METROPOLITAN CHICAGO HEALTHCARE COUNCIL

Hospital and Water Sector Interdependency Summit - Keeping Patients Safe

Report of the September 18, 2008 Stakeholders Meeting

METROPOLITAN CHICAGO HEALTHCARE COUNCIL

BACKGROUND & INTRODUCTION

The Metropolitan Chicago Healthcare Council and the United States Environmental Protection Agency Region 5 cosponsored a ***Hospital and Water Sector Interdependency Summit – Keeping Patients Safe*** on September 18th, 2008 in Chicago. The collaborative project addressed drinking water and waste water safety, security, and preparedness. The invitation-only event was attended by 75 individuals from 20 hospitals, representatives from 19 governmental agencies and 9 other organizations.

The day-long summit was designed to promote a better understanding of public-private sector interdependencies, foster a greater understanding of water infrastructure and the potential impacts from loss of service, and identify resources needed to respond and recover from a water emergency. In addition, there was an open forum and discussion on water usage, water discharge, and preparedness planning. The summit concluded with a panel discussion that summarized the issues discussed, and made recommendations for next steps to help hospitals to be better prepared.

PRESENTATIONS

Eleven presenters were featured at the Summit, which was facilitated by John M. Hickey, President/CEO, J.M. Hickey & Associates. Highlights of each of the presentations and discussions are summarized below, and each of the presentations and the participant feedback summary are available in their entirety in the appendices.

"The Water Infrastructure in the Chicagoland Area"

JOHN SPATZ
COMMISSIONER, CITY OF CHICAGO DEPARTMENT OF WATER MANAGEMENT

- The mission of the Department of Water Management (DWM) is to deliver high quality drinking water, and manage waste and storm water.
- The DWM serves the City of Chicago and 125 suburbs, roughly 43% of the population of Illinois.
- Water is obtained from Lake Michigan and treated in one of two filtration plants; it is delivered to customers through a system of pumping stations. Each of the filtration plants has separate, defined service areas. There is no elevated storage capability in the City of Chicago system.
- If water treatment had to be bypassed, raw water could be pumped directly from Lake Michigan; boil alerts would be issued; the water would be used primarily for fire suppression.
- In an emergency, DWM protocols include notifications internally (to the Office of Emergency Management and Communications {OEMC}, Chicago Department of Public Health {CDPH}, the Mayor's office, other departments) and externally (to other governmental agencies, customers, critical facilities).

- DWM is also part of the Illinois Water and Wastewater Agencies Response Network mutual aid agreement (ILWARN). ILWARN's mission is to support and promote statewide emergency preparedness, disaster response, and mutual assistance for public and private water and wastewater utilities, in the event of a natural and/or man-made emergency.
- DWM actively promotes water conservation efforts.

ROBERT MARTIN
GENERAL MANAGER, DUPAGE WATER COMMISSION

- The DuPage Water Commission operates under the Water Commission Act of 1985.
- There are 29 customers (villages, cities, water companies, and Argonne National Laboratories) that receive their water from the Water Commission.
- Water originates from the Jardine Filtration Plant and is transported in two 90-inch transmission mains to a pumping station
- There is a single supply line from the Lexington Pump Station (Cook County) to the DuPage Pump Station (Dupage County).
- The Commission has five standpipes located on the western edge of the distribution system with a combined capacity of 32.5 million gallons. Each standpipe gives 8 hours of water supply (only the top third is useful).
- If there were to be a water shortage lasting longer than two days, the Commission would work with County Emergency Management Agency to enforce restrictions.
- If there were to be an extended power outage or other service disruption, the standpipes could last up to 3 days, with conservation.

TONY QUINTANILLA
P.E., ASSISTANT CHIEF ENGINEER, METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

- The mission of the Metropolitan Water Reclamation District of Greater Chicago (MWRD) is to protect the health and safety of residents, protect the quality of Lake Michigan, improve the water quality of waterways, protect homes and businesses from flood damage and manage storm water for the Cook County area.
- The MWRD provides collection and wastewater treatment for 126 communities which account for approximately 43% of the population of Illinois (5.25 million residents).
- Seven water reclamation plants treat 516 billion gallons per year. The combined capacity of the 7 plants is 1,983 million gallons per day.
- The sewage collection system consists of tunnels, reservoirs, interceptor sewers, sewer lift stations and pumping stations.
- A recent power outage and subsequent flood in a pumping station resulted in operational improvements at pumping stations including improved use of redundant power feeds from the electrical grid and improved pump readiness procedures.
- Security is provided by a MWRD police force.
- When events occur that will impact the community, MWRD notifies the Chicago OEMC, Cook County Office of Emergency Management, the Illinois Environmental Protection Agency, and affected communities.
- There are currently no notification provisions for hospitals. However, The District does notify *communities* in areas experiencing service problems.

"Learning from Experience: Case Studies in Water Service Disruption"

"The 1993 Milwaukee Cryptosporidium Outbreak"

KATHLEEN BLAIR
PUBLIC HEALTH RESEARCH AND POLICY DIRECTOR, CITY OF MILWAUKEE HEALTH DEPARTMENT

- The 1993 Cryptosporidium outbreak in Milwaukee was the largest waterborne disease outbreak in U.S. history.
- More than 400,000 individuals were infected; medical and productivity costs were estimated to exceed $131 million.
- The Emergency Room Surveillance Project was developed in the southeast part of the state after the outbreak. All emergency rooms in the area are now linked in real time and can track patients and disease incidence across the healthcare system.
- Public advisories alerted people to the outbreak, emphasizing even greater caution for individuals receiving chemotherapy and the immunocompromised.

"Protective Security Advisors: Securing the Nation's Infrastructure" And "Hurricane Gustav: Lessons Learned"

DREW ORSINGER
PROTECTIVE SECURITY ADVISOR FOR CHICAGO GREAT LAKES DISTRICT, U.S. DEPARTMENT OF HOMELAND SECURITY

- The mission statements of the U.S. Department of Homeland Security include protecting critical infrastructures and key resources.
- The role of the DHS Protective Security Advisor is to support the development of the national risk picture by assisting in identifying, assessing, monitoring, and minimizing risk to critical assets at the local or regional level. PSA's facilitate, coordinate, and perform vulnerability assessments for local critical infrastructure and key resources. They assist in supporting physical / technical security analyses and convey local concerns to DHS and other federal agencies.
- The Water Sector Specific Plan (SSP) addresses response and recovery as well as prevention.
- There is an intrastate mutual aid and assistance program for water and wastewater agencies that is designed to provide agency-to-agency response during an emergency known as the Illinois Water/Wastewater Agency Response Network (ILWARN).
- The major issues that emerged as a result of Hurricane Gustav were the lack of power, water and telecommunications.
- In the aftermath of the Hurricane, the Department of Homeland Security prioritized generator capacity.
- In support of last year's Hurricanes Gustav and Ike, DHS worked with the US Army Corps of Engineers and the US EPA to prioritize water needs for hospitals, and to prioritize operational assistance for water/wastewater treatment facilities. Support included but was not limited to identifying emergency generator needs and conducting preliminary damage assessments by doing fly-overs of affected areas.
- Most of the portable generators went to hospitals and water supplies.

"Earthquake Preparedness: The California Experience"

JAY LOVE
SENIOR PRINCIPAL AND STRUCTURAL ENGINEER, DEGENKOLB ENGINEERING, OAKLAND, CALIFORNIA

- Historically, regional water systems in California have experienced extensive damage due to earthquakes (San Fernando in 1971 and Kobe, Japan in 1995).
- In 1973, California enacted the 1973 Hospital Seismic Safety Act (HSSA). The legislative intent was to require hospitals to be reasonably capable of providing services after a disaster,

and to be designed and constructed to resist, insofar as practical, the forces generated by earthquakes. The HSSA made a difference as the improved structural performance of hospital buildings was demonstrated during the 1994 Northridge Earthquake.

- As a result of the 1989 Loma Prieta Earthquake, five hospitals had long term water problems. This included broken pipes, interrupted service, reduced pressure, and source contamination.
- In 1989, most hospitals did not have alternative water sources, and truck delivery of water was inhibited by lack of capability to tap into the water system. No planning was conducted to prioritize water allocation.
- A report by the California Association Hospitals & Health Systems recommended that hospitals be educated on the importance of seismic safety and that voluntary seismic upgrades be encouraged.
- Legislation enacted in 1995 required hospitals to upgrade deficiencies necessary for safe evacuation, improve operational capacity in critical care areas without evacuation, and maintain acute care operations for 72 hours without external utilities support. This includes having 50 gallons per day per bed of domestic water, and wastewater storage of 50 gallons per day per bed.
- Hospitals cannot function without water in the right places or with too much water in the wrong places.
- Plumbing, wastewater and fire suppression systems are vulnerable to early, significant damage from earthquakes; improved design and construction practices are necessary to successfully reduce damage and consequential loss of function.

"The Biggest Blackout in U.S. History: No Way to Pump Water in Cleveland"

MAREK OWCA, BSN, MPA, RN, CFRN, EMT-B
DIRECTOR OF EMERGENCY MANAGEMENT
AND
KAREN DETHLOFF, FASHE
DIRECTOR OF FACILITIES
THE METROHEALTH SYSTEM, CLEVELAND, OHIO

- The 2003 Cleveland power outage affected MetroHealth Medical Center as well as 540,000 homes and businesses. 2.9 million people were without power in the Cleveland area. None of the City's primary water pumps were on emergency power.
- The impact to hospital patient care included loss of power to ventilated patients, a hot and humid environment, infection control issues related to water interruption, and the grounding of the air medical program due to lack of radio communications.
- Immediate corrective measures included a partial evacuation to consolidate care areas to "cooler" climates, cancelling elective surgeries, and discharging patients that could go home safely.
- Lessons learned include that in preparing for the next disaster, utility interruption plans need to be reviewed; a water gap analysis should be performed to determine core essential services, needs, capabilities and deficiencies; and a process is needed to evaluate the short and long term impact of loss of water on patient, staff and the facility.
- It is important that hospitals understand the plans of support groups (including utilities, critical suppliers and city services), and that the hospital plan be integrated into the plans of the support groups.
- Hospitals should determine what building systems require water, how much water is used normally, seasonal changes affecting water usage, from where water can be scavenged, and possible substitution/alternative measures.

Panel: "How Hospitals Can Save Money, Be Greener and More Secure"

MODERATOR: DEMETRIA GIANNISIS, PRESIDENT AND CEO, CHICAGO MANUFACTURING CENTER AND MANAGING DIRECTOR OF THE GREAT LAKES PARTNERSHIP PROGRAM

- The vision of the Great Lakes Partnership Program is to ensure the economic vitality of the region through the effective integration of security, sustainability and innovation.
- The Partnership's mission is to bring business and government leaders together to advance resilience and develop solutions for national, homeland and economic security challenges.
- The U.S. economic system's critical infrastructure is interconnected in growth and risk.
- Sustainability plus preparedness equals resilience.
- Interdependencies require a systems-wide approach.

"Water Sustainability at Baxter"

JENNI CAWEIN
SENIOR MANAGER OF ENVIRONMENTAL, HEALTH, AND SAFETY ENGINEERING, BAXTER INTERNATIONAL

- Water is Baxter's base business; more than 2 million bags per day are filled with water-based solutions.
- Water conservation is focused in the processing area of the water life cycle in order to reduce cost and increase efficiencies. It focuses on understanding consumption, understanding true costs, and understanding and implementing opportunities to reduce waste.
- Each drop of warm water is billed 3 times: as incoming fresh water, sewer charges, and energy to heat the water.
- To develop a conservation program, hospitals need to understand where and how the water is being used, look for major consumption patterns, review maintenance procedures to ensure leaks are found and repaired, and ensure janitorial staff shut off all faucets and report leaks immediately.

"GE Water & Process Technologies"

LOU CANONACO,
BUSINESS DEVELOPMENT MANAGER, GE WATER AND PROCESS TECHNOLOGIES

- GE provides a variety of boiler equipment pre-treatment, cooling tower equipment and treatment, and legionella risk minimization programs.
- The technologies result in a reduction of water usage, decreased solid waste and reduced air emissions.

HIGHLIGHTS OF ISSUES DISCUSSED/QUESTIONS RAISED BY PARTICIPANTS

1. Can hospitals seek their own water supply, e.g. a well?

Discussion:

- Chicago has an ordinance prohibiting wells, and the ground water quality under the City of Chicago is generally very poor.
- In areas outside of the city, wells are a possibility; however, there are State regulations that would apply.

2. **As a whole, hospitals have plans for obtaining potable water; however, there are issues in planning for/obtaining water for hospital operations, e.g. HVAC systems.**

   Discussion:
   - Who has the resources to provide large amounts of water to health care facilities?
   - Tankers can be used to transport water to the hospital. What is needed at the hospital to make it feasible - are there special valves/fittings/pumps/other equipment that would be necessary to accept the water at the facility and actually use it?
   - Suburban municipalities have storage capacity and may potentially be able to provide limited service during an emergency, even if the water system is not functioning. The City of Chicago does not have storage.
   - The IDPH is looking at emergency plans and how to manage using tanker trucks.

3. **Who do hospitals contact in situations where there is a water emergency/disruption involving either fresh or wastewater? Who contacts the hospital if there is a situation involving the utility that may impact the facility? What is the communication process?**

   Discussion:
   - In Chicago, call 3-1-1.
   - No clear notification procedures have been articulated to hospitals. Hospitals need to know who will notify them, how, and when, in the event there is a water or waste water situation that may affect their operations.
   - The water supply in Evanston has contact information and procedures for local hospitals.

