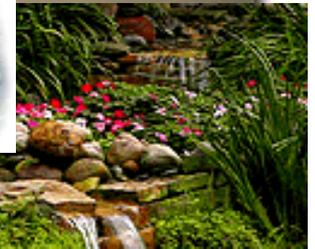
Selected Standards

Jurisdiction	Turbidity	BOD	TSS	Coliform	C. perfringens	Coliphage
CA	2	NS	NS	2.2		
FL		20	5	ND		
NC	5	10	5	14	-3 log	-4 log
VA	5	10	5	14		
NYC	2	10	10	2.2		

Current Reuse Practices

Use of Reclaimed Water - Irrigation

Golf Courses, Residential Lawns,
Agricultural Sites, Cemeteries, Parks,
School Grounds, Commercial / Industrial
Site Grounds, Landscape Areas,
Roadways, Medians and Other Similar
Areas



Additional Uses for Reclaimed Water

- Industrial purposes such as process or cooling water;
- Aesthetic purposes such as decorative ponds or fountains, fire protection, dust control, street cleaning and other similar uses
- Bulk reuse programs



Emerging Uses of Reclaimed Water

Fire Protection

Urinal / Toilet Flushing

Chillers / Cooling

Pollution Abatement

Commercial / Industrial
Buildings, Hotels or Motels

Laundry



Irrigation of Food Chain Crops

- Principal Concerns – Transmission of Pathogens CEC (PCP/Pharmaceuticals)
- Multi-barrier Treatment / Disinfection
 - Tertiary quality effluent (biological treatment, filtration)
 - Membranes
 - Chlorination
 - Ozonation
 - Ultraviolet Light
 - Advanced Oxidation Procedures (AOPs)



Wetland Augmentation

Natural wetlands – Hardwood and Pine Flats

Degraded via clear-cut, ditching, drained, or managed

Benefits such as wildlife habitat; passive and active recreation, boardwalks, bird watching, creature watching, public / schoolchildren education.



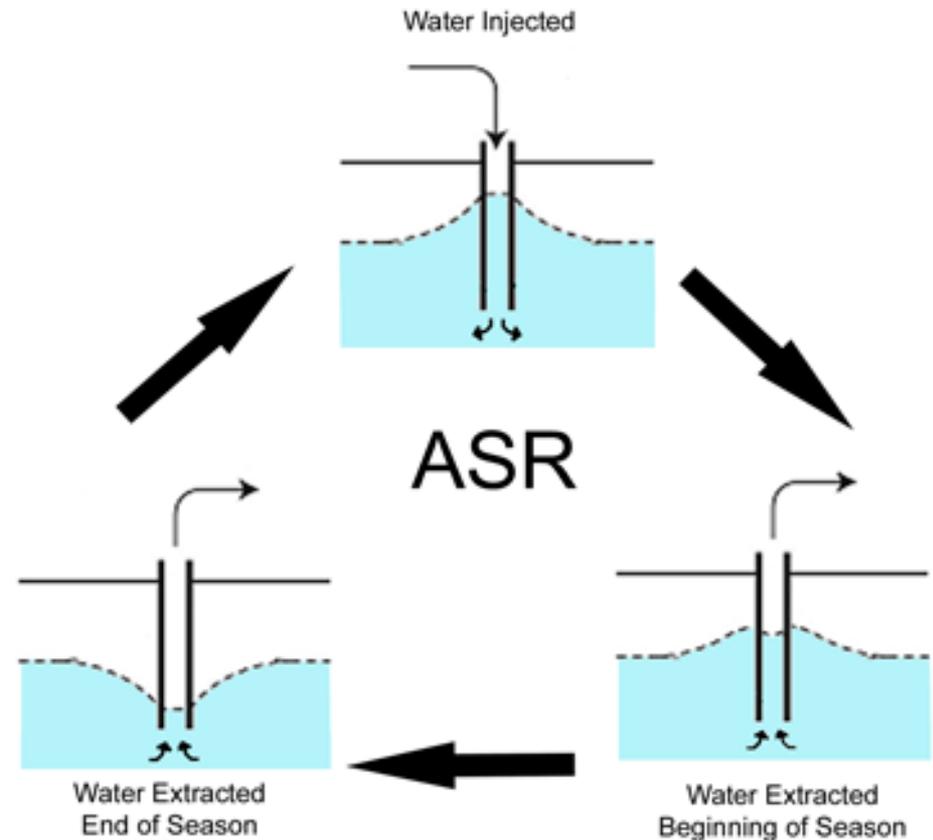
Stream Augmentation

Stream Benefits such as enhancement of degraded biological habitat - 303d listed streams (WQ or Habitat); reclaimed water in streams that are subject to "drying up"; loss of habitat – mussels, fish, etc., public parks, public education, water features. Mitigation of 305b impairments.



