

Army Water Reuse Policy – A Decision Document

Environment, Energy & Sustainability Symposium

Denver, CO

14-17 June 2010

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U.S. Army Corps of Engineers

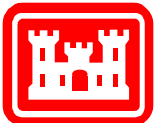
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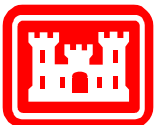
Decreasing Supply

- Over Withdrawal
- Climate Change
- Cost and Financing
- Quality Degradation

"I wish to make it clear to you, there is not sufficient water to irrigate all the lands which could be irrigated, and only a small portion can be irrigated. I tell you, gentlemen, you are piling up a heritage of conflict."

-- Maj. John Wesley Powell, 1893

Lynn Betts, NRCS

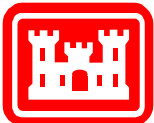


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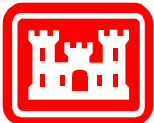
Future Concerns

- **Future water shortages**
- **Global climate change**
- **Reduced levels of surface streams or aquifers**
- **Competing regional requirements**
- **Reuse/Recycling to play bigger component**



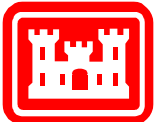
Tasking

- **Are policies needed?**
- **Drive/shape technology investments**
- **Need to understand issues, threats, and problems to help shape development of policy and guidance**
- **Task: Develop a decision document for Army to evaluate water reuse policies and identify changes/strategies to increase recycling/reuse at Army installations**
- **Focus area: indirect and direct potable reuse**
- **Focus area: reuse of lesser quality waters**



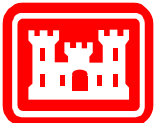
Product

- **Identify where and to what extent water reuse practiced on installations**
- **Identify conflicting issues and potential topic areas**
- **Summary of Army, DoD and federal policies related to water reuse**
- **Review of current state of the art on policies, technology and emerging trends which may have implications for the Army**
- **After review through appropriate channels, final document will suggest potential policy directions for water reuse**
- **Recommend opportunities to increase water reuse on installations and summarize current situation**



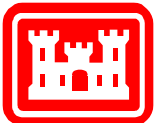
Partners and reviewers

- **Public Health Command**
- **Installation Management Command**
- **Corps of Engineers**
- **Army Environmental Policy Institute**
- **Army Environmental Command**
- **Others as appropriate**



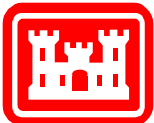
Key issues for direct potable reuse

- **Definition of direct potable reuse**
- **Compensation for loss of an environmental buffer**
- **Multiple barriers**
- **Dilution**
- **Constituents of concern and monitoring**
- **Assessment of health risks**
- **Applicability of regulations**
- **Regulatory responsibility**
- **Development of a communication system among agencies**



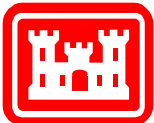
Potable reuse

- **Key between indirect and direct potable reuse is that there is no temporal or spatial separation between introduction of recycle water and distribution as drinking water**
- **Defn. IPR – Augmentation of a drinking water source with recycled water, followed by an environmental buffer that precedes normal drinking water treatment**
- **Defn. - direct potable reuse is generally defined as the introduction of recycled water directly into a potable water distribution system downstream of a water treatment plant**
- **Environmental buffer provides mixing, dilution, natural processes, time for corrective action**