4. **Is there a recommendation delineating how much water is required per patient per day?**

   Discussion:
   - There should be one gallon of potable water per patient (as well as per staff member) per day. This is for drinking water use only, and does not account for hospital operations.
   - Is there a template that hospitals can use to assess the facility's water consumption and emergency needs for both drinking and hospital operations, including patient care?
   - Pre-certification of mobile water treatment equipment involves several issues. The Illinois Environmental Protection Agency has to review specific equipment for adequacy beforehand. For *intra-state* situations, it is more likely that this will be sorted out ahead of time. For *inter-state* situations, it is less likely that this will be done beforehand.

RECOMMENDED NEXT STEPS

The following are recommendations for next steps gleaned from the participants at the Summit:

1. Develop and distribute clear and well-understood notification procedures to health care facilities of potential or existing drinking water and/or waste water service disruptions.

2. Develop regional plans for responding to widespread water or waste water disruptions.

3. Identify alternative sources of water and waste water services to serve multiple facilities simultaneously, to avoid the problem of having a single emergency source or vendor overwhelmed by competing demands.

4. Hospitals should quantify current water usage in various processes; evaluate options to reduce water needs through conservation and technology during normal operations; and have a detailed plan for further reducing water needs in an emergency, in order to increase the ability of hospitals to stay operational during an emergency.

5. There should be facilitated discussions between hospitals and their water suppliers to make sure they understand each others' capabilities and limitations.

APPENDICES

City of Chicago Department of Water Management

Hospital & Water Sector Interdependency Summit

Keeping Patients Safe

John F. Spatz Jr.
Commissioner
Dept. of Water Management

Why is the Department of Water Management Here Today?

- Provide an overview of who we are and our system
  - Understand how we provide services to you and your neighbors
  - Consumption
- Emergency Planning
  - Planning & training
  - ILWARN
  - Example
- Conservation

OVERVIEW
OF THE
CHICAGO WATER SYSTEM

Mission

The Department of Water Management protects the public health in the most environmentally and fiscally responsible manner by delivering a sufficient supply of exceptional quality water and efficiently managing waste and storm-water. We are committed to providing the highest level of professional services to meet our customers' needs now and for future generations.

Water & Sewer System Overview

Protecting public health & safety

- 2 Cribs
- 2 Water Treatment Plants
- 12 Water Pumping Stations
- 4,200 Miles of Distribution Mains
- 4,400 Miles of Sewer Mains
- 263,000 Catch & Valve Basins
- 47,600 Fire Hydrants
- Serves City & 125 suburbs (~43% of IL)
- Serves 5.38 million people

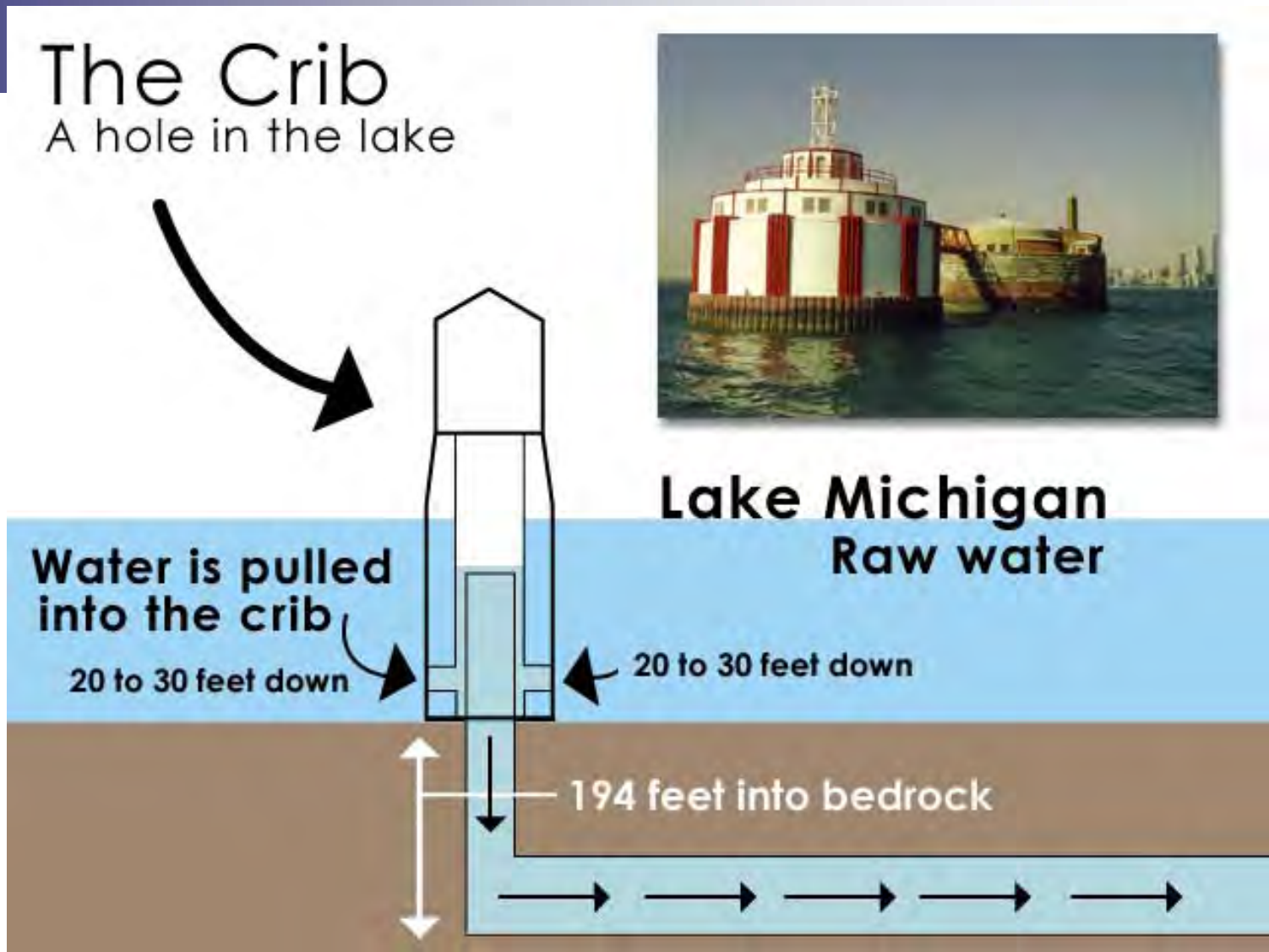
South Water Purification Plant

In service 1947

Jardine Water Purification Plant

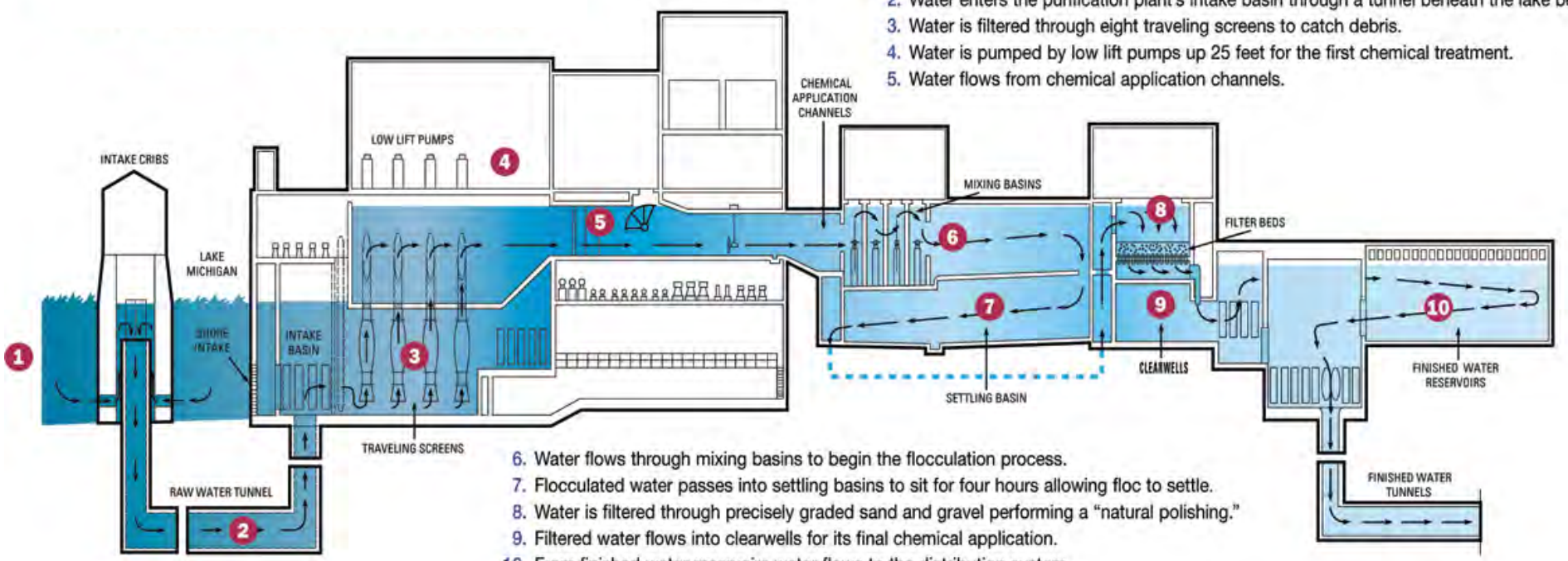
In service 1964

Water Intake



Water Treatment

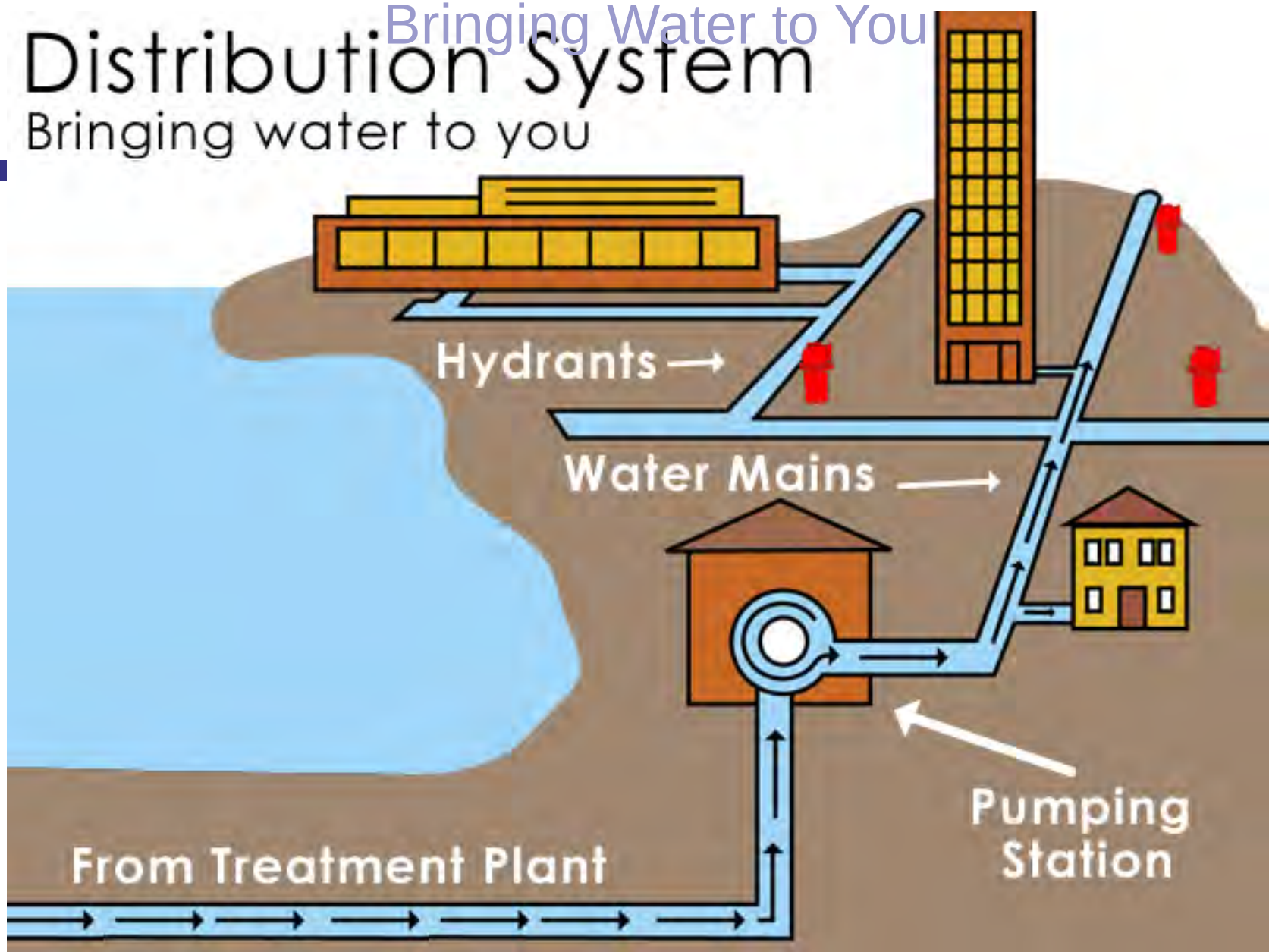
1. Water from Lake Michigan enters the intake crib at depths of 20 to 30 feet.
2. Water enters the purification plant's intake basin through a tunnel beneath the lake bed.
3. Water is filtered through eight traveling screens to catch debris.
4. Water is pumped by low lift pumps up 25 feet for the first chemical treatment.
5. Water flows from chemical application channels.