ASRs & Groundwater Recharge

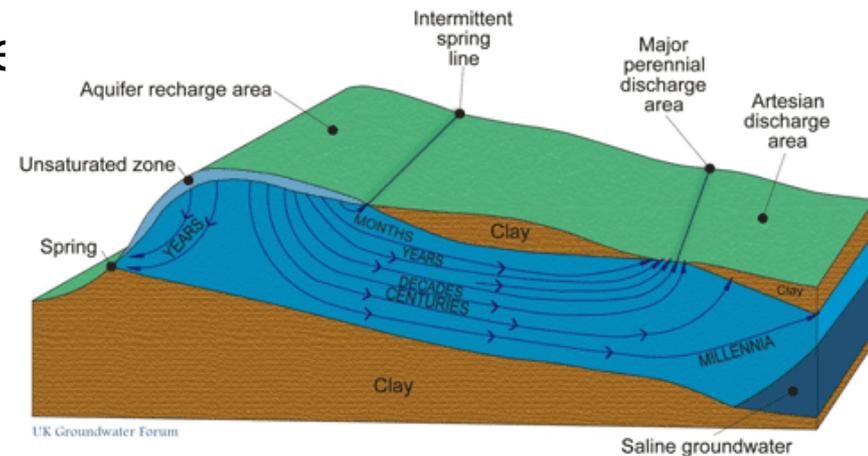
- ASRs – Opportunities to store and recover hundreds of millions of gallons of water
- Coastal Barriers for Saltwater Intrusion
- Slow Rate / High Rate Infiltration Systems – Aquifer Recharge
- Statutory Restrictions
- **Caution – solubility**



Planned Direct and Indirect Potable Reuse

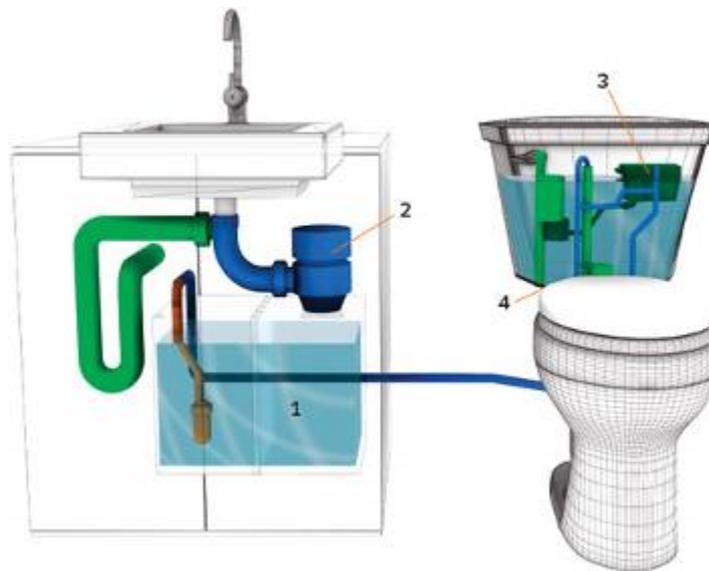
Few National Examples (Clayton Co, GA;
Water Factory 21, OCWD, CA), AZ

- Generally, no more than 25% indirect feed for direct reuse (treatment plant through wetland to water treatment plant)
- Indirect – natural buffers – surface or groundwater
 - Twelve month travel time between infiltration / withdrawal
 - Minimum 2,000 foot between infiltration / withdrawal



Future Trends

- More efficient use of our water resources
 - Aggressive reuse
 - Commingling divergent sources
- Conservation
- Agricultural reuse for food & non-food crops
- Residential reuse
- Indoor reuse
- Planned direct & indirect potable reuse



Rainwater and stormwater

- May not be as clean as you think
- Reactive
- Impact on metal pipe?
- Impact on plumbing fixtures
 - Appearance
 - Aesthetic

Table 1, Typical Residential, Commercial and Industrial Harvested Rainwater and Paved Lot Stormwater Quality

	Residential rainwater ₁	Commercial rainwater ₁	Industrial rainwater ₁	Paved Lot Stormwater ₂
TSS (mg/l)	27	15	41	56
Coliform C/100ml)	290	1117	144	41976
Zn (mg/l)	149	330	1155	1.2

1. Bannerman, 1993; 2. Pitt, 2004

Water Quality Concerns

- Intended Use of reclaimed or harvested water drives issue
- Risk Based Management
- Treatment Requirements
 - Constituents of concern (BOD, N, P, Na, coliform, virus)
 - Treatment and Disinfection
 - Microbiological
 - Organic
 - Nutrients and salts
 - turbidity

Standards

- No federal reuse standard
- State rule or guideline
 - Generally for MUNICIPALLY TREATED wastewater
 - Treatment requirements
 - Water Quality Standards
 - BOD, TSS, Turbidity, Indicator Organisms, Nutrients
- NSF/ANSI 350 and 350-1 *Onsite residential and commercial reuse treatment systems*
 - Equipment requirements
 - Treatment levels
 - BOD, TSS, Turbidity, Indicator Organisms, Nutrients

