

CHALLENGES AND WATER TECHNOLOGY OBJECTIVES AT FIXED FACILITIES

BILL ENG

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MANAGEMENT**

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**MILITARY APPLICATIONS FOR EMERGING WATER USE
TECHNOLOGIES WORKSHOP**

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Water as a Resource

Essential to Maintain Life and Quality of Life

The World is Not Producing any More

Limited Amount of Freshwater

Expanding needs: Population, Economy

Vital to Efficiently Use and Reuse and Recycle What We Have

Current Practices and Supplies Are Not Sufficient for Future Needs

Only Two Options

Encourage Less Use

Find Alternative Sources and Supplies

Water is a Valuable Natural Resource and Commodity

Cost Includes Cost of Water, Wastewater Treatment and Disposal, Energy for Treatment, Heating, and Disposal and Often Pretreatment



Competition

**Sufficient High Quality Water is Not Only a Global Concern,
but Vital to the Military in CONUS**

Multiple Competing Interests

Industry

Agriculture

Silviculture

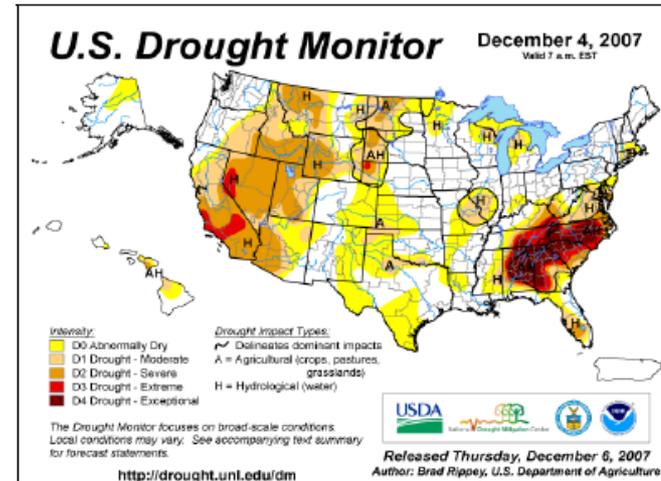
Resource Extraction

Tourism

Municipal

Energy

Maintenance of Natural Habitat





Military Installations

Installations Vary in Size, Geography, Climate

Populations Vary

Self-contained, Complete Small City

Whole Gamut of Options for Water and Wastewater Treatment

Infrastructure Aging

Central Control and Planning

Generally Relatively Low Water Costs

Senior Water Rights in West



Military Installation Water Drivers

Installation Sustainability Plan

Energy Policy Acts

Strategic Plan for Army Sustainability

Increasing Environmental Concern

Army Environmental Policy

Army Strategy for the Environment

Army Energy and Campaign Plan for Installations

Clean Water Act

**All Installations Must Reduce Consumption 2 Percent Annually –
Executive Order 13423**

LEED (Leadership in Energy and Environmental Design) USGBC

Water Conservation Goals

Federal Best Management Practices





Options

What Can be Done to Increase Available Supply?

How Can We Use What's Available Efficiently?

Water Reuse

Produced Water

Desalination

Rainwater Harvesting

Graywater Reuse

Sewer Mining



Water Reuse

~90% of Water Needs Do Not Require Potable Quality

Why?