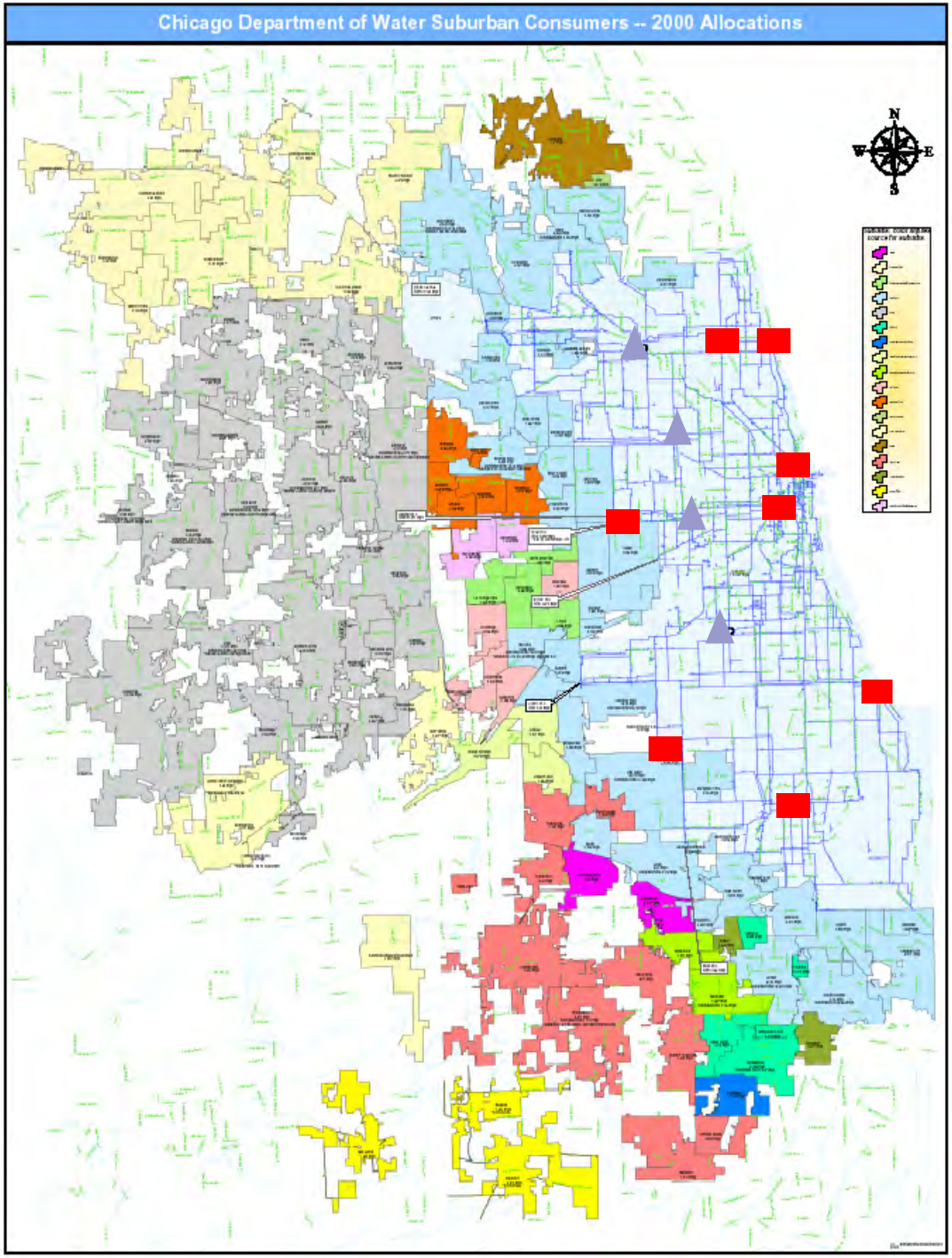


6. Water flows through mixing basins to begin the flocculation process.
7. Flocculated water passes into settling basins to sit for four hours allowing floc to settle.
8. Water is filtered through precisely graded sand and gravel performing a "natural polishing."
9. Filtered water flows into clearwells for its final chemical application.
10. From finished water reservoirs water flows to the distribution system.

Water Distribution

Bringing Water to You

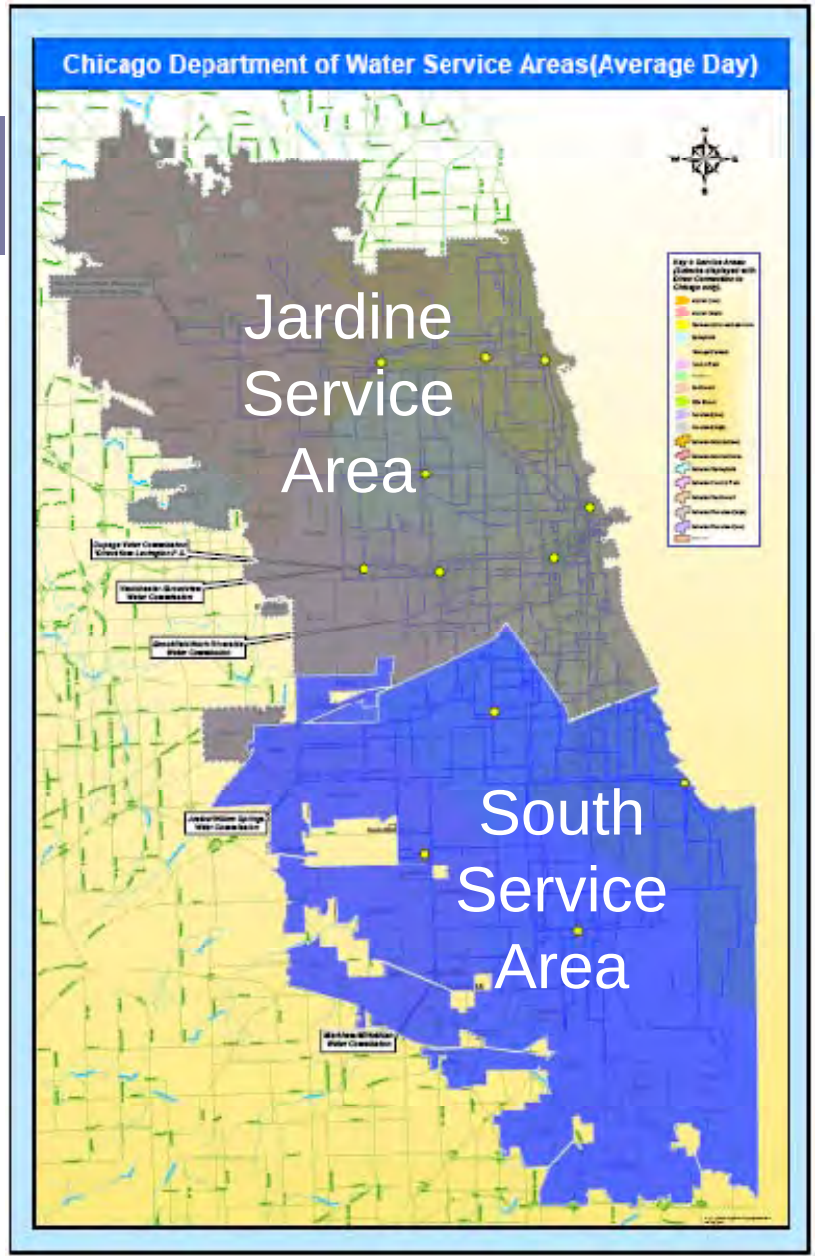




City of Chicago Water Supply Area

- 12 Pumping Stations
- Draw Water From Tunnels
  - 8 Electric
  - 4 Steam
- No Elevated Storage in System
- (Pump "On Demand")
- Over 600 Miles of Transmission Mains Ranging From 16-inch to 78-inch

Water Distribution

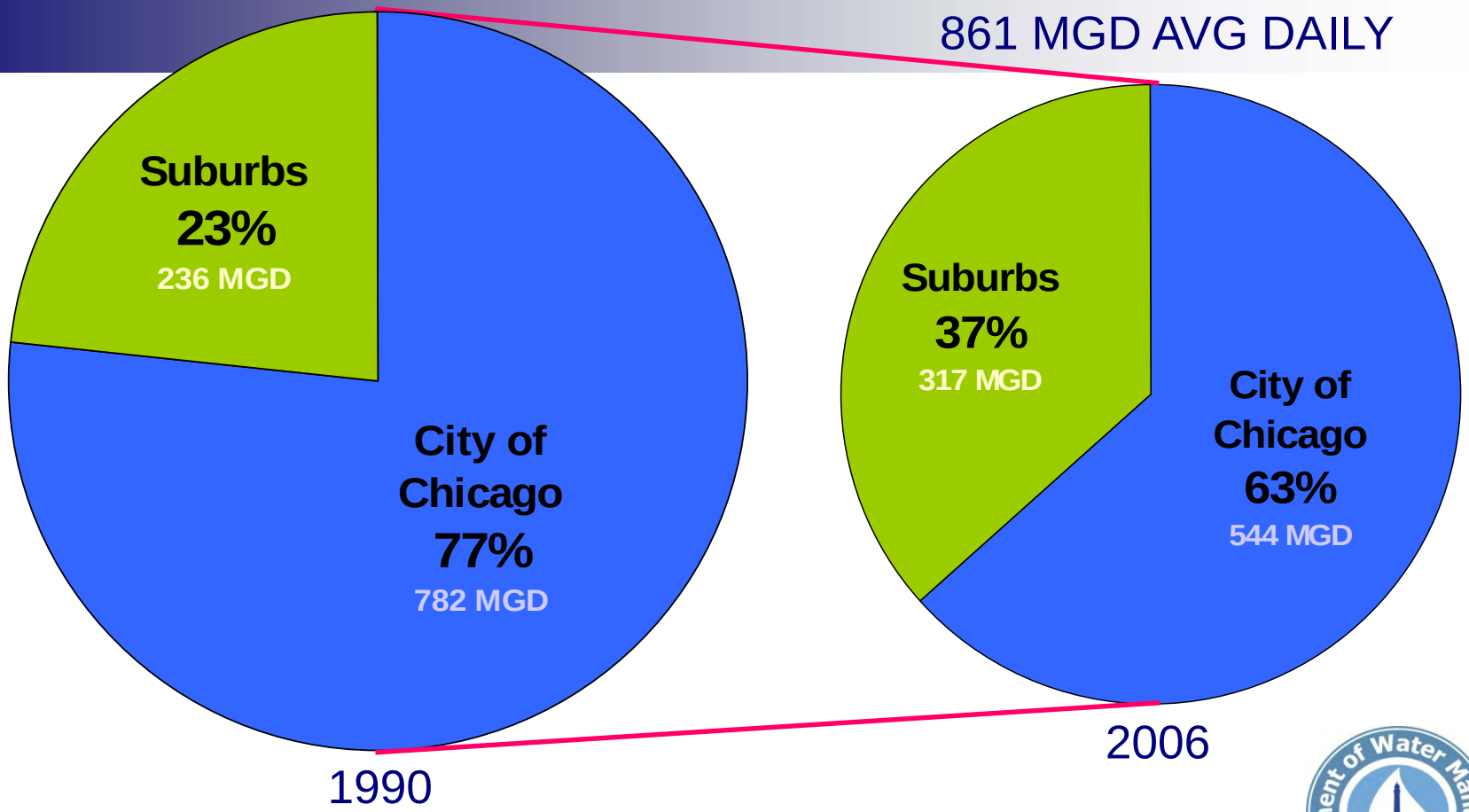


Consumption

in million gallons per day

1018 MGD AVG DAILY

861 MGD AVG DAILY



City Consumption: ⬇ since 1990

Overall Consumption 30% ⬇ 15% since 1990

EMERGENCY

RESPONSE, RECOVERY & PLANNING

We keep your water safe!

- Excellent Water Quality
- If had to bypass treatment and pump raw water directly from Lake Michigan:
  - Boil Alert would be required because of concerns of bacterial levels
  - Use water primarily for fire suppression
  - Minimal concern regarding inorganics & organics
- Pharmaceuticals—although there has been press lately, we ha been testing—results on web cityofchicago.org

We keep your water safe!

- **State Legislation -** FOIA (Freedom of Information Act) exemption and background checks
- **Security -** Incorporated in all of our facilities and operations
- **Plan& Train -** with City, State & Fed. agencies to prepare for, respond to, mitigate damage from, and recover from emergency events
- **Research -** AwwaRF & AMWA

Communication in an Emergency

- DWM Protocols dictate:
- Make internal notifications
  - OEMC, Public Health, Mayor's Office & other departments
- Make external notifications
  - Other gov'tal agencies, municipal water customers, critical care facilities, etc.
- Maintain records of who and when we made contact

INTERNAL & AGENCY NOTIFICATION RECORD

DWM INTERNAL AND AGENCY NOTIFICATION RECORD

DWM Employee Name: _____ Date: _____

Incident Description: _____

DWM INTERNAL & AGENCY NOTIFICATION CHECKLIST

For each applicable contact, acknowledge successful notification by checking in the list below and completing the record. If not applicable, mark "NA." Use blanks for internal contacts and agencies not listed.