Water Quality Standards

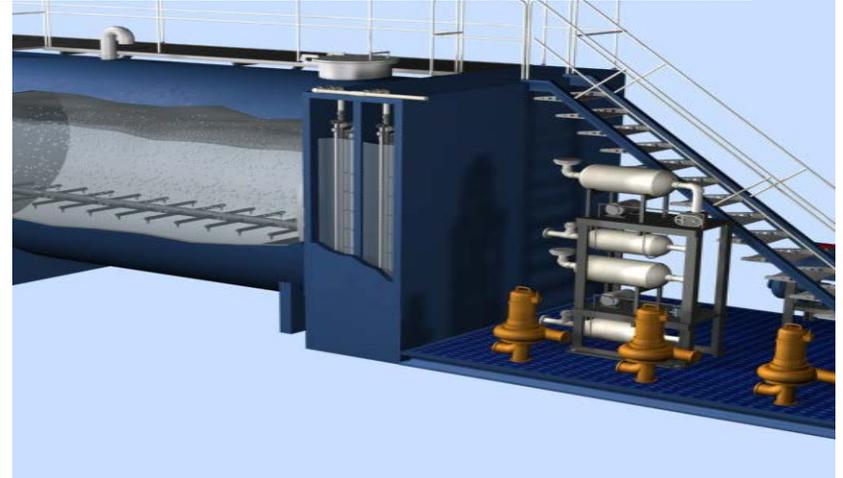
- 15 A NCAC 0.2U (reclaimed water)
- 18 Arizona Administrative Code 11 A3 (B)
 - Classes A+, A, B+, B, C
 - Type 1, 2 or 3 permit
- California Title 22 (reclaimed water from municipal sources)
- NSF 350 and 350-1 (Non-Potable water use)
- NO EPA STANDARDS for Non-Potable use
 - No congressional mandate
 - Guidelines only

Selected Standards

Jurisdiction	Turbidity	BOD	TSS	Coliform	C. perfringens	Coliphage
CA	2	NS (adv oxidation)	NS (adv filtration)	2.2		
FL		20	5	ND		
NC	5	10	5	14	-3 log	-4 log
VA	5	10	5	14		
NYC	2	10	10	2.2		

Treatment Technologies

- Advanced levels of treatment possible with complex and simple technologies
 - High quality water
 - Fit for purpose
 - Rule compliant
 - MANAGEMENT ESSENTIAL



NSF/ANSI 350

- American National Standard
- Residential and commercial treatment systems
- Sources; graywater and combined wastewater
 - Graywater: laundry and bathing, excluding toilet and kitchen.
 - Combined: blackwater and graywater.
- Non-potable effluent uses
 - Indoor; toilet and urinal flushing.
 - Outdoor; surface and subsurface irrigation.

NSF/ANSI 350

- Residential wastewater; Up to 1500 gpd
 - Laboratory testing with actual wastewater.
- Graywater; Up to 1500 gpd
 - Laboratory testing with synthetic wastewater; bathing, laundry, or both
 - Exception; commercial laundry water
- Systems exceeding 1500 gpd, and commercial laundry
 - Field evaluation using actual building wastewater.

350 and 350-1 Standards

350

- Domestic wastewater and graywater used indoors
 - Chemical
 - Biological
 - Physical
 - Indoor uses and unrestricted outdoor use

350-1

- Graywater
 - BOD and TSS
 - Outdoor use only
 - Buried/subsurface drip

NSF/ANSI 350 Effluent Criteria

Standards

Parameter	Class R	Class C
CBOD ₅	10 mg/L (25)	10 mg/L (25)
TSS	10 mg/L (30)	10 mg/L (30)
Turbidity	5 NTU (10)	2 NTU (5)
E. coli	14 MPN/100 mL (240)	2.2 MPN/100 mL (200)
pH	6.0 – 9.0	6.0 – 9.0
Chlorine	0.5 - 2.5 mg/L	0.5 - 2.5 mg/L

Use

- Indoor
 - Toilet flush
 - Laundry (?)
- Outdoor
 - Unrestricted irrigation
 - Pressure washing
 - De Minimis discharge

NSF 350-1 Criteria

Sources

- Laundry only
- Laundry and shower/lavatory
- Outdoor irrigation only
 - Subsurface drip (3-6 in typ)
 - Covered surface drip (1 in mulch cover)

Standard

Measure	Standard
CBOD5	25 mg/l
TSS	30 mg/l

Solaire and Visionaire



- Wastewater system incorporated into foundation
- Advanced treatment with MBR
- High quality water
- DOB approval