Overcome Water Scarcity

Environmental Protection Requirements

Drought

Increasing Demands

Dependable Supply

Major States – AZ, CA, TX, FL

Benefits

Drought-proof

Quantity Increases with Growth

Reduce Stress on Aquifers and Surface Waters

Improved Water Security

Local Control

Trends

Gaining in Prominence Around the Globe

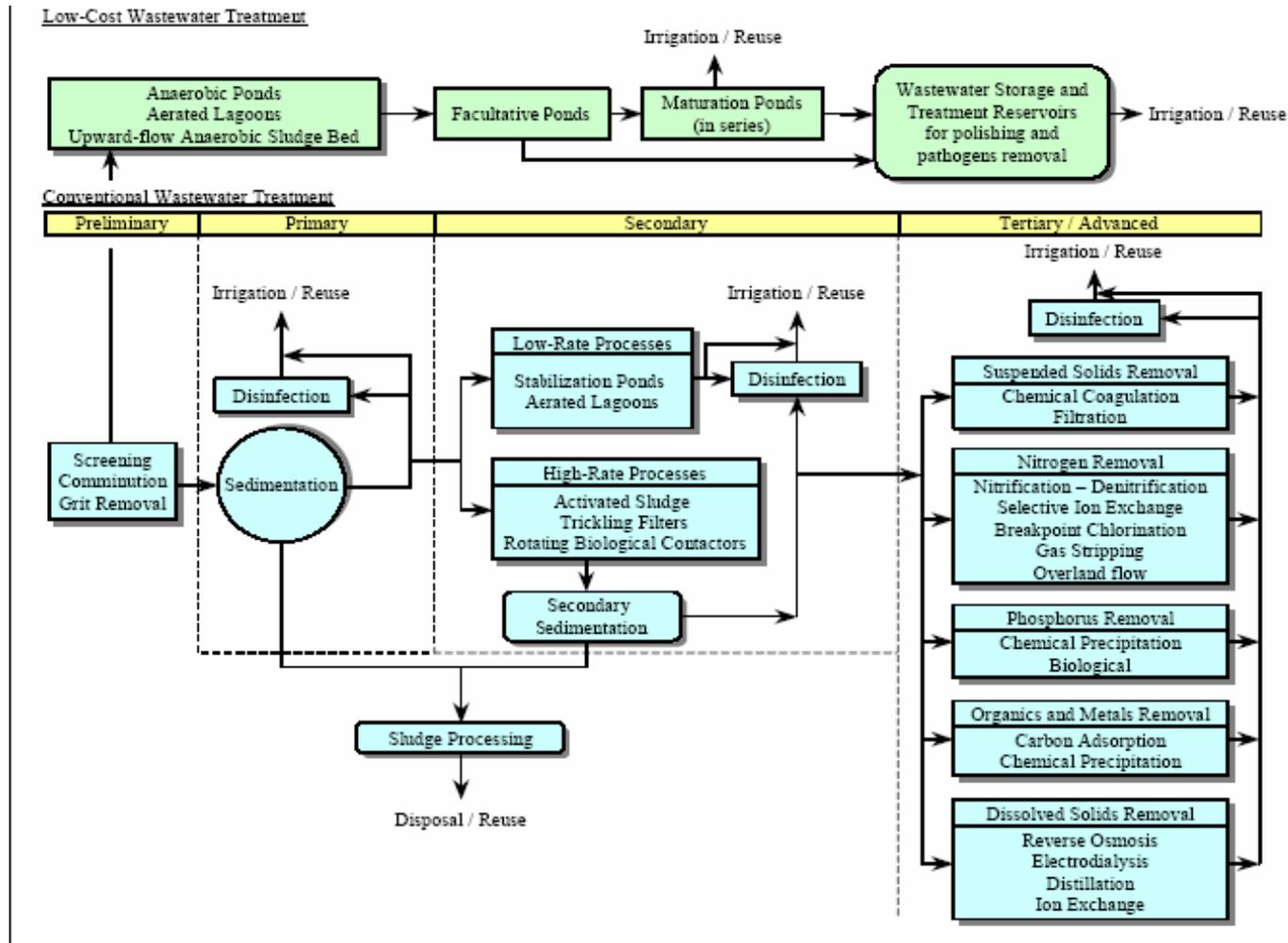
Technology MBRs and AOPs