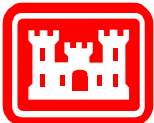
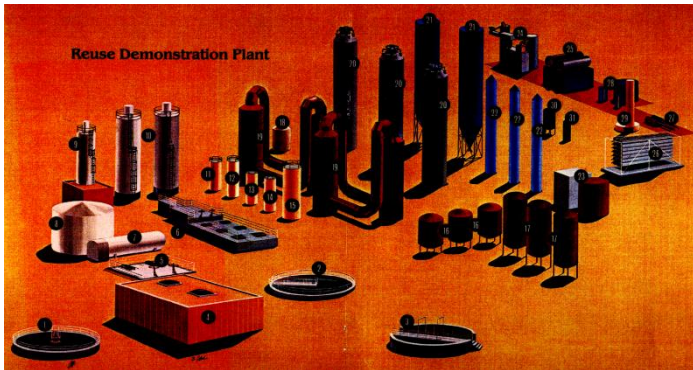
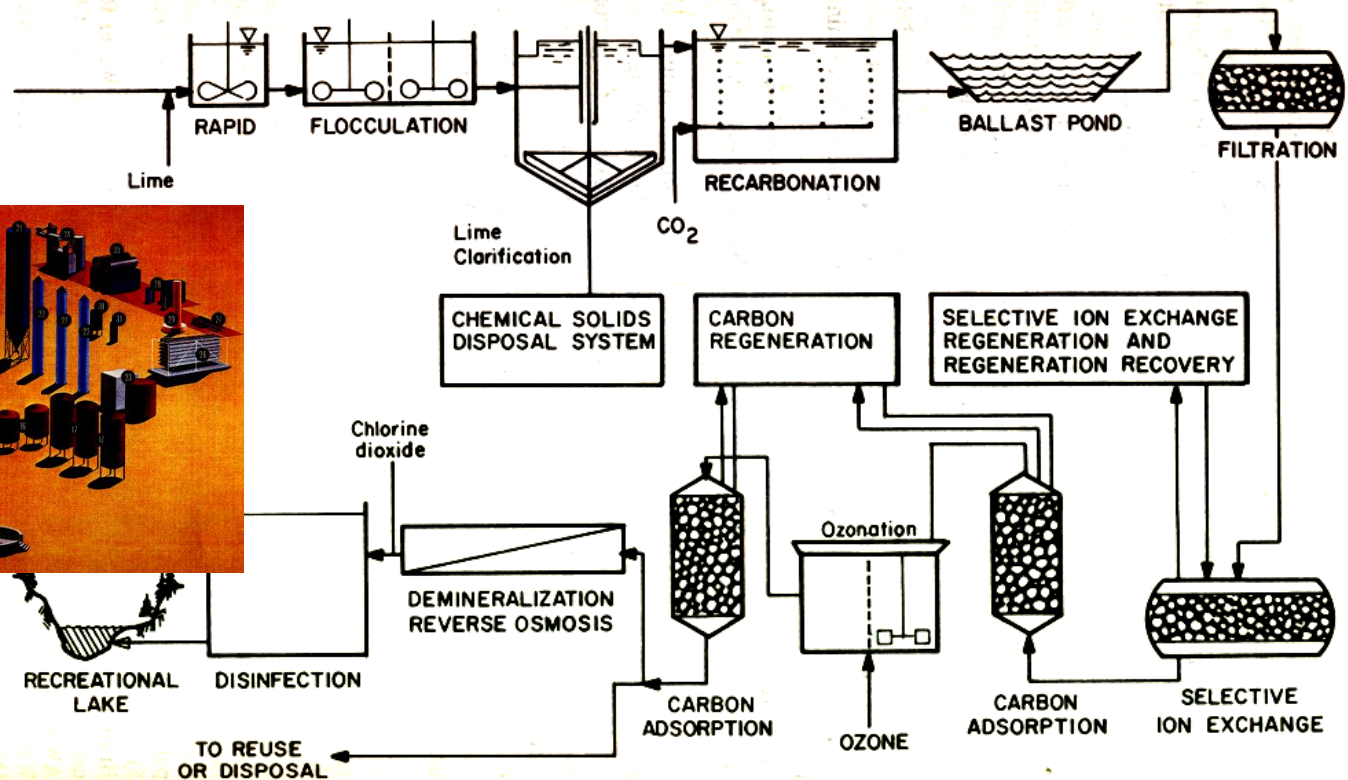
Indirect potable reuse

- **Planned IPR has been practiced for decades**
- **Surface spreading, direct injection, addition upstream of WTP**
- **Increasing frequency**



Water Reuse Application

Denver, CO Demonstration Plant
Closed water/wastewater
system approaching 100%
water recycle.