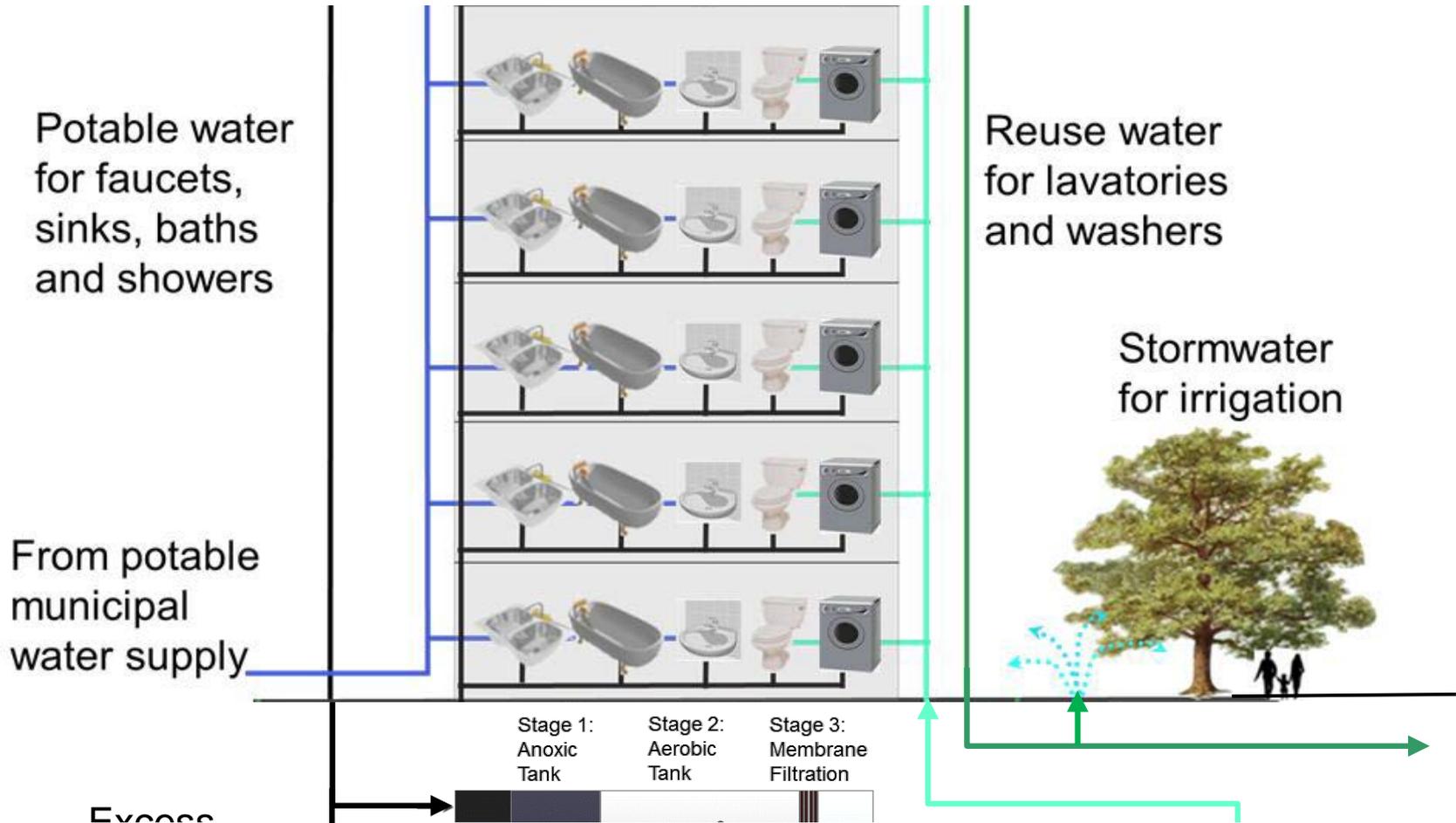
NYC



- Decentralized reuse in highly urbanized area
- LEED Platinum
- Green roof filters and captures stormwater
- Wastewater and stormwater treated for reuse
 - Toilet flushing
 - Cooling tower supply
 - Irrigation of park
- 48% reduction in potable water consumption
- 56% reduction in wastewater discharge

*Reference – Battery Park City Authority
Manhattan Borough, NYC, The Solaire
– Alliance Environmental, LLC*

NYC Concepts



NYC Water Quality Monitoring

	BOD	TSS	Turbidity	E. Coli	T. Coli	pH
Ave	6	1	0.3	1	1	6.9
Limits	10	10	2	2.2	100	6.5-8.0

Natural System Applications

Lagoons/wetlands

- Lagoon technology
 - Facultative
 - Aerated
 - Land requirements
 - Performance
- Wetland systems
 - Constructed or natural
 - Land area
 - Performance