INTERNAL NOTIFICATIONS (Required)

___ Central Dispatch
___ Commissioner
___ Public Information Officer
___ First Deputy Commissioner
___ Duty Engineer, Engineering Services
___ Deputy Commissioner, Water Supply
___ Water Quality Manager
___ Water Quality Division, On-Call Engineer
___ Safety and Security - Comand Control Center
___ _____
___ _____
___ _____
___ _____
___ _____
___ _____
___ _____
___ _____
___ _____

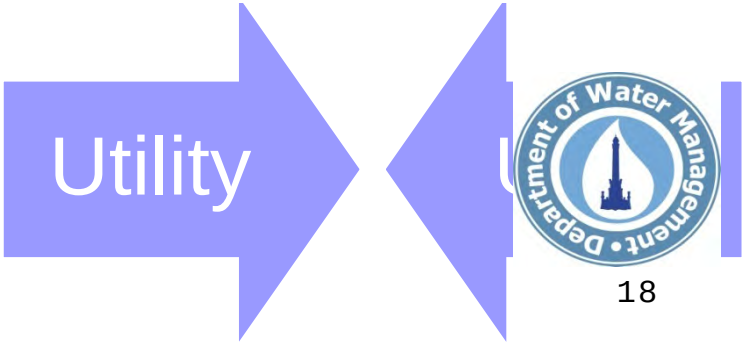
AGENCY NOTIFICATIONS (As necessary)

___ Law Enforcement
___ Fire Department
___ OEMC
___ Local/State Emergency Management Agency
___ National Response Center
___ Regulatory Agencies
___ Local/State Health and/or Environmental Depts.
___ Critical Care Facilities
___ Local Emergency Services
___ Key Water Users
___ Local Area Utilities
___ Local/Area Governmental Officials
___ Secondary Agencies
___ MWRD
___ _____
___ _____
___ _____
___ _____

Internal/Agency	Name of Contact Reached	Phone # or Fax #	Notified By (initials)	Time

ILWARN

- Illinois Water and Wastewater Agencies Response Network Mutual Aid Agreement
- Voluntary
- 36 States have already established WARNs since 2006
- ilwarn.org



Example 1

August flooding in the S.E. Side

- **Significant investment in Sewer System**
  - Hydraulic Modeling-priority & needs
  - ⬆ Sewer Lining Program
  - ⬆ New Construction
  - ⬆ Catch-Basin Lining Program
- **Property owners**
  - Downspout disconnection, where appropriate
  - ⬆ Pervious areas
  - Install Rainbarrels

Example 2

This week's flooding - Chicago River

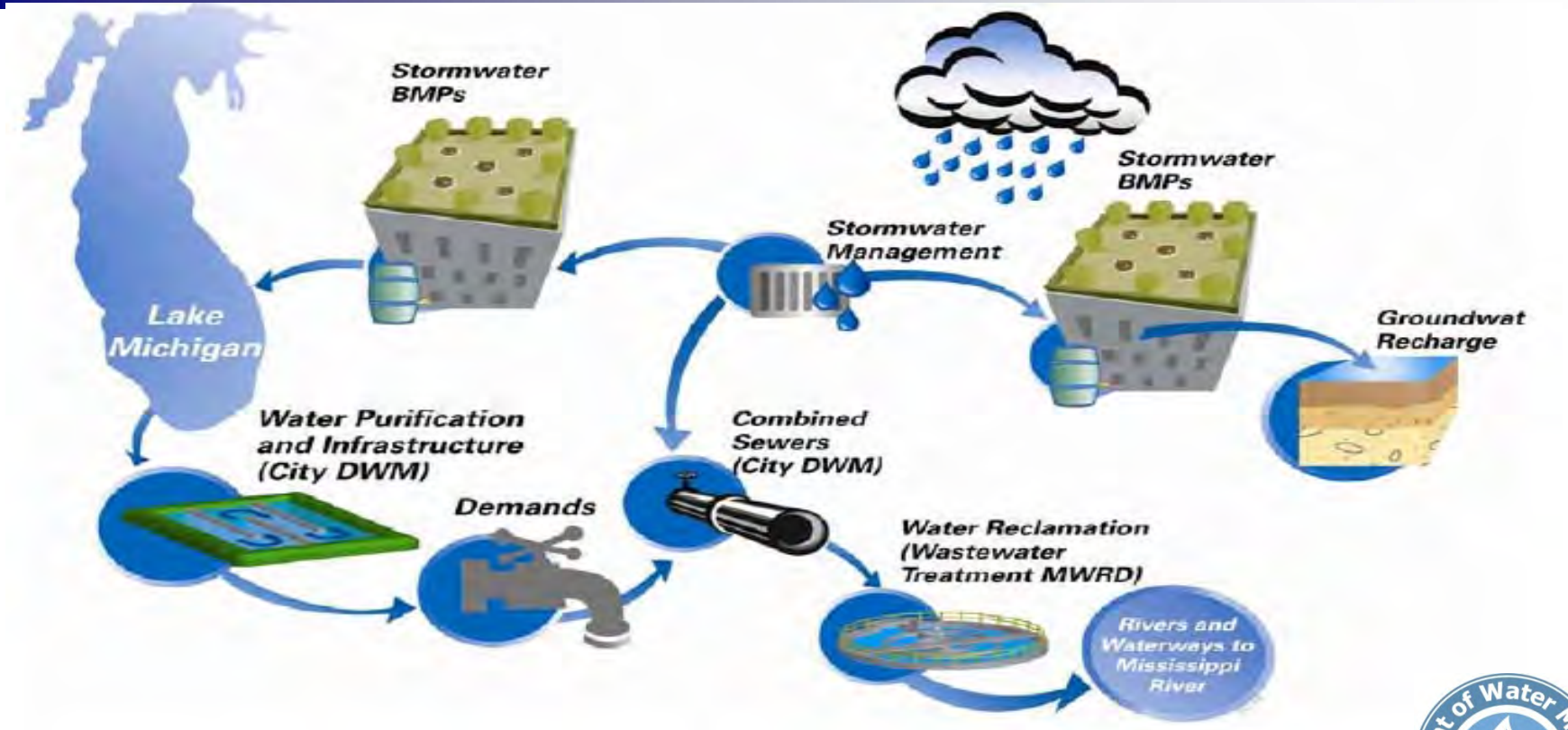
As of this morning:

- Water in Basement - 1922 Completed
- Water on Street - 58 Completed
- Flooded Viaduct - 38 Completed
- Assisted with other agencies in the sandbagging operation that began Saturday and continued until the rains subsided
- ILWARN tool for obtaining sandbags from Naperville
- Clean-up continues

CONSERVATION

Water Conservation

Integrated Approach



New Goals

- The City's soon to be released Strategic Water Conservation Plan sets even more aggressive goals:
  - Significantly decrease water pumpage from year 2000 with goals for 2015 and 2024
  - Retain stormwater by significantly increasing the amount of pervious area each year through 2015

How will we reach these goals?

- Water infrastructure replacement
- Universal Metering
- *Water Conservation Best Practices*
  - Inside: low-flow fixtures, residential leak detection programs, customer water use monitoring
  - Outside: landscape rebate program, soil depth initiative, sprinkling ordinance
- *Stormwater Retention Best Practices*
  - Outside: street edge alternatives, rain garden program, rain barrel program, disconnecting downspouts, stormwater ordinances

DWM Conservation Partnerships

- **WaterSense**
  - DWM is a partner
  - EPA-sponsored program
  - Protect the future of our nation's water supply by:
    - Promoting water efficiency
    - Enhancing the market for water-efficient products, programs, & practices
  - Helps consumers identify water-efficient products & programs

DWM Conservation Partnerships

- **Alliance for Water Efficiency**
  - City of Chicago is a charter sponsor
  - Serves as the national voice on water efficiency
  - Promotes the efficient & sustainable use of water

Questions?

Robert Martin

General Manager

DuPage Water Commission

Board of Commissioners

- Commission Operates Under the Water Commission Act of 1985
  - Modified by PA 93-0226
- Board of Commissioners
  - Six (6) Elected by Mayors of Municipalities
  - Six (6) Appointed by County Board Chairman with the Approval of County Board
  - Chairman Appointed by County Board Chairman with the Approval of County Board and Commission
  - Staggered terms are for six (6) years

Original Charter Customers

Village of Addison	Village of Glendale Hgt.	Village of Roselle
Village of Bensenville	Village of Glen Ellyn	Village of Villa Park
Village of Bloomingdale	Village of Hinsdale	Village of Westmont
Village of Carol Stream	Village of Itasca	City of Wheaton
Village of Clarendon Hills	Village of Lisle	Village of Willowbrook
City of Darien	Village of Lombard	City of Wood Dale
Village of Downers Grove	City of Naperville	Village of Woodridge
City of Elmhurst	Village of Oak Brook	

