# Green Building Roundtable:

## Peak Water – Building for Water and Energy Efficiency

**April 15, 2011**

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# Water Consumption

**Domestic**: residential, commercial, industrial, and public uses
(street cleaning, fire fighting, parks, and public swimming pools)
**43 billion gallons** per day.

**Power Plants**: energy production, cooling purposes
**136 billion gallons** of fresh water per day.

**Agricultural**: irrigation for crops, livestock, dairies, fish farms.
**142 billion gallons** of fresh water per day.

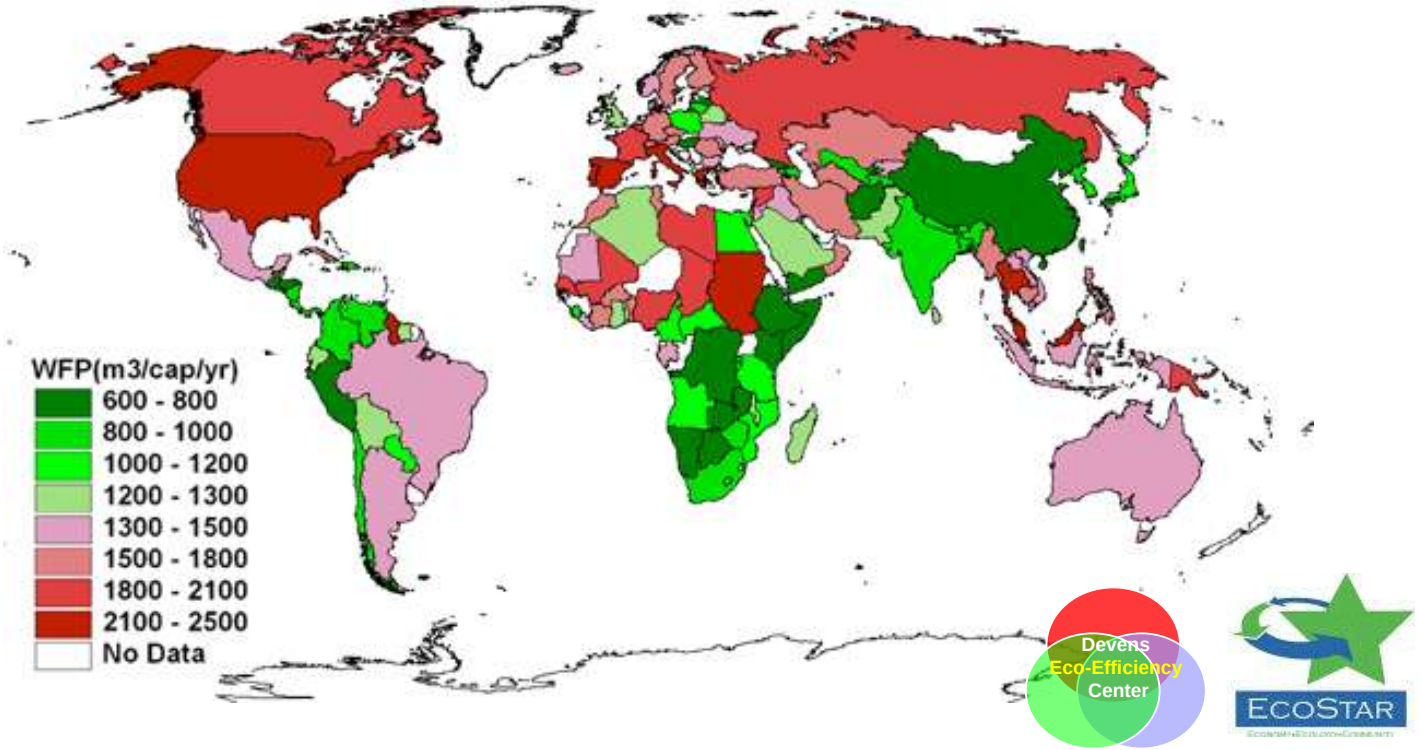
**Industrial & Mining**: cooling, washing and rinsing.
**20 billion gallons** of fresh water per day.

# What's the Problem?

- Limitless supply of water?
- Droughts, floods, climate shifts, growing populations, increasing consumption
- Climate refugees
- Abundance, waste
- 3,700 BILLION gallons more water extracted than returned to the natural water system
- Ipswich and Charles River basins - demand exceeds supply - water use restrictions.
- Regional impacts.
- Flooding – dead zones

# Water Consumption

- Global average water footprint - 1240 m3/yr/cap.
- USA the average water footprint - 2500 m3/cap/yr.
- China the average water footprint - 700 m3/cap/yr.



# “Peak Water”

- Extraction/Depletion from a source faster than it can be replenished
- Peak oil and Peak Water - Global vs. regional
- Global impacts on industry and supply chains (risk)
- Peak “ecological” Water - point past which a watershed’s water supply is depleted, causing irreversible damage to local ecosystems that depend on it.  (human-caused desertification example).
- Supplies diminish while demand grows - triple-bottom line impacts
- Future water wars?