Wetland producing 25000 GPD reuse quality water
indoor
outdoor irrigation



Wilkerson Park, Wake Co

Indoor reuse and SAS

Building Code approval

MBR treatment/Pressure
manifold/Chamber

NO REDUCTION

HQW achieved

Award winner

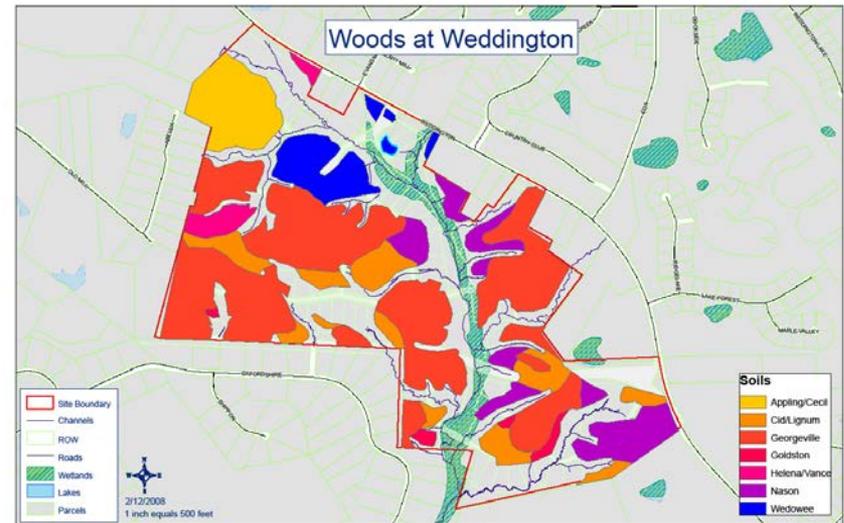
On-line turbidity monitor



	BOD	TS	N	coli	Turbidity (5 min/3 yr)
Av	ND	ND	37	ND	.05
Max	7	ND	51	ND	.08

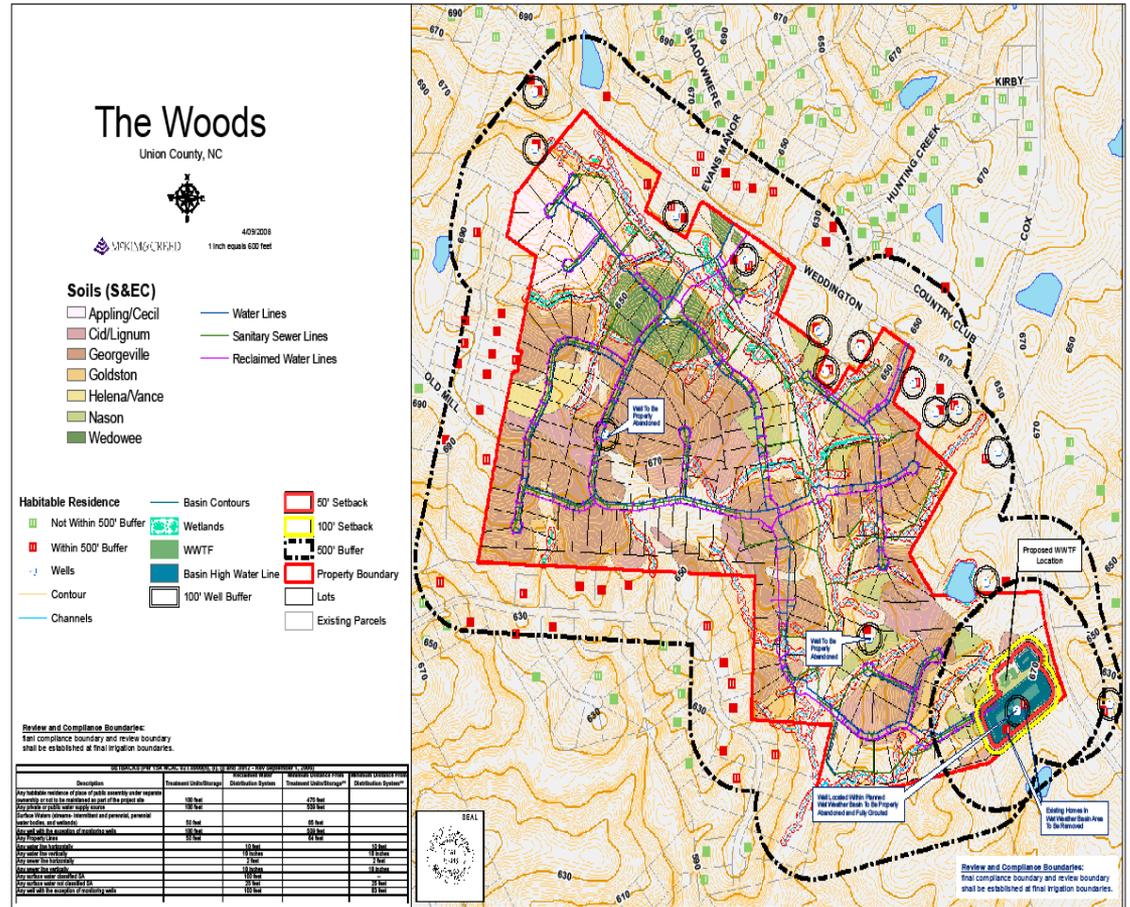
Residential Development -

- WOODS
- Initial plan approved - sewer
- State Review – No capacity in POTW
- Option selected: onsite reuse at each home