Subsequent Customers

Illinois American Water Co,
5 Systems 1995 - 1996

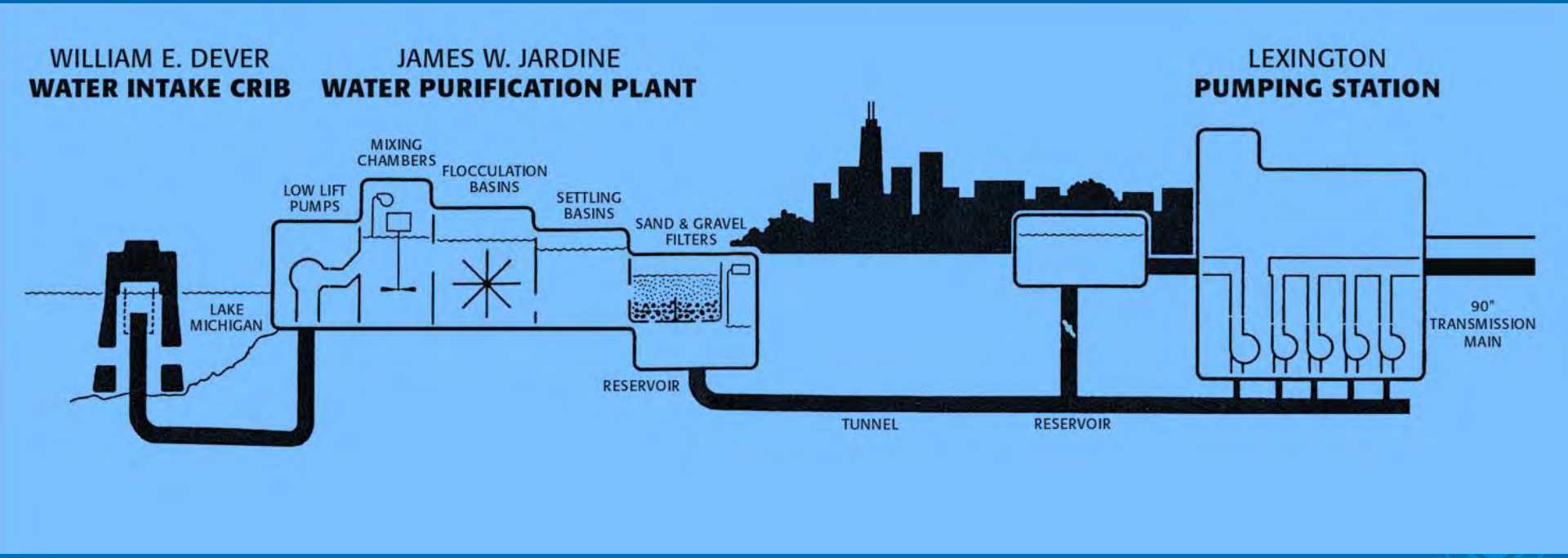
Argonne National Laboratories
1996

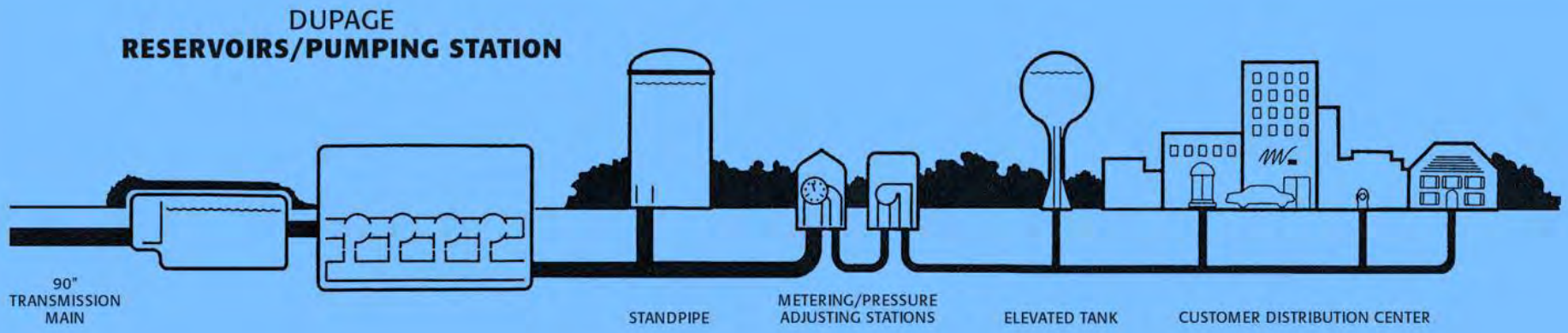
Village of Winfield
1996

Illinois American Water Co,
2 Systems 1999 - 2000

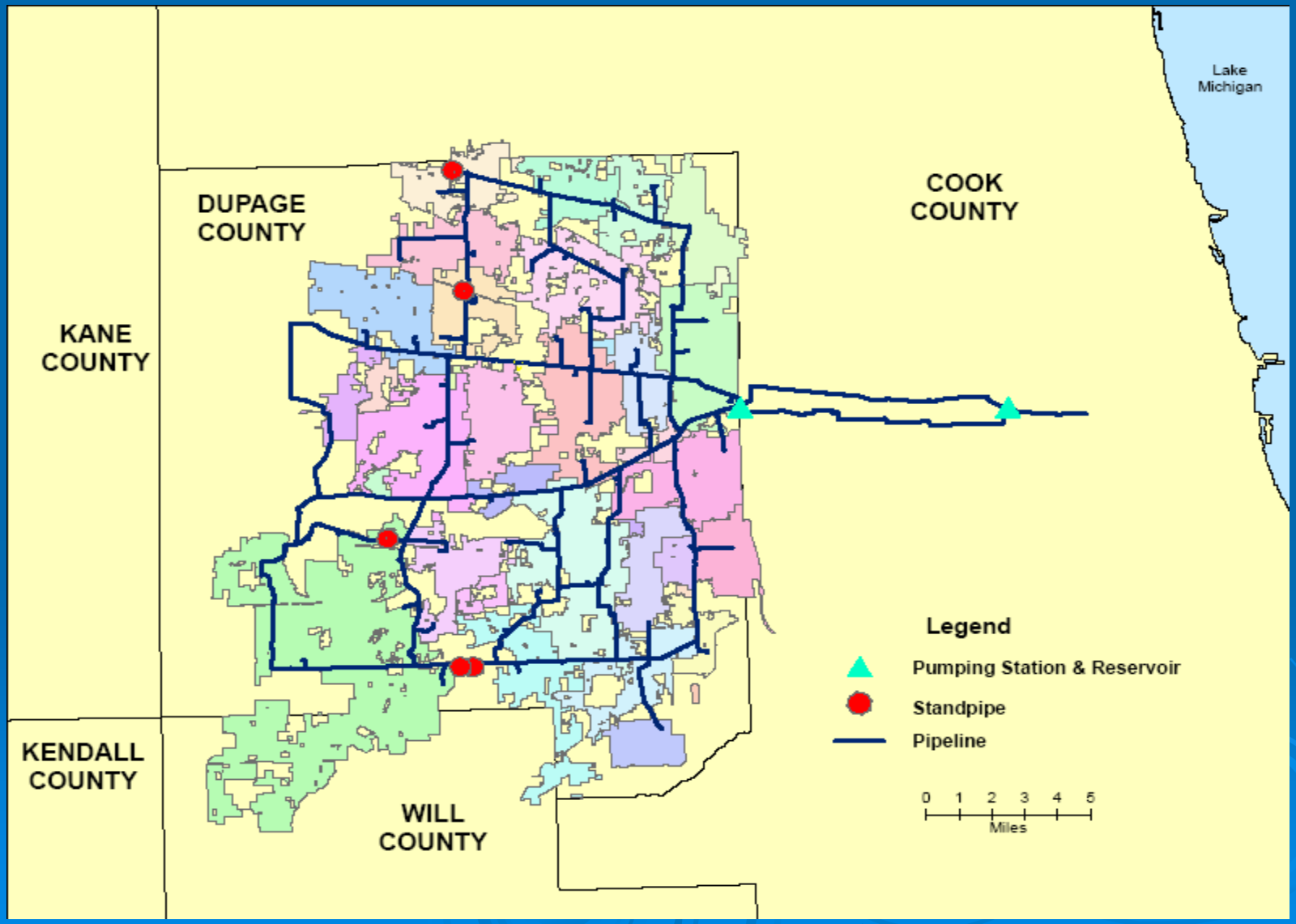
City of Oakbrook Terrace
1999

County of DuPage
2008


WILLIAM E. DEVER
WATER INTAKE CRIB
JAMES W. JARDINE
WATER PURIFICATION PLANT
LEXINGTON
PUMPING STATION
MIXING CHAMBERS
FLOCCULATION BASINS
LOW LIFT PUMPS
SETTLING BASINS
SAND & GRAVEL FILTERS
LAKE MICHIGAN
RESERVOIR
TUNNEL
RESERVOIR
90" TRANSMISSION MAIN

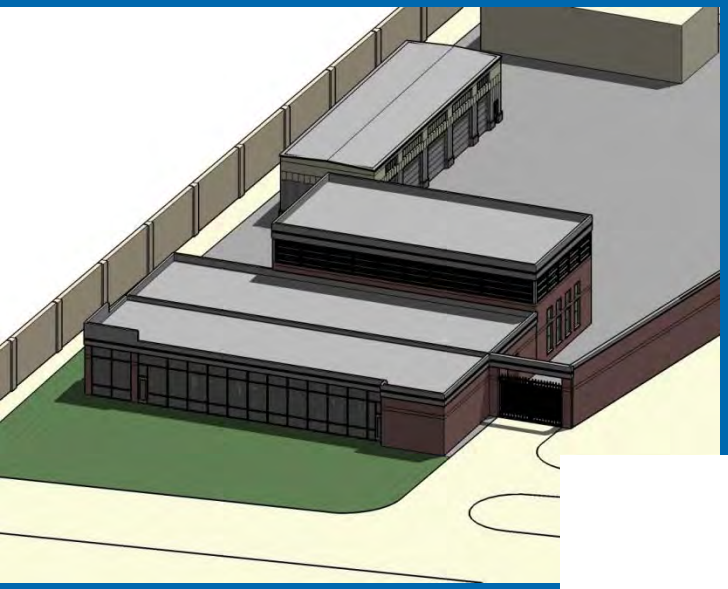

DUPAGE
RESERVOIRS/PUMPING STATION
90"
TRANSMISSION
MAIN
STANDPIPE
METERING/PRESSURE
ADJUSTING STATIONS
ELEVATED TANK
CUSTOMER DISTRIBUTION CENTER

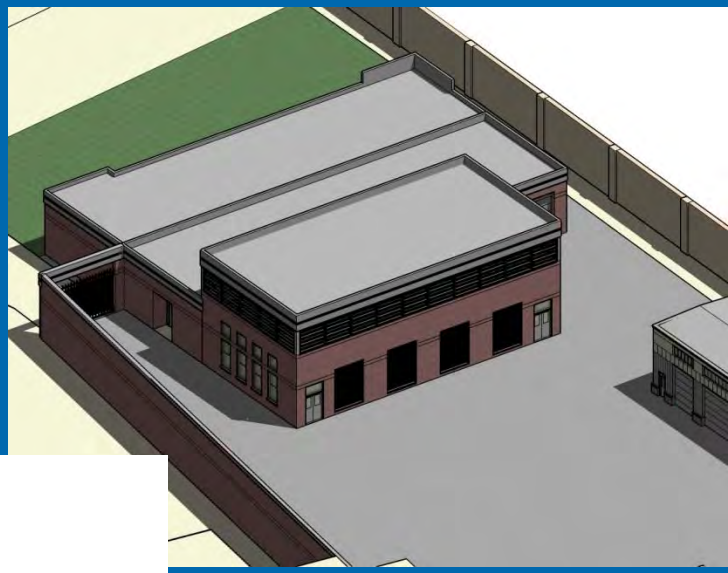
TW-2 West Transmission Main



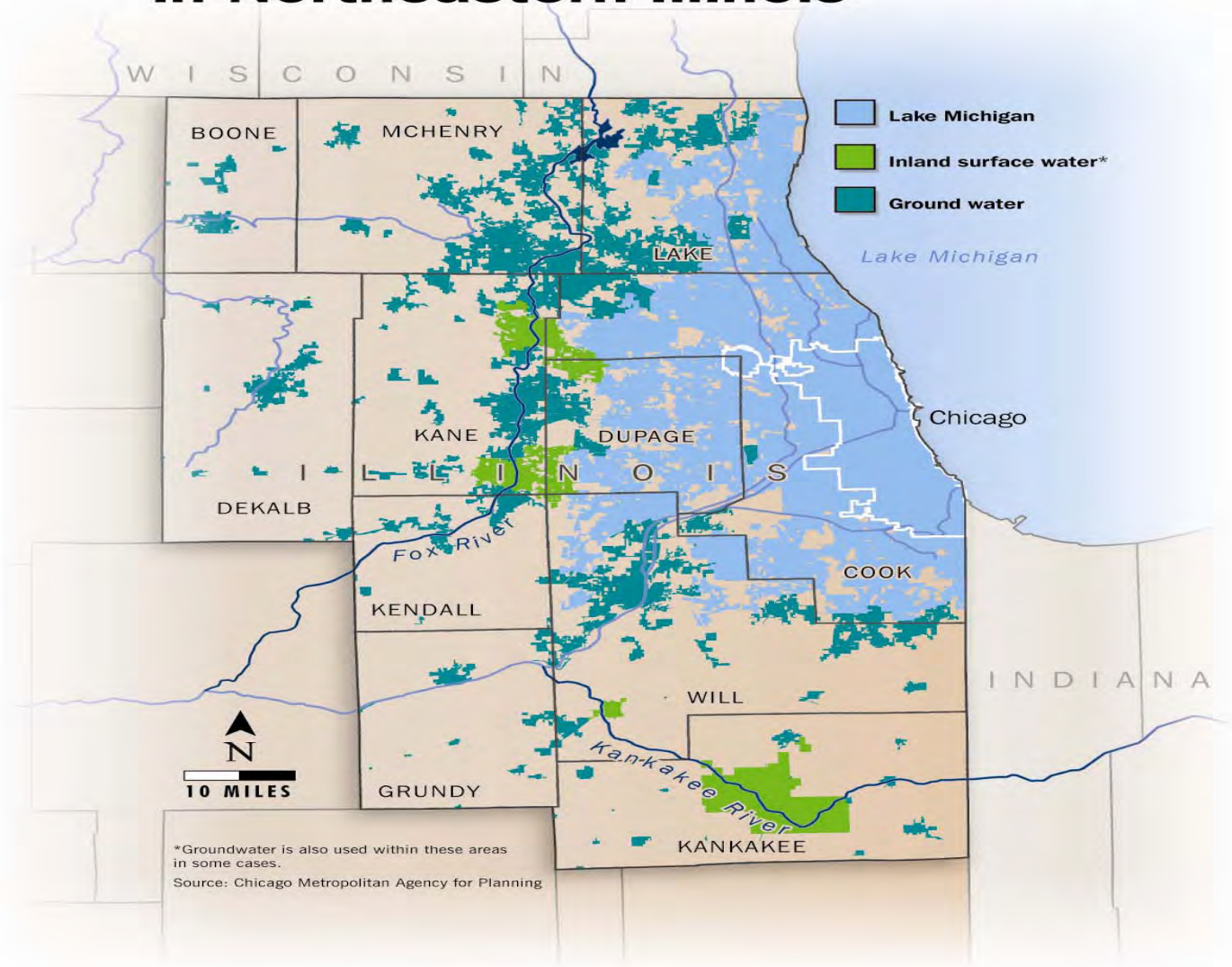
Rendition of LPS Facilities

Rendition of DPPS Facilities





Water Sources for Public Supply in Northeastern Illinois



Metropolitan Water Reclamation District of Greater Chicago

Antonio Quintanilla
Assistant Chief Engineer

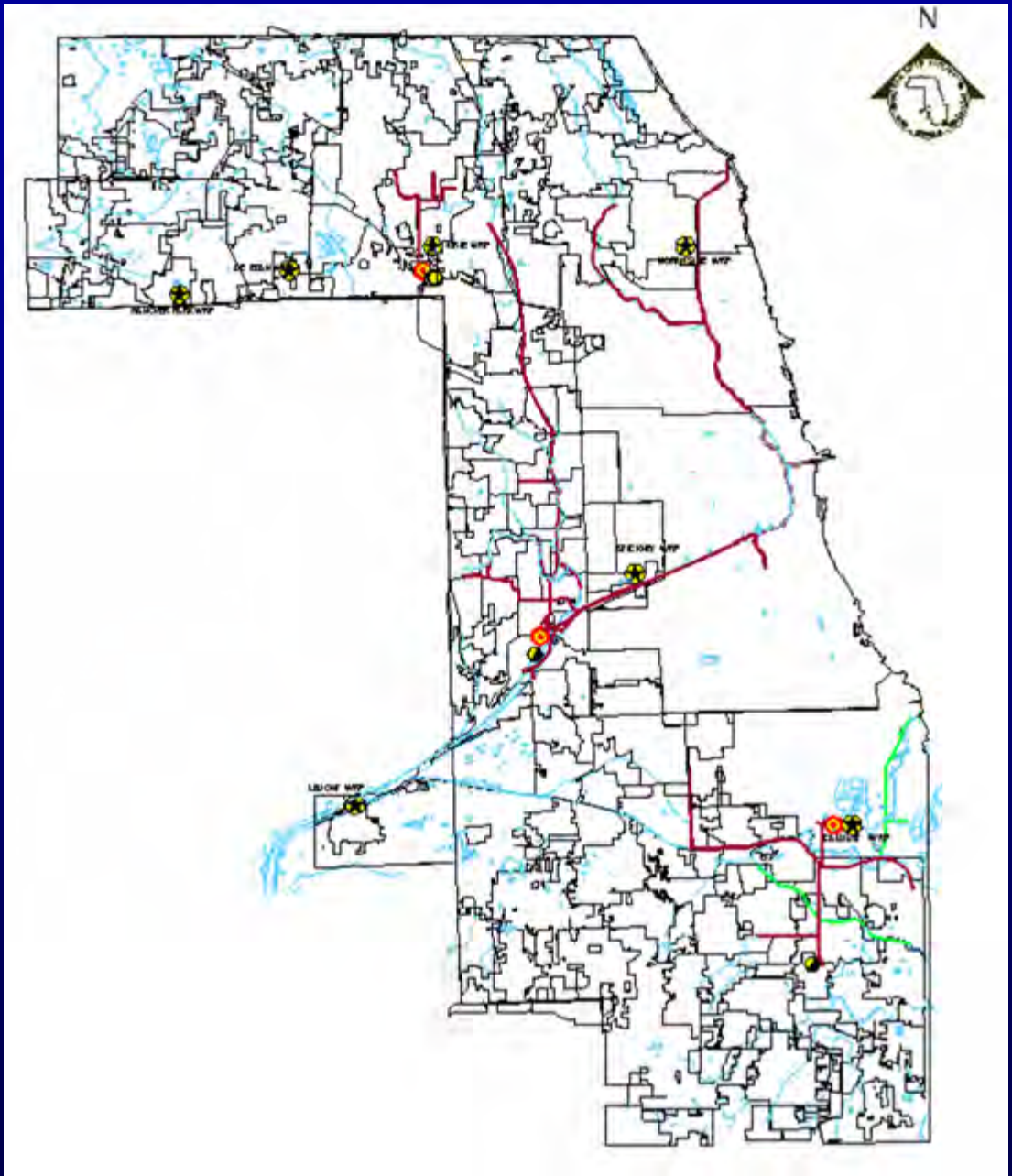
Hospital and Water Sector Interdependency Summit – Keeping Patients Safe