On Federal Radar Screen

Indirect Potable Reuse Coming

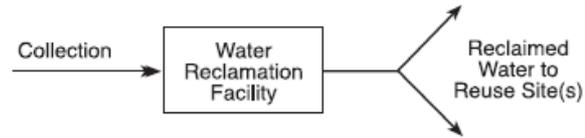


Wastewater Treatment and Reuse Options

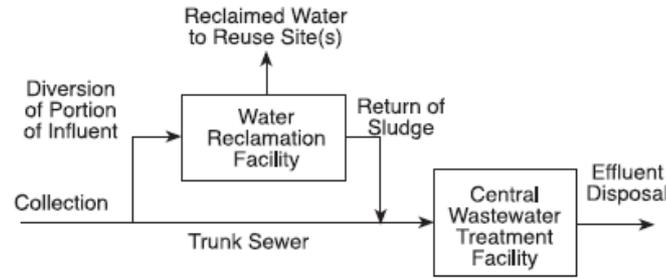


Alternatives for Water Reuse Systems

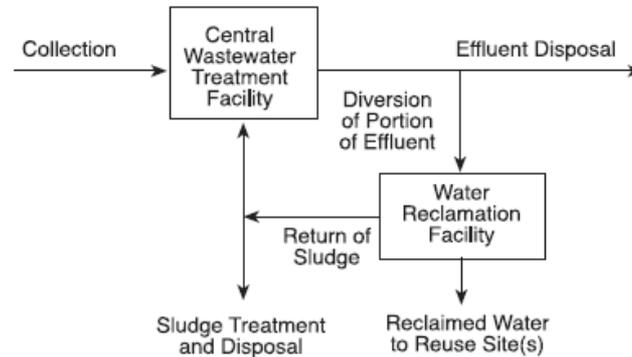
A. Central Treatment Near Reuse Site(s)



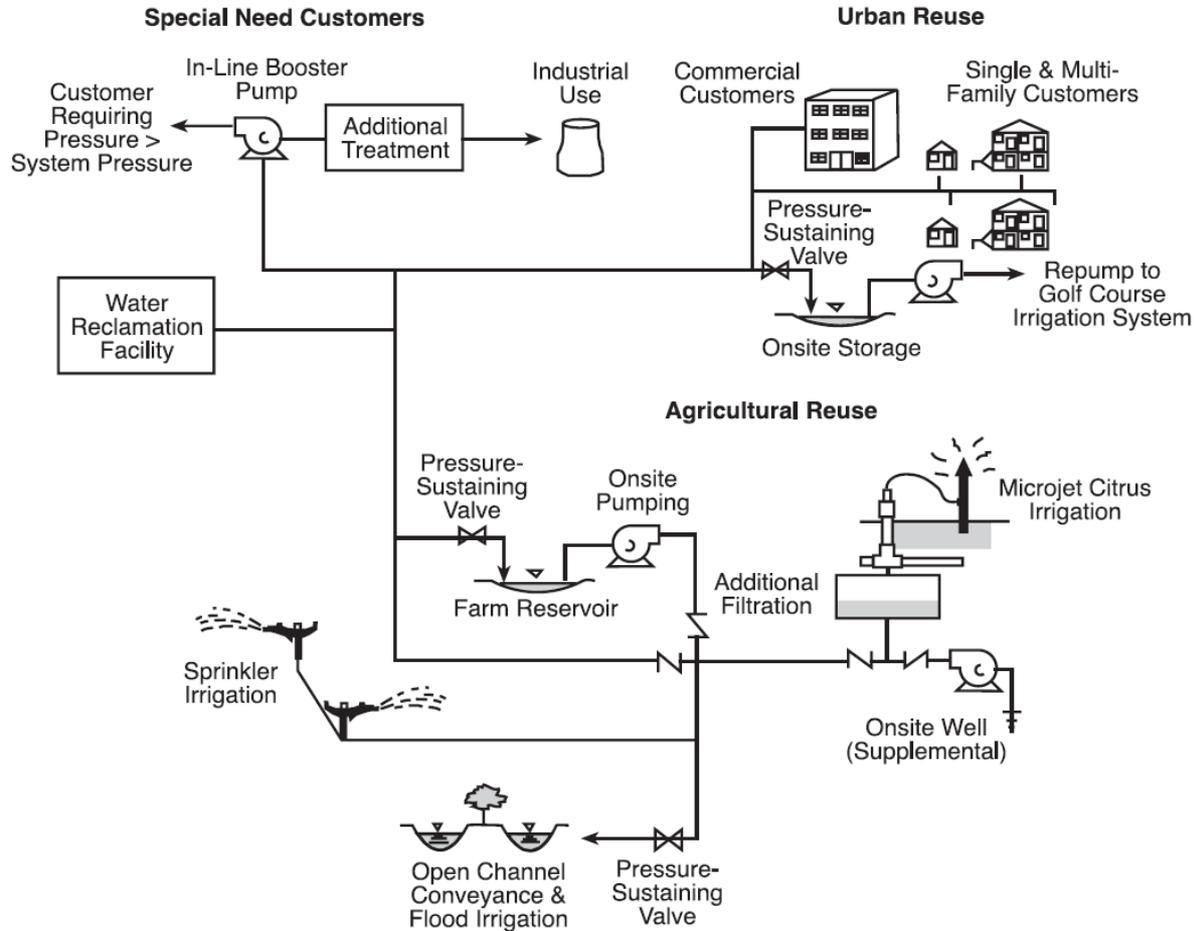
B. Reclamation of Portion of Wastewater Flow