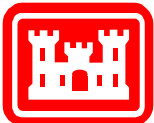


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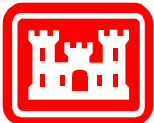
Direct Potable Reuse

- **Regulatory requirements**
- **Health concerns**
- **Facility operation and management**
- **Consumer perception**
- **Potential to address supply needs in water-scarce areas**
- **Greater flexibility**
- **Potential environmental benefits**



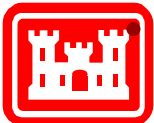
Direct Potable Reuse

- To date, no regulations or criteria
- Generally been deemed unacceptable in past
- Is now the time?
- Advances in treatment technology and monitoring
- Data from IPR projects
- Data from the limited number of direct potable demonstrations

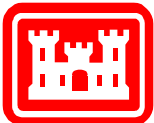
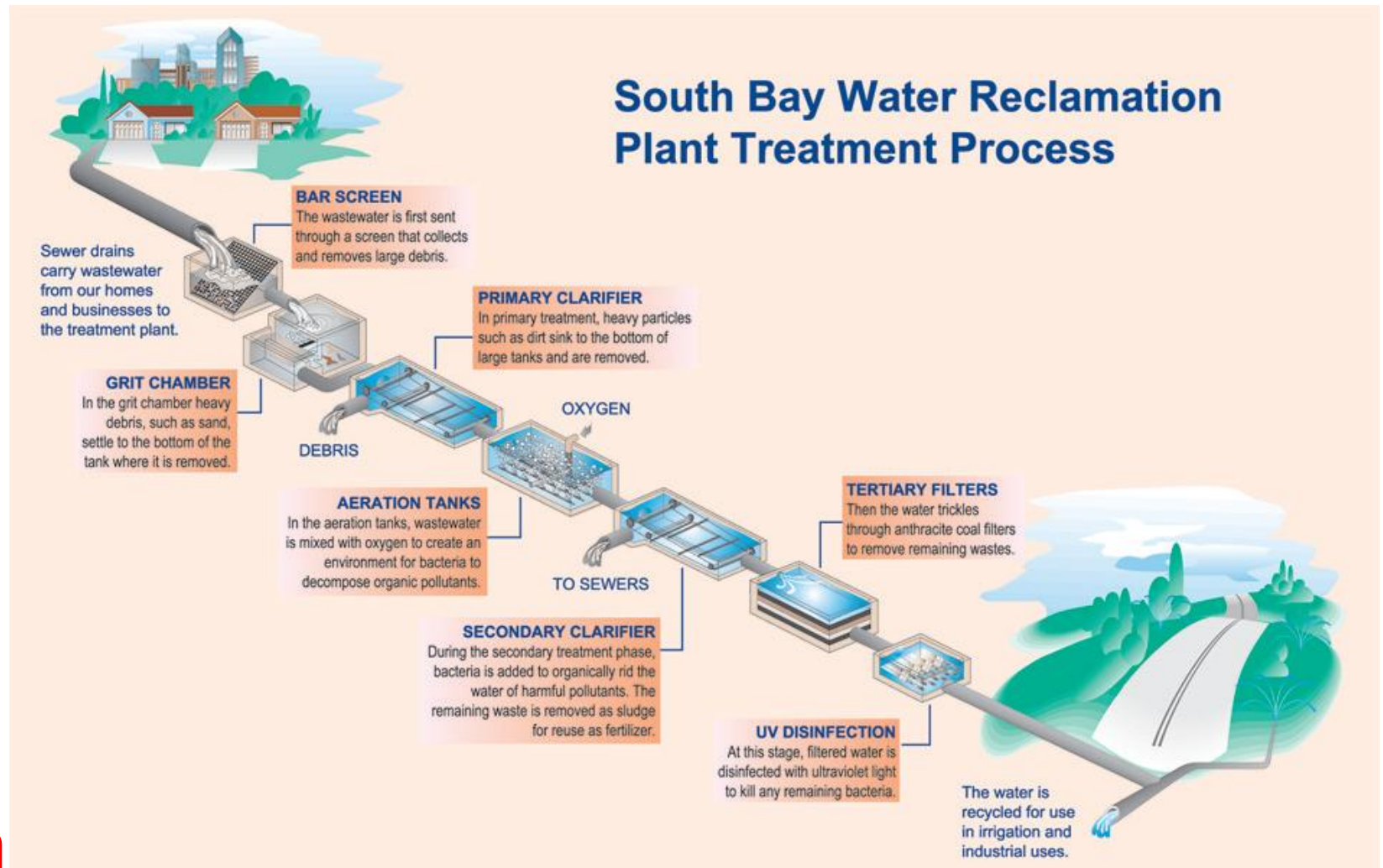