September 18, 2008

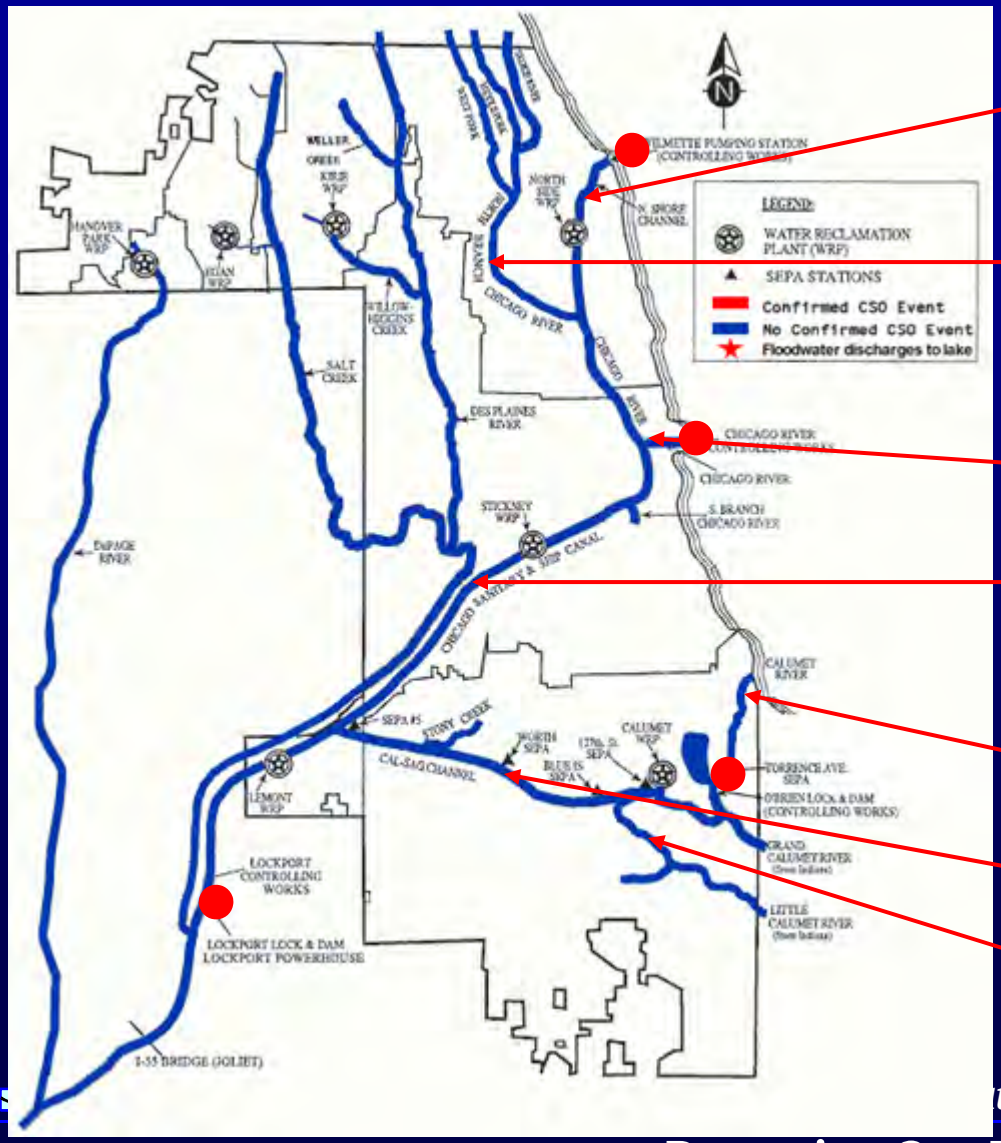
Mission

- Protect the health and safety of residents
- Protect the quality of Lake Michigan
- Improve the water quality of Chicago area waterways
- Protect homes and businesses from flood damage
- Maintain navigational levels in the Chicago area waterways
- Manage storm water for the Cook County area

- 883 square-miles
- 126 communities
- 10.35 million population equivalents
- 516 billion gallons treated
- 7 plants
- 554 miles of sewers
- 109.4 miles of deep tunnels
- 76 miles of rivers and canals
- 1,000 miles of small streams



Waterways



- North Shore Channel
- North Branch of the Chicago River
- Chicago River
- Sanitary and Ship Canal
- Calumet River
- Cal-Sag Channel
- Little Calumet River

Services

- The District provides collection and wastewater treatment for an equivalent population of 10.35 million people:
  - 5.25 million residents
  - Commercial and industrial equivalent of 4.5 million people
  - Combined sewer capture equivalent of 0.6 million people

7 Water Reclamation Plants

Stickney Plant

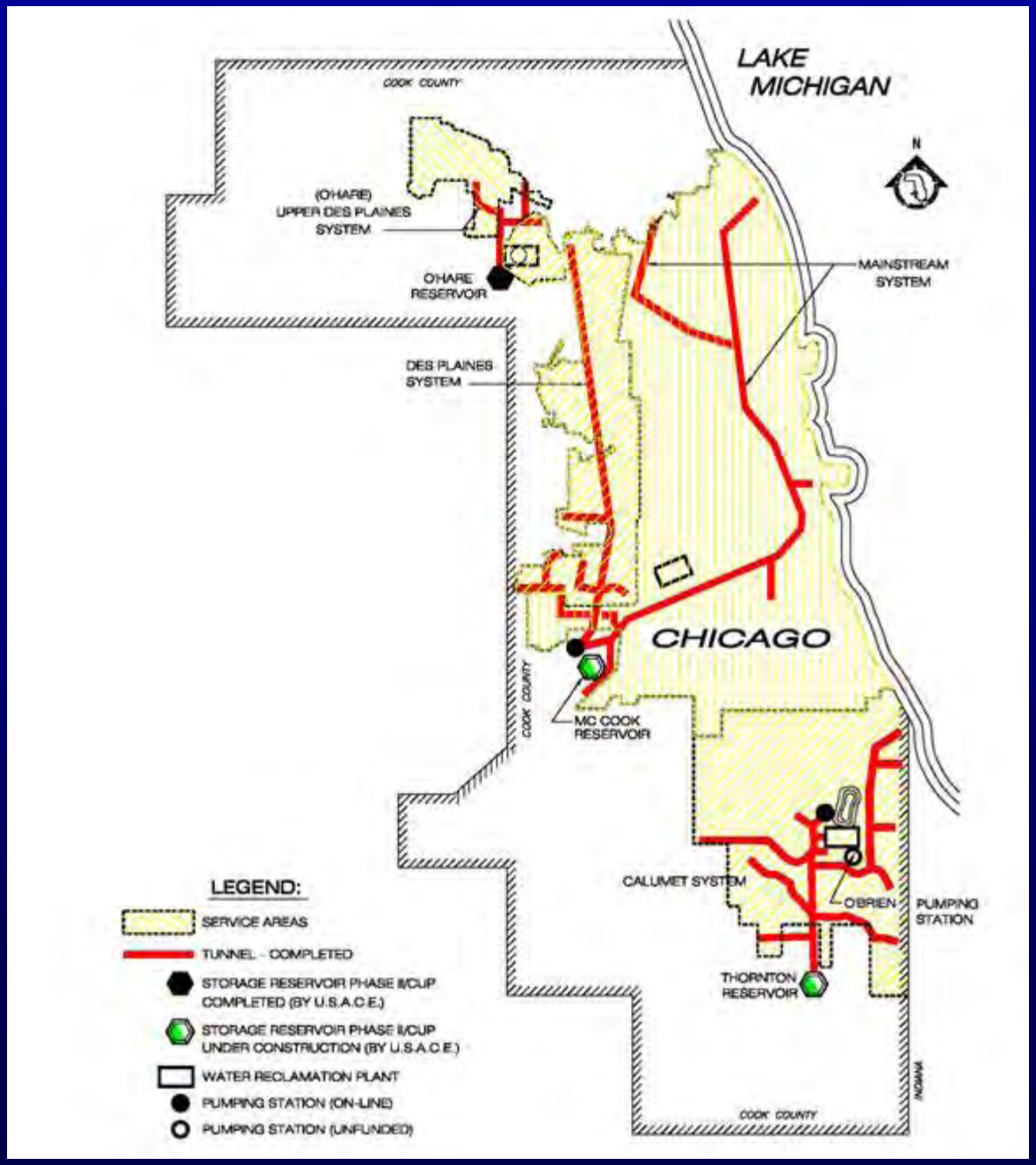
Capacity, Millions of Gallons per Day (MGD):

Stickney	1,200
Calumet (Chicago)	354
North Side (Skokie)	333
Kirie (Des Plaines)	52
Egan (Schaumburg)	30
Hanover Park	12
Lemont	2.3
Total Capacity	1,983
Average Flow	1,400

TARP

Tunnels
109.4 miles built
(completed)
1.9 BG storage

Reservoirs
350 MG built
15 BG planned



Sewage Collection System

- TARP tunnels
- O'Hare TARP reservoir
- Interceptor sewers
- Sewer lift stations

Thornton Reservoir

Future (combined sewage, 7.9 BG)

Other Facilities

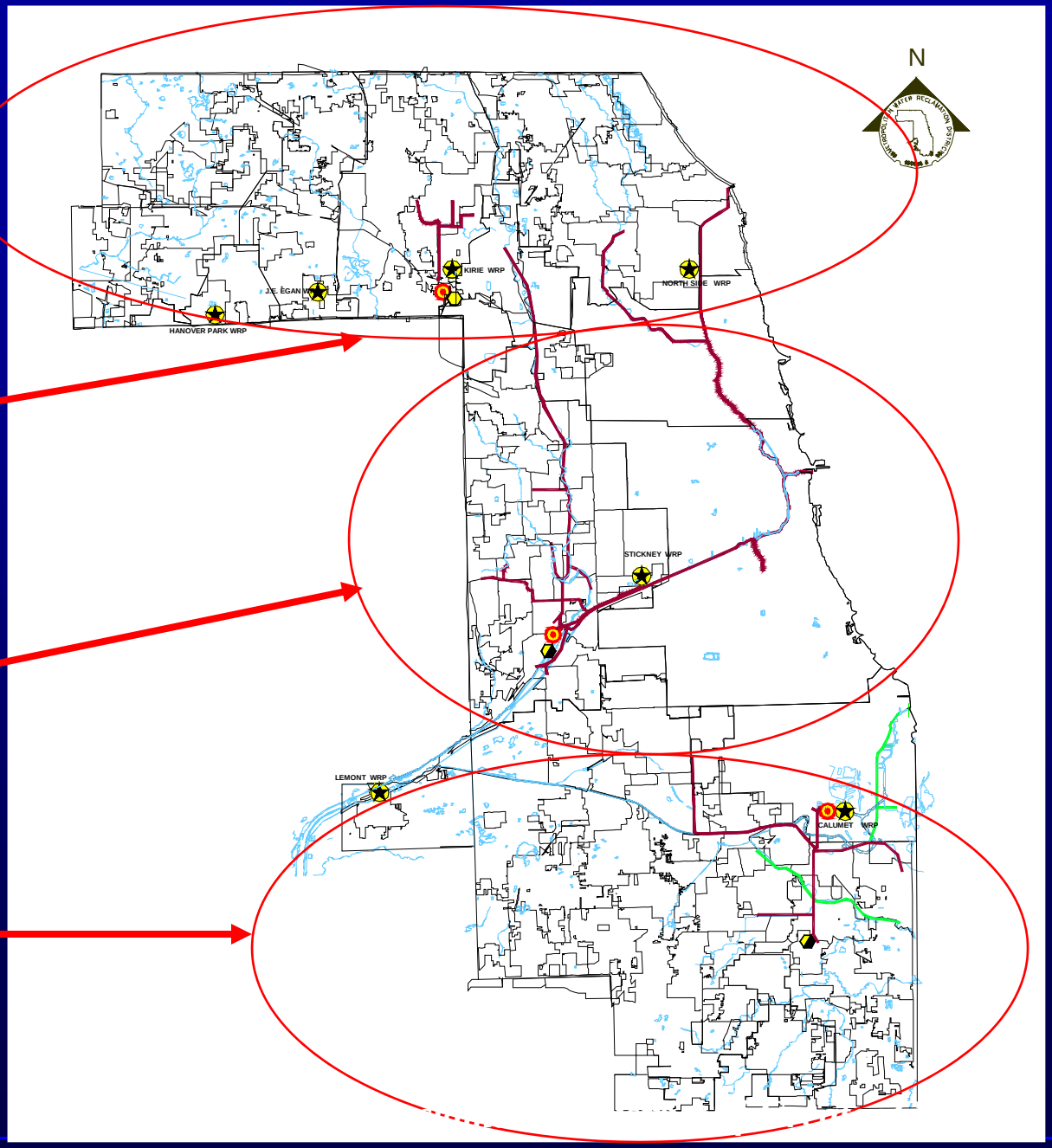
- TARP pumping stations
- Storm pumping stations
- Instream aeration stations
- Sidestream Elevated Pool Aeration stations (SEPA)
- Storm water retention reservoirs
- Waterway controlling works
- Solids management areas