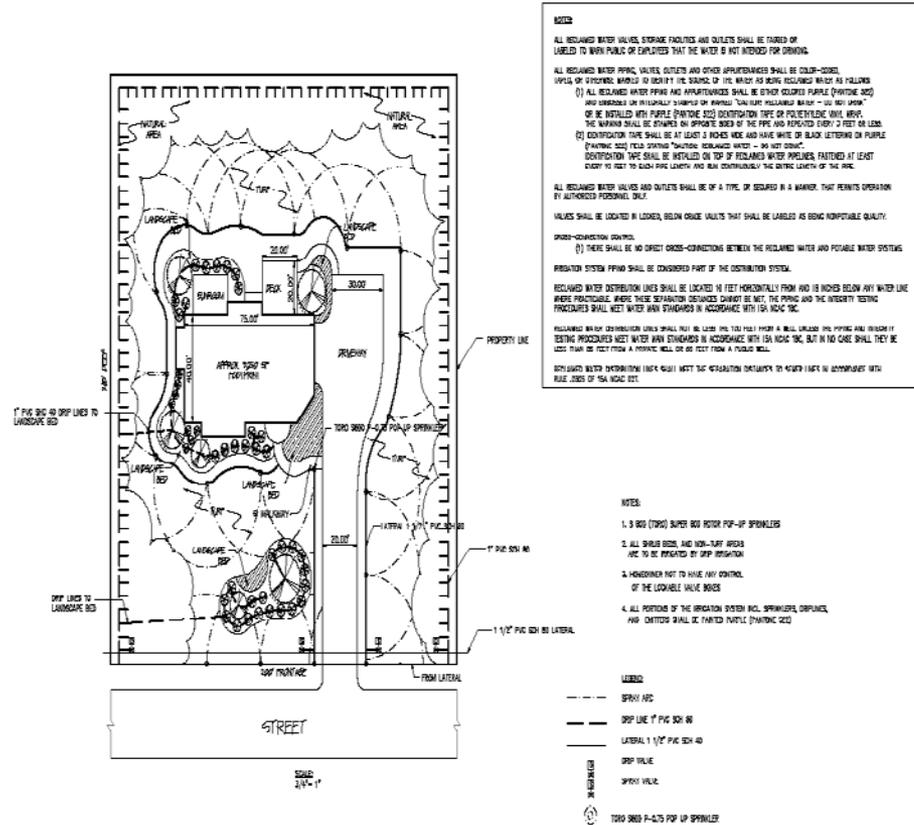
The plan

- Collection,
- Treatment and
- Redistribution to each lot



Typical Lot

- Spray and Drip
- Maximize irrigation
- Landscape plan required (CID involved in irrigation planning and design)



Standards Additional Activities

- NSF Standard 350
 - Water use standards
 - Use specific
- ICC
 - Plumbing code acceptance
- IAPMO
- LEED (gold and platinum require reuse)

ICC and USGBC

- IgCC (Green Code, 2012)
 - Water efficiency provisions
 - Ch's 3, 7, and 9
- ICC (2015 Code)
- LEED Building
- LEED ND

LEED Certification

Leadership in Energy and Environmental Design



LEED for New Construction and Major Renovation 2009 Project Scorecard

Yes ? No

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Water Efficiency	10	Points
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<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Prereq 1	Water Use Reduction, 20% Reduction	Required
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.1	Water Efficient Landscaping, Reduce by 50%	2
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	2
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 2	Innovative Wastewater Technologies	2
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 3.1	Water Use Reduction, 30% Reduction	2
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 3.2	Water Use Reduction, 40% Reduction	2

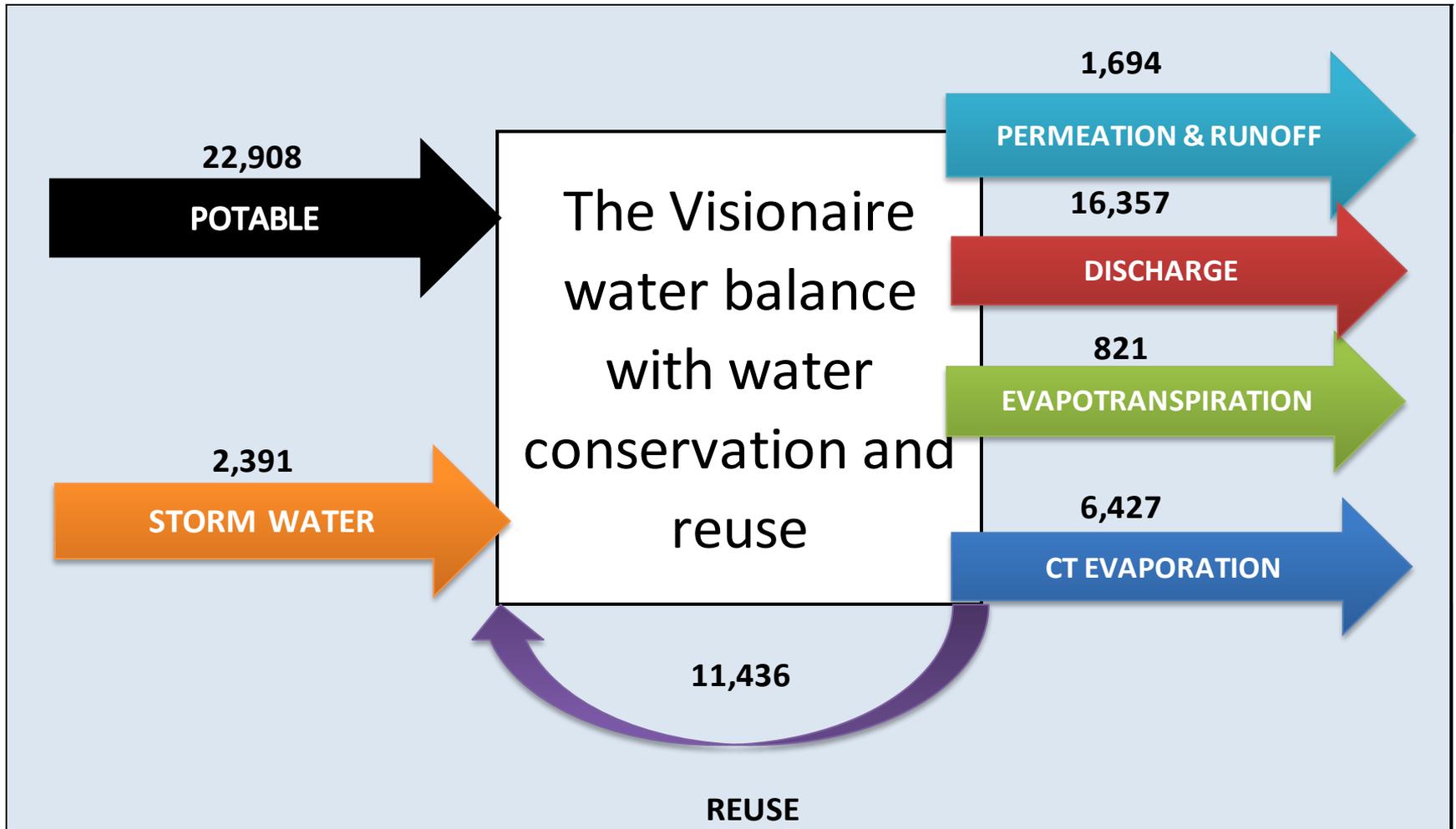
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Project Totals (Certification Estimates)	110	Points
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Not Certified