Windhoek, Namibia direct potable reuse system

- **Primary sedimentation**
- **Activated sludge secondary treatment with nutrient removal**
- **Maturation ponds (4 days)**
- **PAC, polymers**
- **Pre-ozonation**
- **Coagulation/flocculation with ferric chloride**
- **Dissolved air flotation**
- **Rapid sand/anthracite filtration preceded with KMnO_4 and NaOH**
- **Ozonation preceded by hydrogen peroxide**
- **Biological and granular activated carbon**
- **Ultrafiltration**
- **Chlorination**
- **Stabilization with NaOH**
- **Blending prior to distribution**
- **Extensive monitoring**

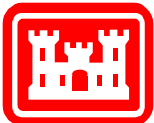


San Diego Wastewater Reclamation Plant



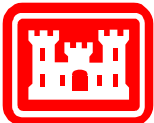
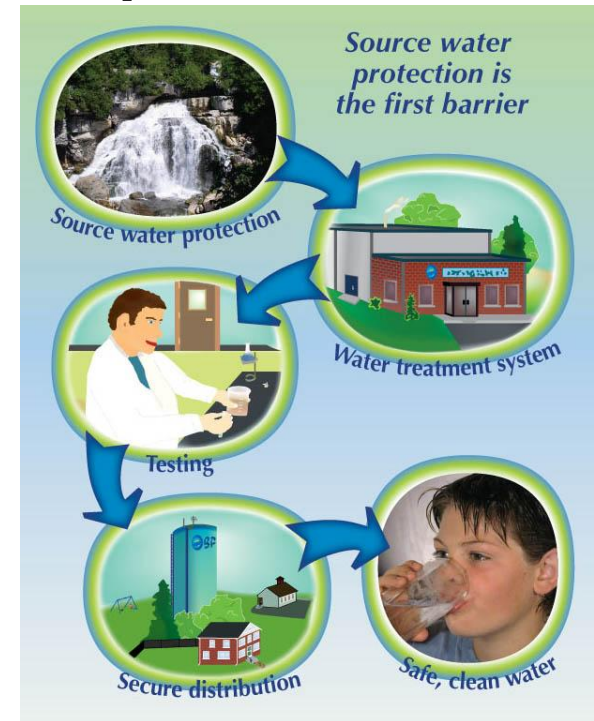
Assessment of safety for direct potable reuse

- **Microbial and chemical quality of product water**
- **Treatment performance and reliability**
- **Multiple barriers**
- **Monitoring capability**
- **System operation and management**
- **Need to be resolved by regulatory agencies during development of regulations, policies and guidelines**



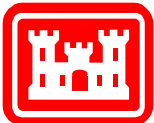
Multiple barriers

- Source control programs
- Combination of treatment processes
- Design and operational procedures to rapidly detect abnormalities in treatment process performance
- Constituent monitoring
- Environmental buffers



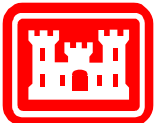
Advancements in Treatment Technology

- **Advanced oxidation processes**
- **Ultraviolet radiation for disinfection**
- **Analytical monitoring methodology for trace organics**
- **Recycled water quality data meets all drinking water standards**



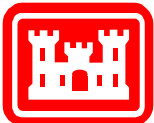
Health Effects

- **Several health effects studies over 30 years**
 - None show health risks greater than current water supplies
 - Limitations in techniques
- **Some health experts opinion – multiple treatment barriers, water quality criteria for constituents of concern met and chemical composition well understood – need for toxicological characterization is low**



Constituents of Concern

- **Microbial pathogens**
- **Chemicals**
- **Other parameters**
- **Need a means for immediate response to prevent release of water with unacceptable microbial quality**
- **Real-time online monitoring**
- **Multiple treatment barriers may require criteria for defining “sufficient”**
- **Chemical contaminants similar to microbial**
- **May be additional monitoring requirements**



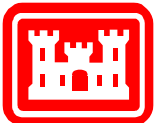
Potential Regulators

- Vary by states
- Is it water supply, wastewater treatment, both
- Water rights issues
- Expert review panels
- Public health department involvement, other state departments, duplication of effort might be needed due to complexity
- Clarification of rules such as surface water treatment rule
- Clarification of drinking water source assessment programs
- Clarification for “Use of extremely impaired sources”
- Draft regulations exist for groundwater recharge into potable aquifers, what modifications may be needed?
- Beneficial use of recycled water as drinking water
- Source water protection program throughout sewershed?