C. Reclamation of Portion of Effluent



Water Reuse Distribution System



Water Reuse Categories and Typical Applications

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

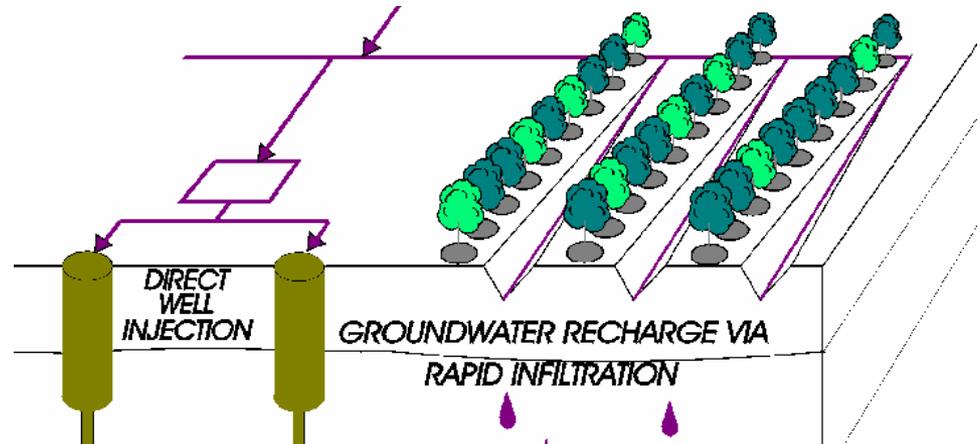
Lakes and ponds
Marsh enhancement
Streamflow augmentation
Fisheries

Nonpotable urban uses

Fire protection
Air conditioning
Toilet flushing
Water features



Reuse Opportunities





Desalination

**Extensive Programs Underway
Seawater and Brackish Groundwater**

**Competing Desalination Technologies Also Improving and Making
Advances**

**Energy Requirements Dropping in the Amount of Energy Required to
Produce Given Amount of Product water**

**In U.S., Seawater is Primarily by Membranes with Reverse Osmosis,
Electrodialysis and Nanofiltration**

**Thermal Processes Also Used
About 40% of Global capacity is Multi-Stage Flash Distillation**



Rainwater Harvesting

Collection of Rainfall for Beneficial Use

Most Applicable Where Other Sources are Expensive or Not Available

Usually Rooftop Capture, Cistern Storage and Pumped for Indoor or Outdoor Use

Uses: Potable, Toilet Flushing, Irrigation, Other

Collect 600 gallons per inch of rain per 1,000 sq ft of surface

Components:

Catchment Surface

Gutters and Downspouts

Leaf Screens, First-flush Diverters, and Roof Washers

Storage Tanks or Cisterns

Treatment System (Potable Use)

Delivery system



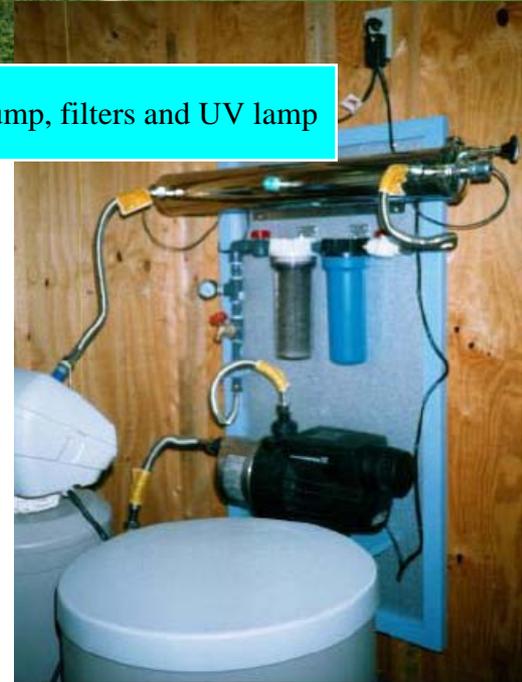


Rainwater Storage



Ancient stormwater storage

Disinfection array with pump, filters and UV lamp



Rainwater Harvesting

Also Can Be Done at Larger Scale

Parking Lot Runoff

Hillsides

Capture Water for Irrigation, Recreation, Ornamental Features

Ponds or Underground Storage