Certified: 40-49 points **Silver:** 50-59 points **Gold:** 60-79 points **Platinum:** 80+ points



Site specific water balance



IgCC – Ch 3: Jurisdiction

- Water Use Provisions
- Local Jurisdiction determines applicability for Municipal Reuse Systems (Table 302.1)
- Ref: ASHRE/USGBC/IES Standard 189.1 design of High Performance of Green Buildings

Ch 7: Water Resource Conservation, Quality and Efficiency

- 702 – fixtures
 - 702.7: municipal reclaimed water; where available and required in 302.1 reclaimed water shall be supplied to:
 - Water closets
 - Water supplied urinals
 - Water supplied trap primers, and
 - Applicable industrial uses (NCDENR 0.2U defines these)
 - Accessible if less than 150% of distance to potable line

Section 704: Treatment Devices

- 704.3: Onsite reclaimed water system applicable to graywater and wastewater
- Water use in toilet and urinals or irrigation
AND SIMILAR APPLICATIONS
- NSF 350

Ch 7, section 706: Non-Potable Water Requirements

- 706.1: Scope – Use and application comply w/local laws, rules and ordinances
- 706.2: Signage – “Non-Potable water is used for... DO NOT DRINK”
- 706.3: Quality – Rules and regs in local jurisdiction or NSF 350

Section 707 – Rainwater Collection and Distribution

- 707.11.5: Filtration – intended use
- 707.11.6: Disinfection – intended use
- 707.11.7.2: Materials NSF 61 if potable use

Section 708 – Gray Water Systems

- 708.2: Permits – Local jurisdiction
- 708.3: Potable connection - backflow protection
- 708.5.1 – Gray water irrigation –
 - Surface and subsurface irrigation
 - 24 Hr retention time

Section 709: Reclaimed Water Systems

- 709.2: Permits – Required!!!
- 709.3: Potable Connections – Protected
- 709.5: Applications – used IAW section 706 and local codes
- 709.1: Tests and Inspections
 - 709.10.1: testing make up piping and reclaimed system
 - 709.10.2: inspection and testing of backflow prevention assemblies IAW 312.10 IPC

Section 710: Alternative Onsite Nonpotable Water Sources

- 710.1: including but not limited to stormwater, RO reject water, foundation drain water, pool backwash shall be permitted if properly treated for intended use and IAW local jurisdiction requirements