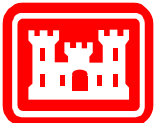
Who's in Charge?

- **Most states have primacy for Clean Water Act and Safe Drinking Water Act**
- **BUT, they do not directly apply to potable reuse**
- **No federal regulations for direct potable reuse**



Regulatory Responsibilities

- **Approval of pollutant source control programs for wastewater collection systems**
- **Issuance and enforcement of reclaimed water requirements to producers and users of recycled water**
- **Regulation of operators of wastewater and water reclamation plants**
- **Water rights determinations**



Some questions to address

Reduce potable use

Water reuse and wastewater recycling

Army reuse and recycling

Irrigation

Cooling towers

Dust control

Vehicle washing

Other questions

Indirect potable reuse –define

Used in CA, TX, VA, others

No Army policy

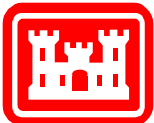
Use of IPR from suppliers or to practice on Army facilities

Impact of privatization



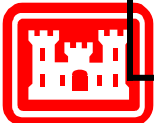
Army Policy on Water Reuse

- Where LCC effective, reclaimed or treated recycled water will be used for irrigation and other non-potable uses.
- Graywater or untreated effluent from laundry, dishwashing, and personal hygiene/bathing will not be recycled or reused as part of a United States Green Building Council (USGBC) sanctioned program for a LEED (Leadership in Energy and Environmental Design) credit without approval from IMCOM.
- LEED and Green Building Initiative both encourage Rainwater Harvesting
- Example- LEED Points
 - Percent water savings
 - Storm water reduction
 - Water efficient irrigation
 - Reduction of sewage generated from use of potable water

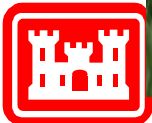
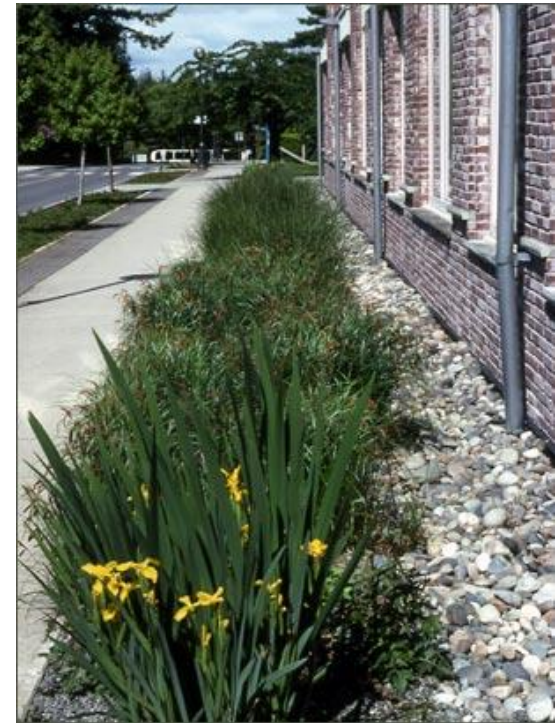


Water Reuse Categories and Typical Applications

Category	Typical Application
Irrigation	Parks School yards Highway medians Golf courses Cemeteries Parade grounds Athletic fields Building landscapes Crops or vegetable gardens
Industrial recycling and reuse	Cooling water Boiler fed Process water Construction
Groundwater recharge	Groundwater recharge Saltwater intrusion control Subsidence control
Recreational/environmental uses	Lakes and ponds Marsh enhancement Streamflow augmentation Fisheries
Nonpotable urban uses	Fire protection Air conditioning Toilet flushing Water features