# Water and Energy Efficiency

- Water = Energy
- Extracting, processing, treating, transporting and consuming freshwater
- Municipal budgets and taxes

(planning, engineering, construction, operation, maintenance, treatment, wastewater facilities costs, piping, metering, leak detection, compliance costs, salaries, protection costs, pensions, health care, staff training, and public education….)

# But Wait!  The glass is half full!

- Reduce, Reuse and Recycle
- Efficiency and Innovation - doing more with less
- Regulatory Agencies reducing barriers for reuse
- Conservation = enhanced water quality, aquifer and stream recharge
- septic systems and wastewater treatment plants function more efficiently and last longer
- more water retained in the natural environment - dilutes pathogens and other pollutants, buffers waterways from excessive heating or freezing
- investments in efficiency/conservation provide long term savings (compared to cost of developing/treating new water supply sources and wastewater treatment)
- Triple bottom-line impacts -  natural resource protection, energy efficiency and enhanced QOL.


# Typical Water Efficiency Examples

- System water audits/metering
- Dual flush toilets (1.6 gpf – 1.1 gpf – 0.8gpf)
- Low-flow fixtures (showerheads, aerators 2.5gpm – 1.8 – 0.5gpm),
- Waterless urinals (1.0gpf – 0.0 gpf)
- High efficiency appliances
- Water Efficient Landscaping
- Moisture sensor irrigation
- Compost and mulch

# Water Footprinting

- Like electricity, carbon and GHG's – can't reduce what we don't measure;
- How much and what kind?
- Making products, materials, buildings and operations
- Water = energy  - GHG impacts

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# WATER FOOTPRINT

*virtual water embedded in products*



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# Water Footprinting


http://www.allianceforwaterefficiency.org/WorkArea/linkit.aspx?LinkIdentifier=id&ItemID=2212

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# Water Reuse Regulations in MA

- Greywater Reuse - Filtration, disinfection, overflow protection, separate tank, dual plumbing - $$$$$
- Rainwater Reuse – significantly fewer requirements

# MADEP Water Reuse Regulations

# MA DEP Water Reuse Regulations

**314 CMR 20.00: Reclaimed Water Permit Program and Standards**

**Definition:** Domestic wastewater treated to a level beneficial for reuse

Reduce microbial and chemical constituents (public health)

Interim guidelines developed in 1999 - very limited (irrigation ,golf courses)

Increasing water demands, protection of stressed public water supplies

March 2009 – New Program and Standards released

# DEP Water Reuse Regulations

**314 CMR 20.00: Reclaimed Water Permit Program and Standards**

**Expands list of potential uses and creates a system of classifications:**

- **Class A –** Contact with public likely (golf course, parks, playgrounds, athletic fields, toilet flushing)
- **Class B –** Contact with public less likely (sod farms, non-edible crop irrigation, nurseries, cooling water)
- **Class C –** No public contact (industrial process water, forestry)

Highest standards apply to uses with greatest potential for public exposure

Establishes effluent standards

Consistent with national standards

# DEP Water Reuse Regulations

**314 CMR 20.00: Reclaimed Water Permit Program and Standards**

**http://www.mass.gov/dep/service/regulations/314cmr20.pdf**

# MA Case Study

**Wrentham Village Premium Outlets**

- 575,000-square-foot outlet center, a 550-seat food court, mall management offices, and a cinema
- onsite wastewater treatment plant - recycle wastewater as flush water for the toilets
- subsurface disposal recharging groundwater.
- Treatment using a trash trap, an equalization chamber, a series of aerobic digestion chambers and a membrane filtration system to separate solids from liquids.
- Additional treatment through carbon absorption and disinfection (UV and $O^3$ technologies).
- BOD of < 30 milligrams per liter, TSS of < 10 milligrams per liter, total nitrogen of < 10 milligrams per liter, fecal coliform of < 100 organisms per 100 milliliters, turbidity of < 5 nephelometric turbidity units, and pH of 6 to 9.

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# Solaire
# Battery Park, NYC

- 293-unit building
- Reuse water stored in individual reservoirs in basement of each building
- distributed based on demand.
- Non-potable water distribution system draws water from the reservoirs, which are then replenished with
- additional reuse water from the treatment process.
- toilet flushing, cooling, laundry, and irrigation.

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# Solaire

**Recycles up to 25,000 GPD:**
- 9,000 GPD toilet flush water
- 11,500 GPD cooling tower make-up
- 6,000 GPD landscape irrigation

**Advanced membrane bioreactor system:**
- 35% less overall energy consumption
- 65% less energy at peak demand
- 50% less potable water used than other high rise buildings of same size

**Rainwater collection system** irrigates 10,000 square feet of rooftop gardens


***Treated Effluent in storage tanks in Basement***

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# Solaire

- LEED Gold
- 100% of wastewater treated
- No potable water use outside
- 5000 gal/day of treated effluent to public parks
- Uses 50% less potable water than conventional
- 88% water use reduction inside