Service Areas

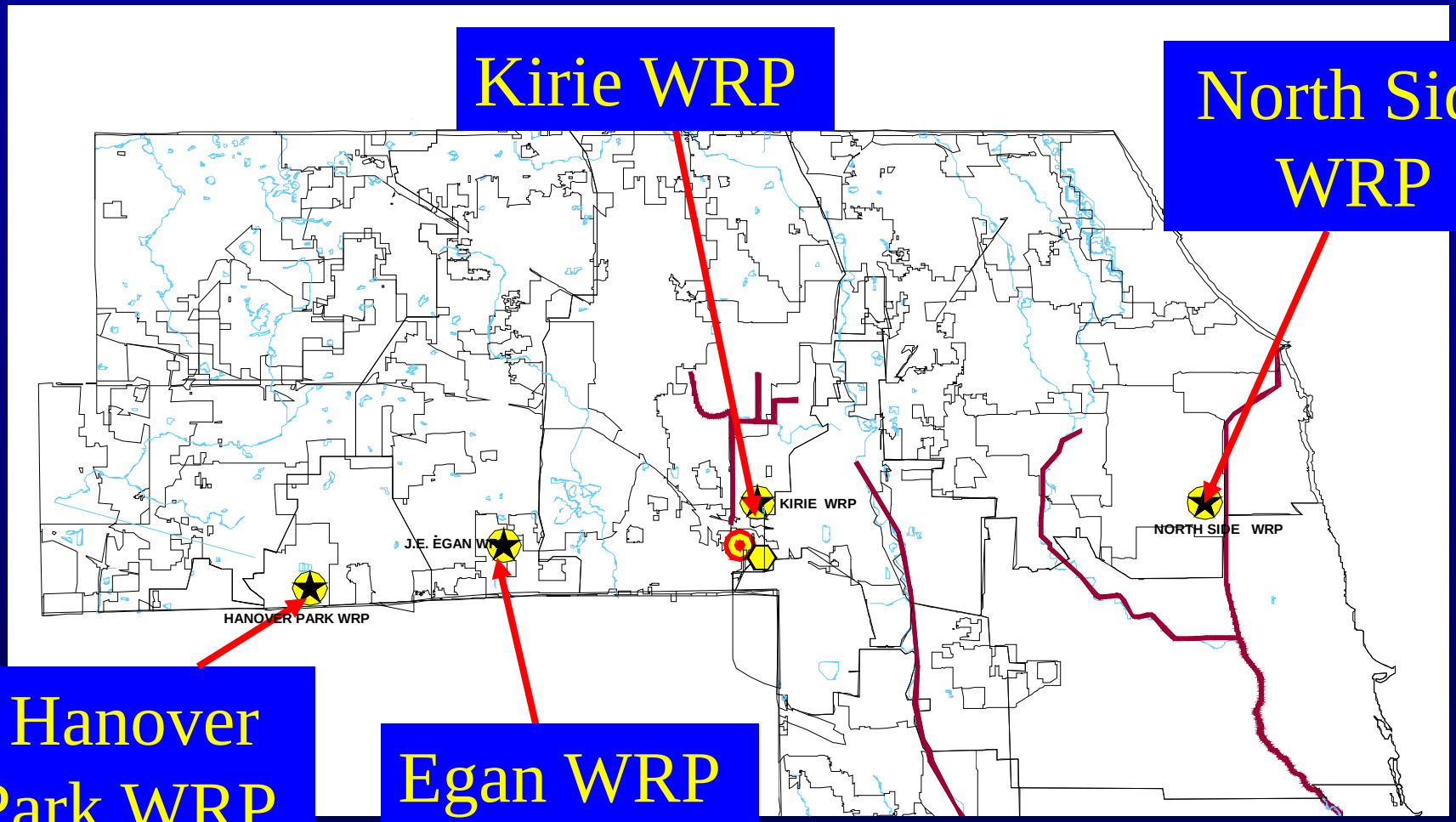
North Area

Central Area

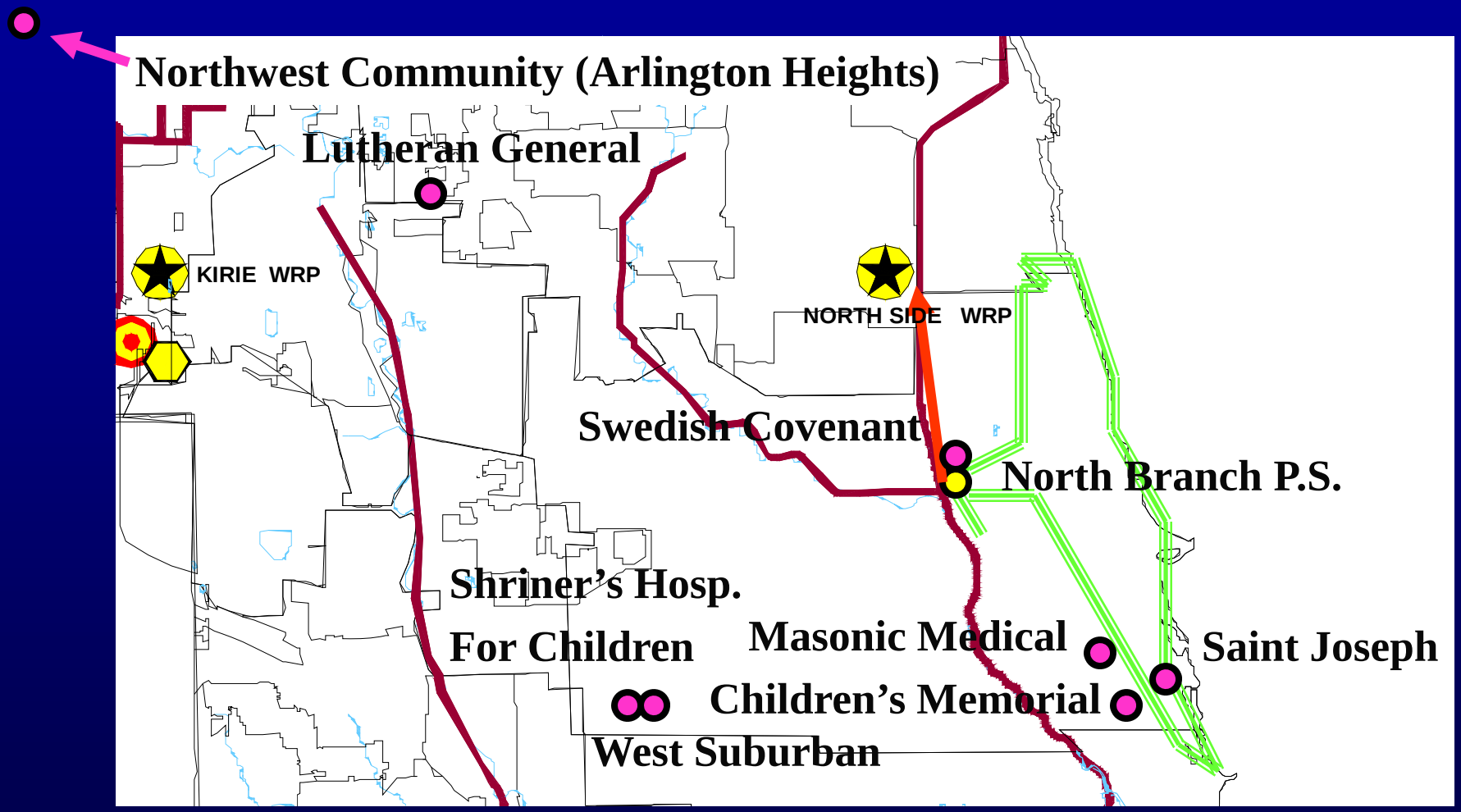
South Area



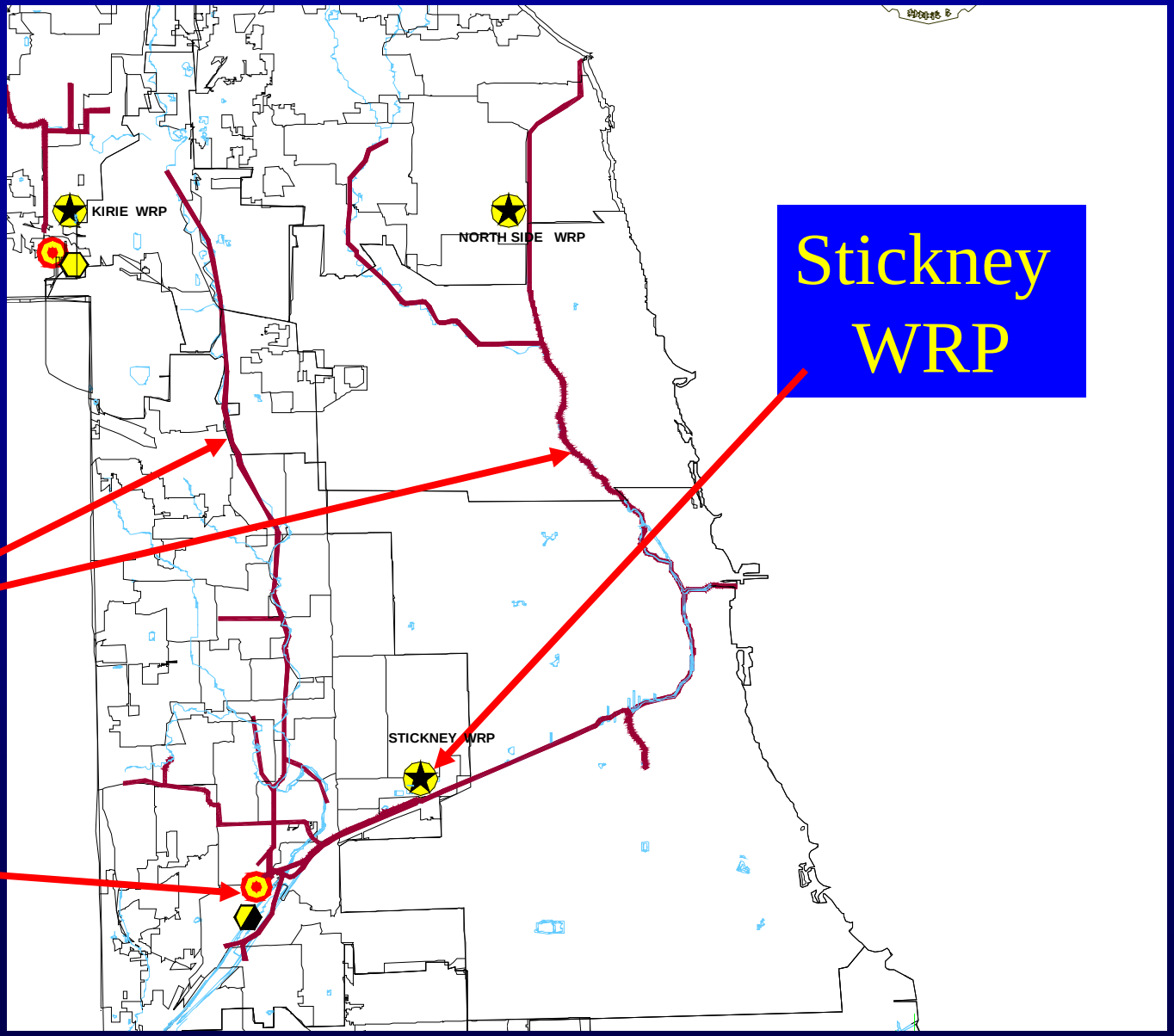
North Area


Kirie WRP
North Side WRP
KIRIE WRP
NORTH SIDE WRP
J.E. EGAN WRP
HANOVER PARK WRP
Hanover Park WRP
Egan WRP

North Area (detail)