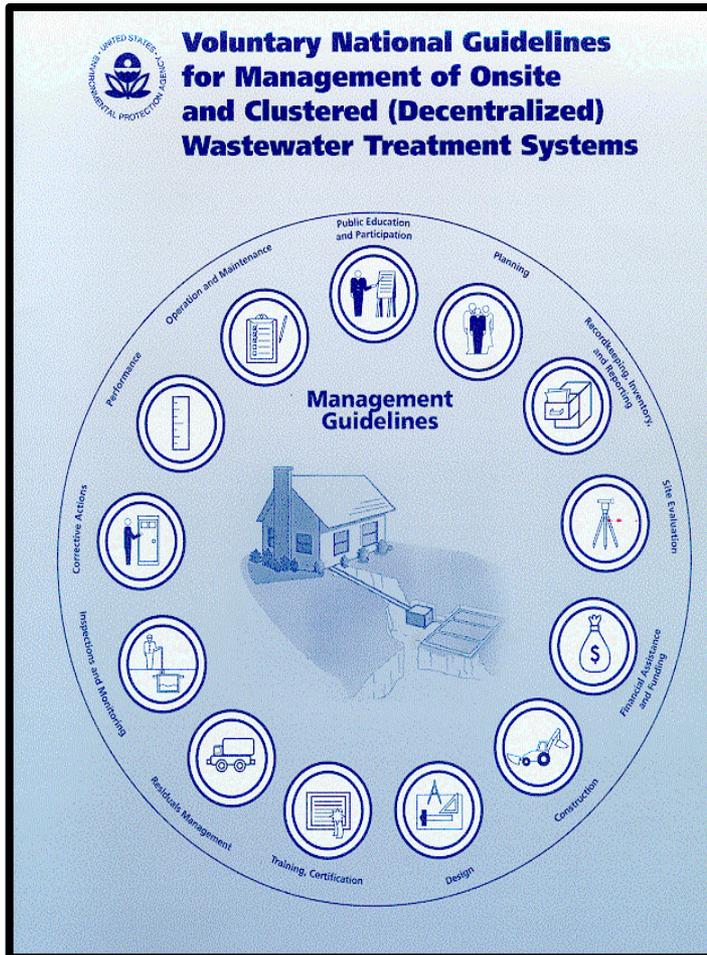
Ch 9: Commissioning, O and M

- 901.1: Scope - Pre and Post occupancy issues
- 903.1: Commissioning –
 - Registered design professional requirements
 - Commissioning plan
 - 904.3: Building O and M
 - Record documents
 - O and M manual shall be provided to owner

NEWS

- Nutrient Concern ? Harvest urine
- Energy Concern ? Anaerobic digestion
- Water concern ? Reuse
- Regardless all must be sustained...!!!

Goals of the Management Guidelines



- To raise the level of onsite/cluster system performance through improved management programs
- To provide conceptual models that may be used by local units of government to assist them in upgrading their programs

Sustainability

- Brundtland Commission, 1983: concern – accelerating deterioration of human environment and natural resources and consequences on economic and social development...
- Brundtland Commission Report – Our Common Future, 1987

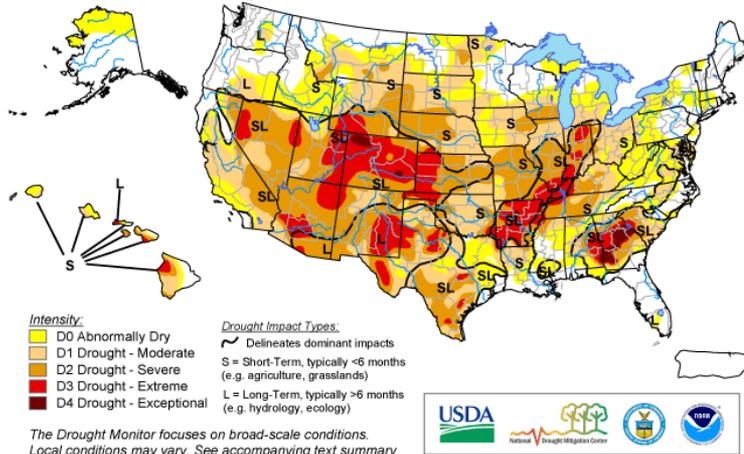
Bob's Sustainability Criteria

- sustainable cities well managed water cycle, secure, green open watershed space
- all water good water – fit for purpose, just in time
- educated citizens and law makers
- Customer driven
- Useful info
- Multi-faceted water management

Planned reuse in your future

U.S. Drought Monitor

July 10, 2012
Valid 7 a.m. EDT



Released Thursday, July 12, 2012
Author: Rich Tinker, NOAA/NWS/NCEP/CPC



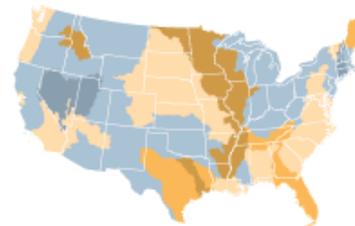
Needing More Water, Coast to Coast

Large areas of the United States have reduced their withdrawals of water over the last 25 years. But an analysis suggests that if warming related to climate change occurs as anticipated in the next quarter-century, the demand for water would rise in most places.

It is the right thing to do



Change from 1985 to 2010



Potential change from 2010 to 2035



Sources: Thomas C. Brown, U.S. Forest Service

THE NEW YORK TIMES

Additional Information

- Water Environment Research Foundation (WERF) funded research project ***When to Consider Distributed Systems in Urban and Suburban Areas***
- Products
 - Detailed case study summaries, white papers
 - MCDA-based decision-support tool
 - Database of case studies
 - Other targeted communications products (journal articles, presentations, etc.)
- Public access at www.werf.org and www.ndwrcdp.org

Commencement

- A new Beginning
- Integrated resource management
- Technologies well developed and sound
- Management approaches demonstrated
- Your challenge – help implement integrated management