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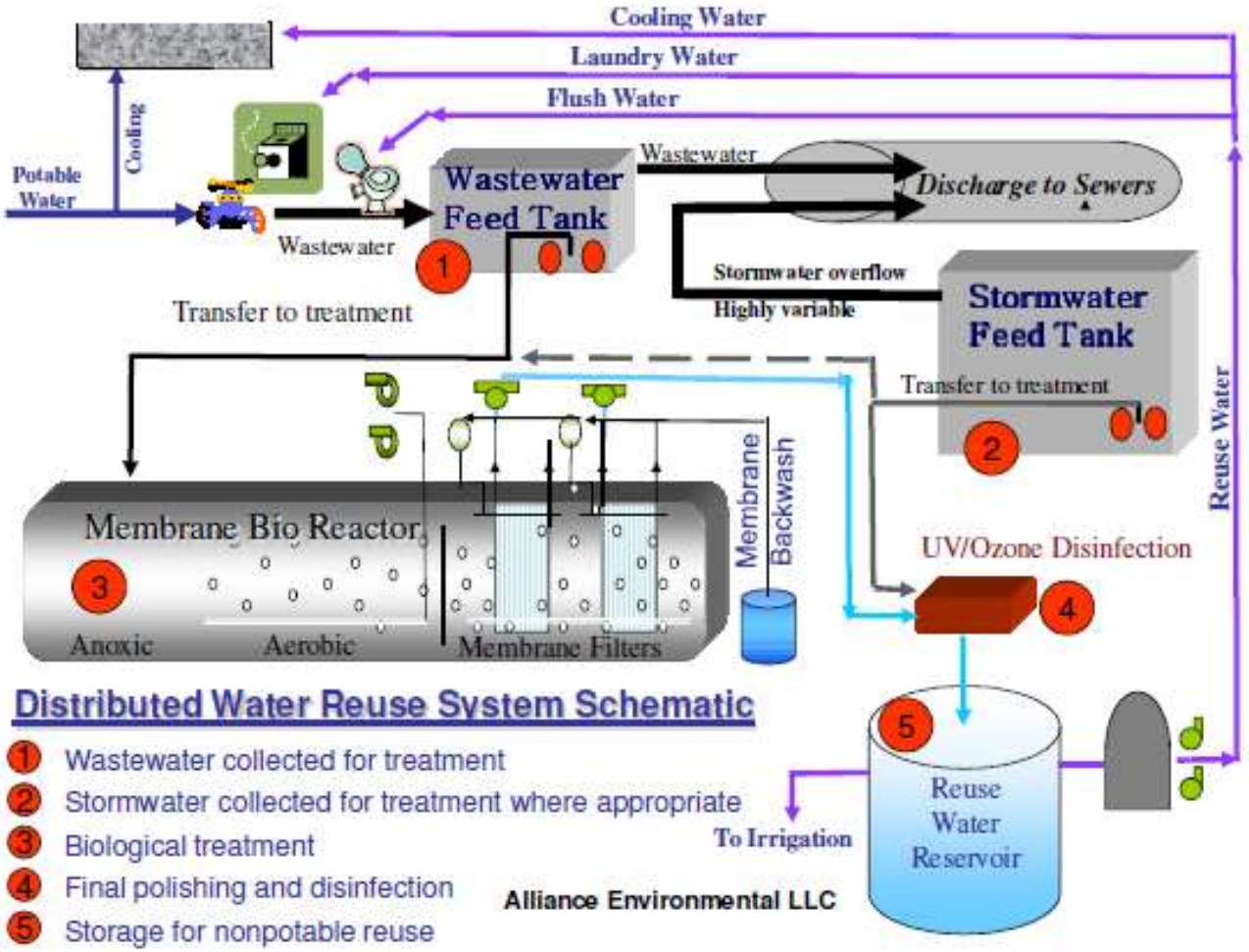
# Membrane Bioreactor Technology



# Innovation – One Bryant Park, NYC

- LEED Platinum (21,000,000 sq.ft.)
- Greywater and rainwater reuse – toilet flushing and cooling
- Low-energy treatment – filtration/disinfection
- Capturing kinetic energy of greywater and rainwater – 52 stories
- Gravity pressure zones every 10 stories
- Basement ice

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# Water Efficiency Resources

**EPA – Water Sense Program**
**http://www.epa.gov/WaterSense/**

**Energy Star Portfolio Manager**
**www.energystar.gov/index.cfm?c...bus_portfoliomanager**

**Solaire - Battery Park Case Study**

**EPA Municipal Rainwater Harvesting Guidelines**

**Alliance for Water Efficiency (CII indoor and Outdoor)**
**http://www.allianceforwaterefficiency.org/Commercial_Institutional_and_Industrial_Library_Content_Listing.aspx**


# Water Efficiency Resources

**Peak water and peak ecological water video:**
**http://www.youtube.com/watch?v=Rm7lxwKgO5I**

**Peak Water vs. Peak Oil**
**http://www.worldwater.org/data20082009/ch01.pdf**

**US Green Building Council**
**http://www.usgbc.org/**

**MA Water Conservation Standards**
**http://www.mass.gov/Eoeea/docs/eea/wrc/water_conservation_standards.pdf**