May Need Treatment



Co-Produced Water

Water generated during oil and gas extraction

Approximately 1.5 billion gallons per day nation-wide

Water to gas/oil ratios

Low: 5 to 1

High: 100 to 1

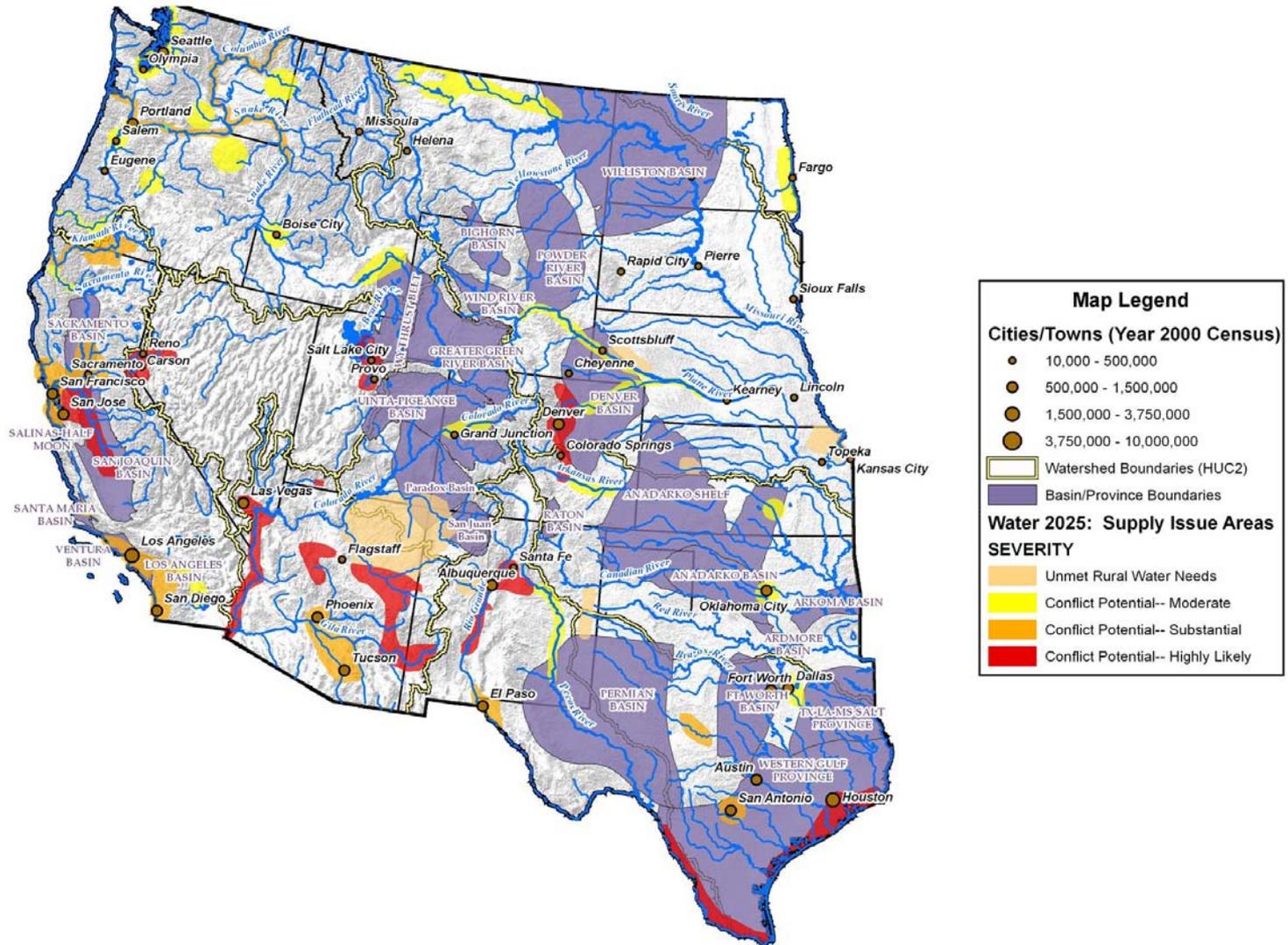
Inorganic, organic, hydrocarbon contaminants

Wide range of contaminant concentrations

May be classified as non-tributary water



Occurrence of PW in Western U.S.



Groundwater Recharge

(Representative Groundwater Replenishment Project)