Water Reuse Opportunities



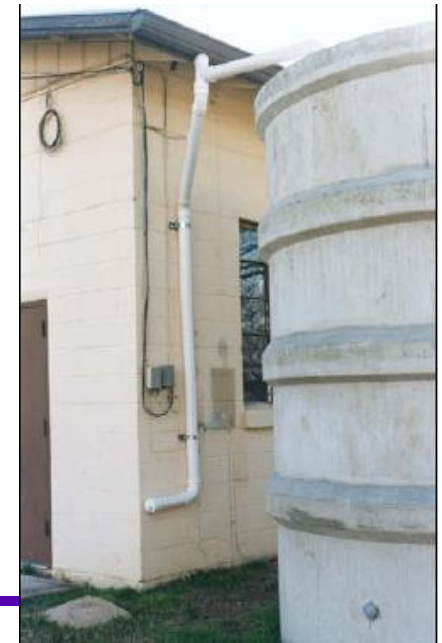
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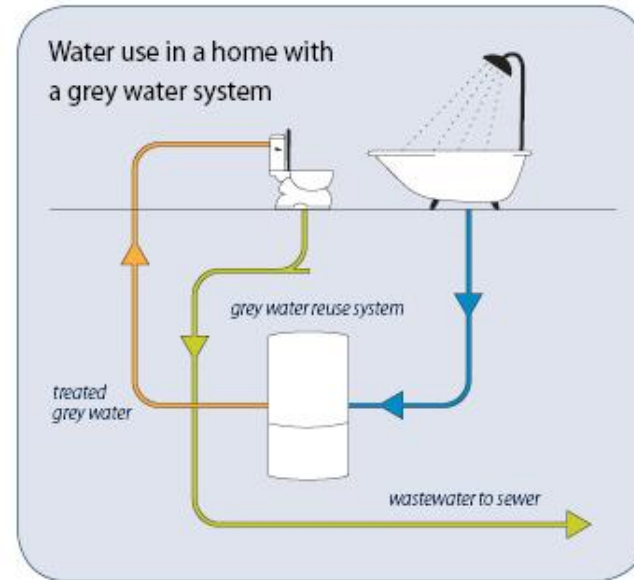
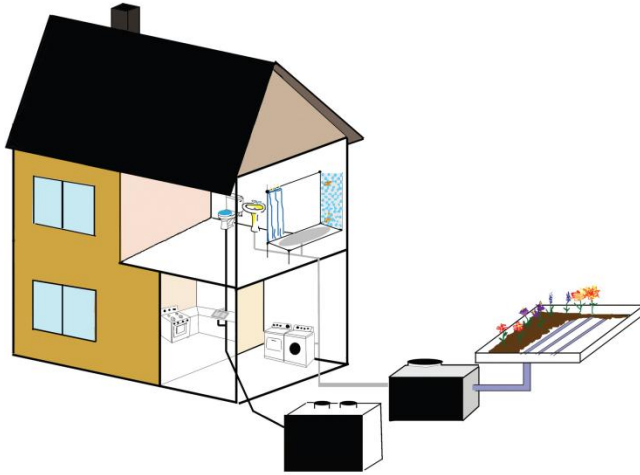


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Definitions

Graywater = Greywater = Gray Water = Grey Water

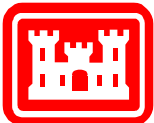


Blackwater

Toilet, Kitchen Wastewater

Reclaimed Water

Wastewater Treated to High Standards at Municipal Treatment Facilities, Delivered to Customers via "Purple Pipe" System



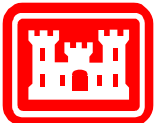
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Graywater Concerns

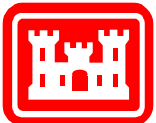
- **Fixture Flushing**
- **Cooling Towers**
- **Irrigation**

- **Regulations – Constantly Evolving**
- **States Vary**
- **Plumbing Codes Vary**
- **Usually Use for Sub-surface or Drip Irrigation**



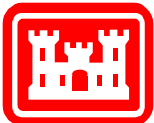
Summary

- Numerous drivers promote water reuse
- Does the Army need policies? Yes, No, Sometimes.
- Direct potable reuse – many considerations
- Indirect potable reuse – already here! How does Army respond?
- Other water reuse categories: reclaimed water, recycling, rainwater harvesting, graywater use, condensate, stormwater, others – being used now, how to encourage safely
- Regulations changing
- Match water quality with end use
- Many agencies/organizations sponsoring and conducting research
- New/emerging technologies should be demonstrated/adopted



Future and Larger Scale Systems

- **More complex operations**
- **Collect large quantities**
- **Blocks and large buildings have dual plumbing and communal systems with sophisticated treatment**
- **Combine with other sources such as rainwater**
- **Showcase examples around the world: U.S., Canada, Australia, Singapore, Korea**



U.S. Examples



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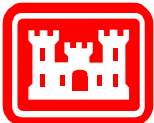
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Questions, Comments?

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