Secondary treatment



Disinfection



Microfiltration



Reverse Osmosis



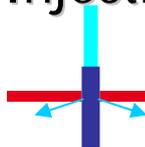
UV-AOP



Degas/Lime



Injection

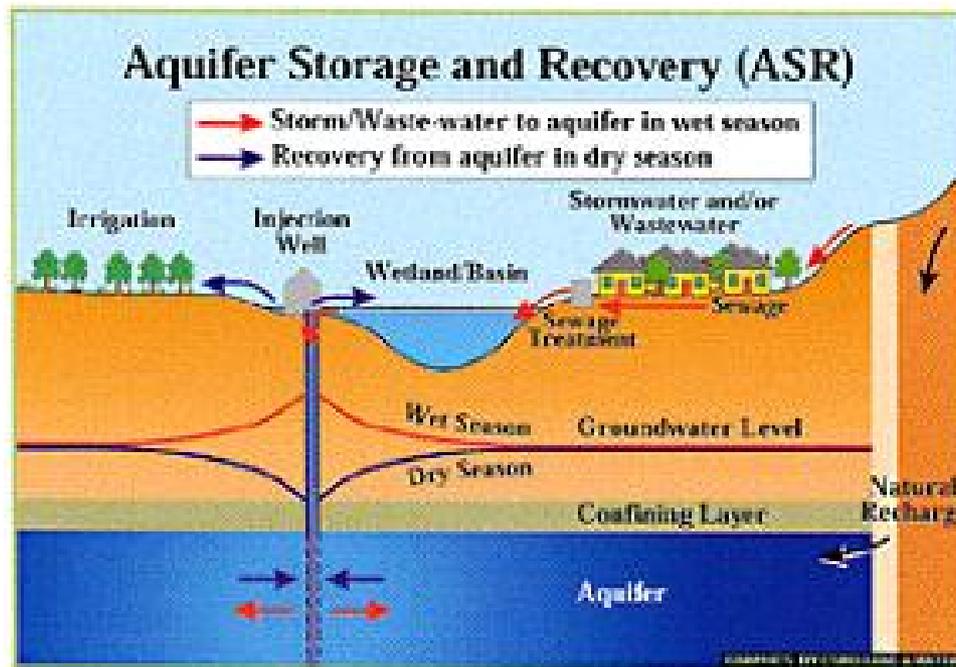


Blending & Storage



Aquifer Storage and Recovery

During a high rainfall period, excess stormwater is filtered and cleaned and then pumped into the aquifer. The water can be recovered and used for irrigation or other purposes.



Greywater Treatment

Defn. Wastewater from Bathroom Sinks and Showers and Laundries

Can be Reused for:

Irrigation

Toilet Flushing

Two Basic System Types

Direct Diversion Systems

Collection, Treatment, Storage and Distribution Systems

DD Available for Subsurface irrigation, Toilet Flushing

CTSD Used for Gardens, Toilets and Potentially Laundries

Numerous Systems Available: Homemade to Complex with Variable Levels of Treatment



Sewer Mining

Also Called Satellite Reclamation Plants

Defined as a Treatment Facility Remote from a Central Treatment Plant that Takes Wastewater from the Collection System and Produces Reclaimed Water for Local Use While Discharging Residuals back to the Collection System for Treatment at the Central facility.

Locating Close to Customers Can Significantly Reduce Costs While Matching Consumer Needs



Portable Sewage Treatment Plant in Container Used for Sewer Mining Trial



FEMP Best Management Practices

- 1. Water Management Planning**
- 2. Information and Education Programs**
- 3. Distribution System Audits, Leak Detection and Repair**
- 4. Water Efficient Landscaping**
- 5. Water Efficient Irrigation**
- 6. Toilets and Urinals**
- 7. Faucets and Showerheads**
- 8. Boiler/Steam Systems**
- 9. Single-Pass Cooling Equipment**
- 10. Cooling Tower Management**
- 11. Commercial Kitchen Management**
- 12. Laboratory/Medical equipment**
- 13. Other Water Use**
- 14. Alternate Water Sources**



Where to Make an Impact

Irrigation – Large Water Consumer
Parade Grounds
Parks and Recreation Areas
Athletic Fields
Golf Courses
Cemeteries
Landscaped Grounds



Buildings
Institutional
Industrial
Barracks





Military Experience Examples

Wastewater Reuse for Irrigation at Golf Courses

Wastewater Reuse for Cooling Towers, Boiler Makeup

Use of Impaired Water for Irrigation

Groundwater Recharge

Technology for Improved Irrigation

Leak Detection and Repair Programs

Low Impact Development

Waterless Urinals



Potential Opportunities

Technologies to Increase Water Supply

Technologies to Increase Reuse

Demonstration Projects

Water Conservation/Efficiency Methods

Cascade Model of Reuse Options

Low Impact Development



Summary

Water is an Essential Resource Vital to Maintain Quality of Life and Support Mission

Water is Becoming Increasingly in Demand

Current Practices and Supplies are Insufficient for the Future

Must Use Less or Find New Sources or Supplies

Water Reuse and Efficiency are Mandatory for the Nation

New/Emerging Technology Should Be Adopted/Demonstrated

Match Water Quality with Needs