Central Area

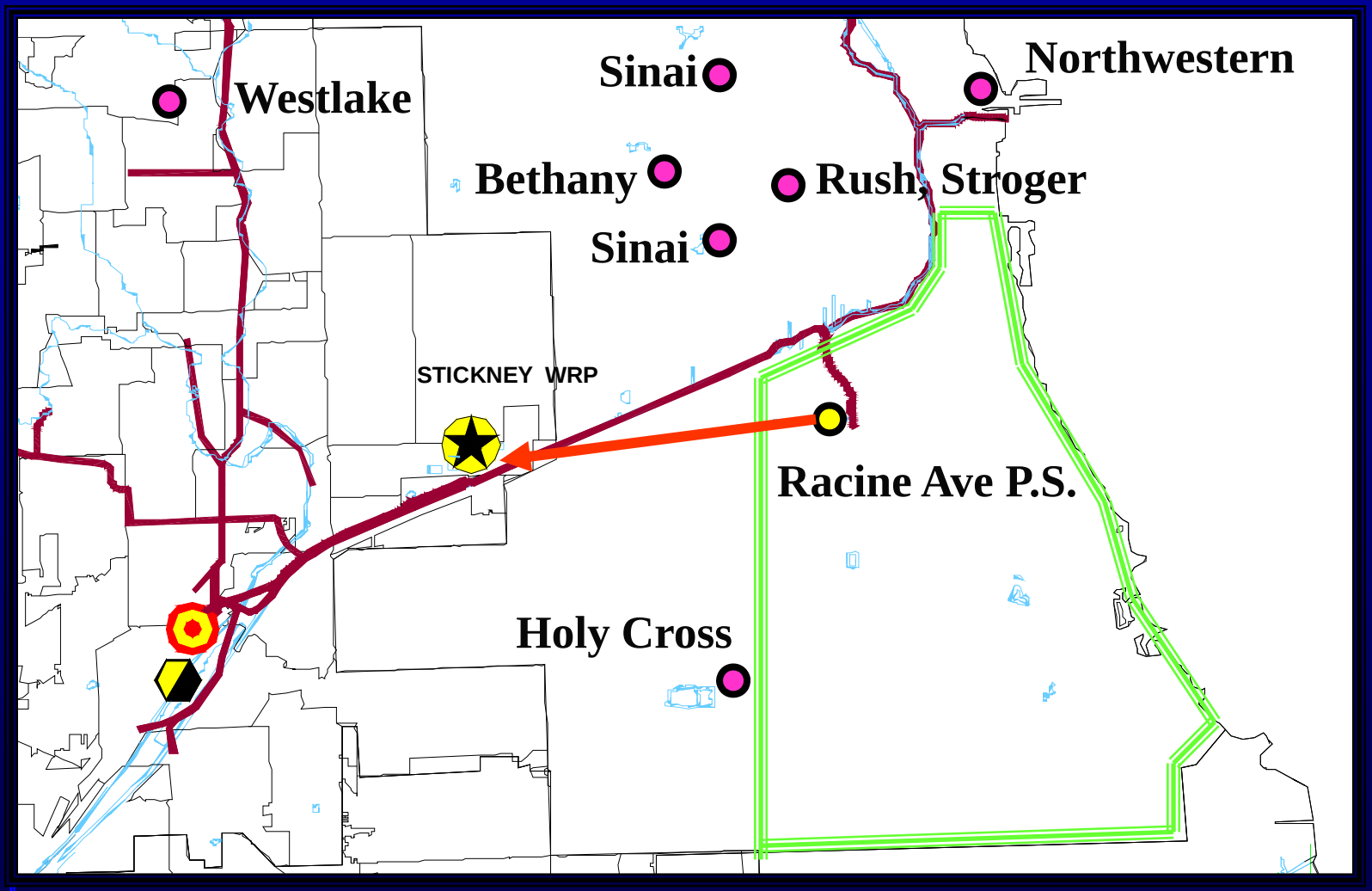


Stickney WRP

TARP Tunnels

TARP Pump Station

Central Area (detail)



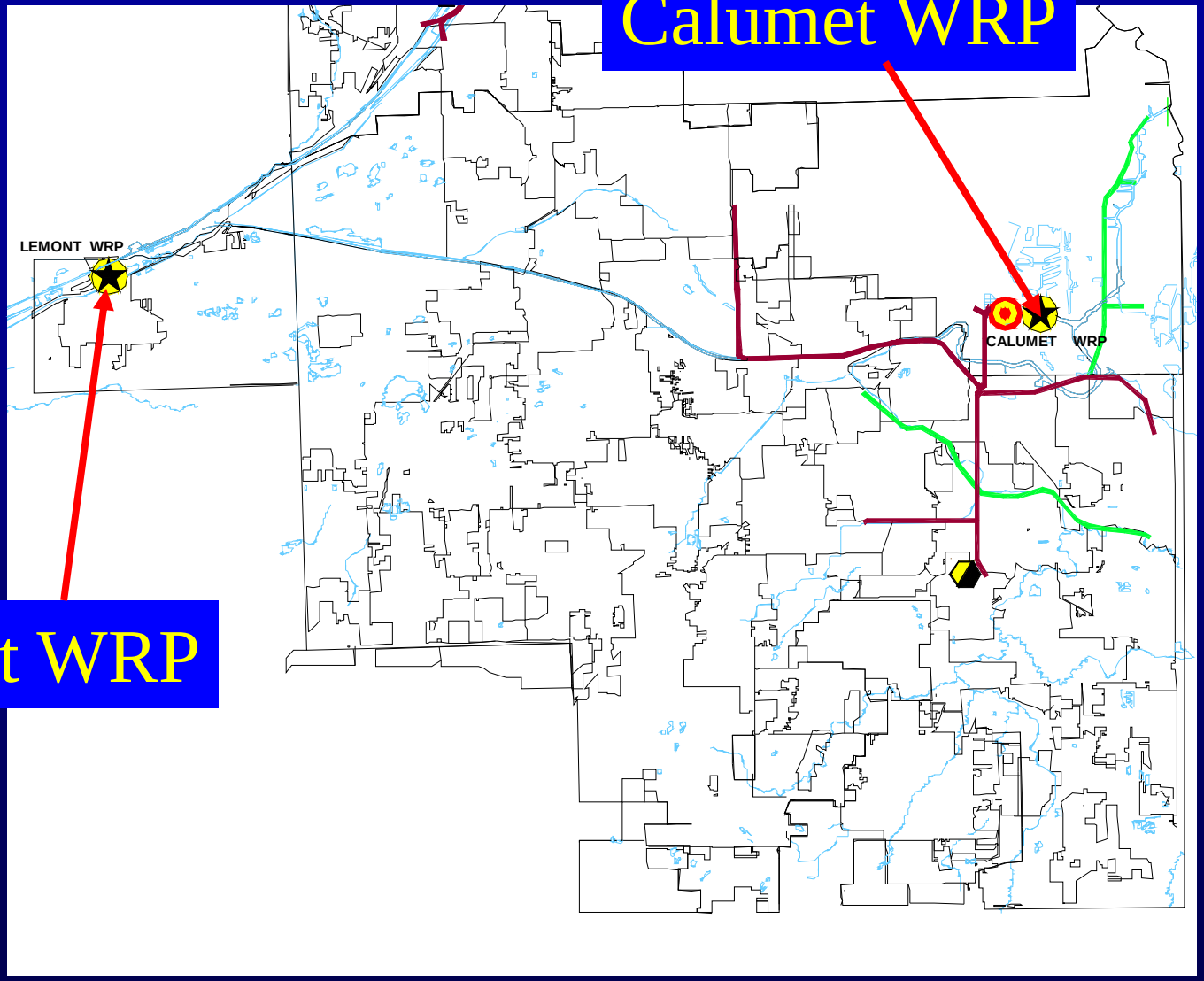
Racine P.S. Flood August 6, 2008

- 3.3 inches of rain
- Pumps running lost electrical power
- Water rose into the pump house 10 feet
- Power was shut off to save the motors
- By August 13, 3 pumps were operational
- By August 22, 6 pumps were operational
- Currently 12 of 14 pumps are operational

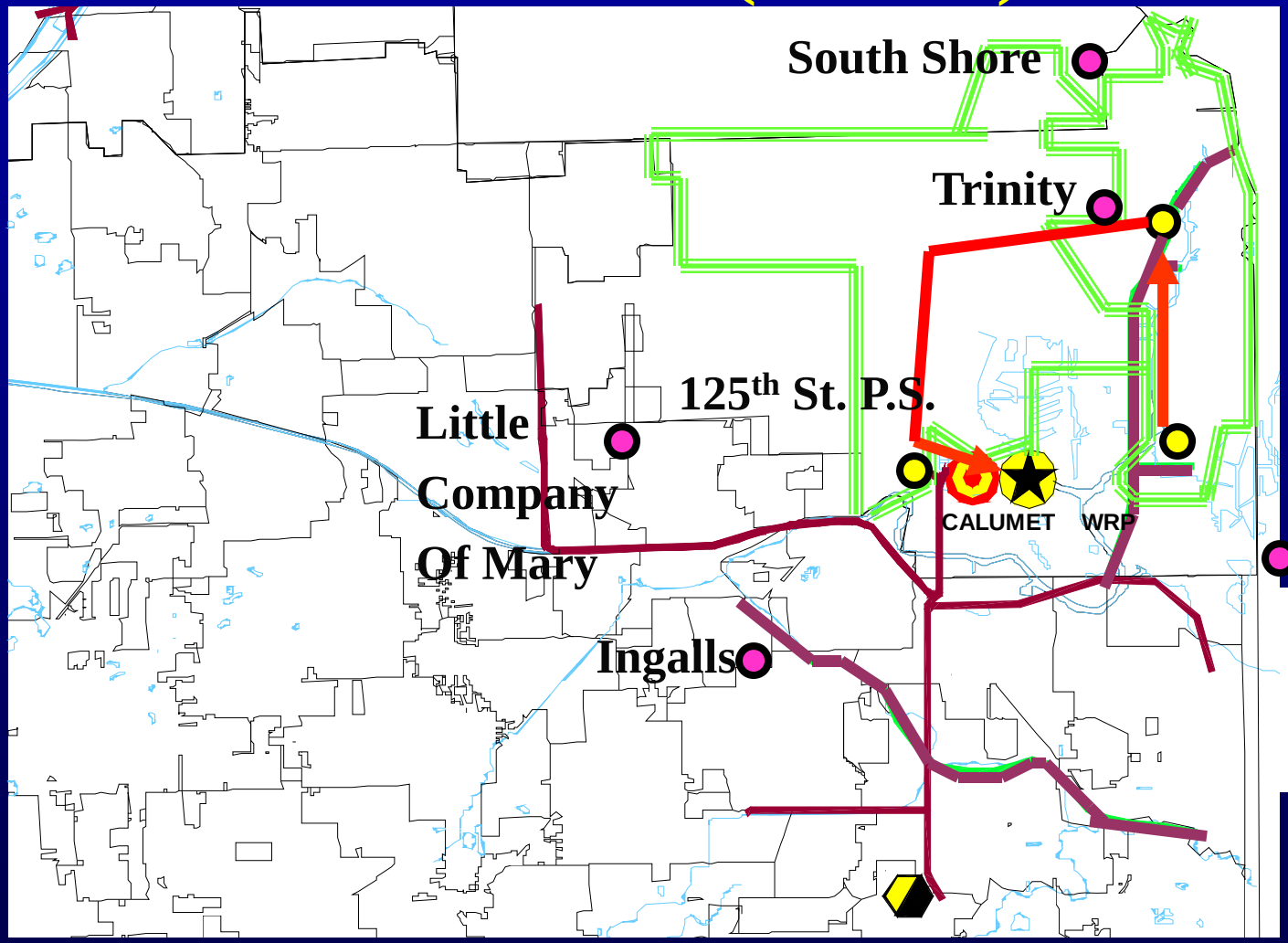
Pumping Station Improvements

- Restoration of damaged equipment
- Operational improvements
  - Improved use of 3 power sources
  - Improved pump readiness procedures
- Study to improve protection of all MWRD pumping stations

South Area



South Area (detail)



Storms of September 12-14, 2008

- 6.8 inches of rain over the Cook County area, locally up to 9.5 inches, with local flooding
  - 100 billion gallons of rain water
- All plants at full capacity
  - Stickney plant treating 1.8 billion gallons per day
- Tunnels full and reservoirs near capacity
- Released billions of gallons to Lake Michigan and the Illinois River
- Continuing to dewater the system during the next several weeks

Security

- Public Hotline
- Sewage and Waste Control Ordinance
- District police force
- Emergency response plans
- Redundant power sources
- Training and awareness

Community Notification

- When events occur that will impact the community, we notify:
  - Affected communities
  - Chicago Office of Emergency Management
    - Staff Joint Operations Center when needed
  - Cook County Office of Emergency Management
  - Illinois Environmental Protection Agency

Private Sector Participation

- Understand the impact of your discharges to the collection and treatment system
- Consider consequences of:
  - Disruption to the discharge collection system
  - Contamination of the Chicago area waterways
- Inform MWRD of problems or questions, 24/7 Hotline: (312) 787-3575

24/7 Hotline: (312) 787-3575

The 1993 Milwaukee Cryptosporidium Outbreak

Think Health Act Now!
CITY OF MILWAUKEE
HEALTH DEPARTMENT

Kathleen A. Blair, RN, MS
Public Health Policy and Research Director

September 18, 2008

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Milwaukee, WI 1993

- Largest waterborne disease outbreak in US history
- Estimated more than 400,000 individuals infected
- Medical and productivity costs estimated to exceed 131 million dollars
- Significant number of premature deaths

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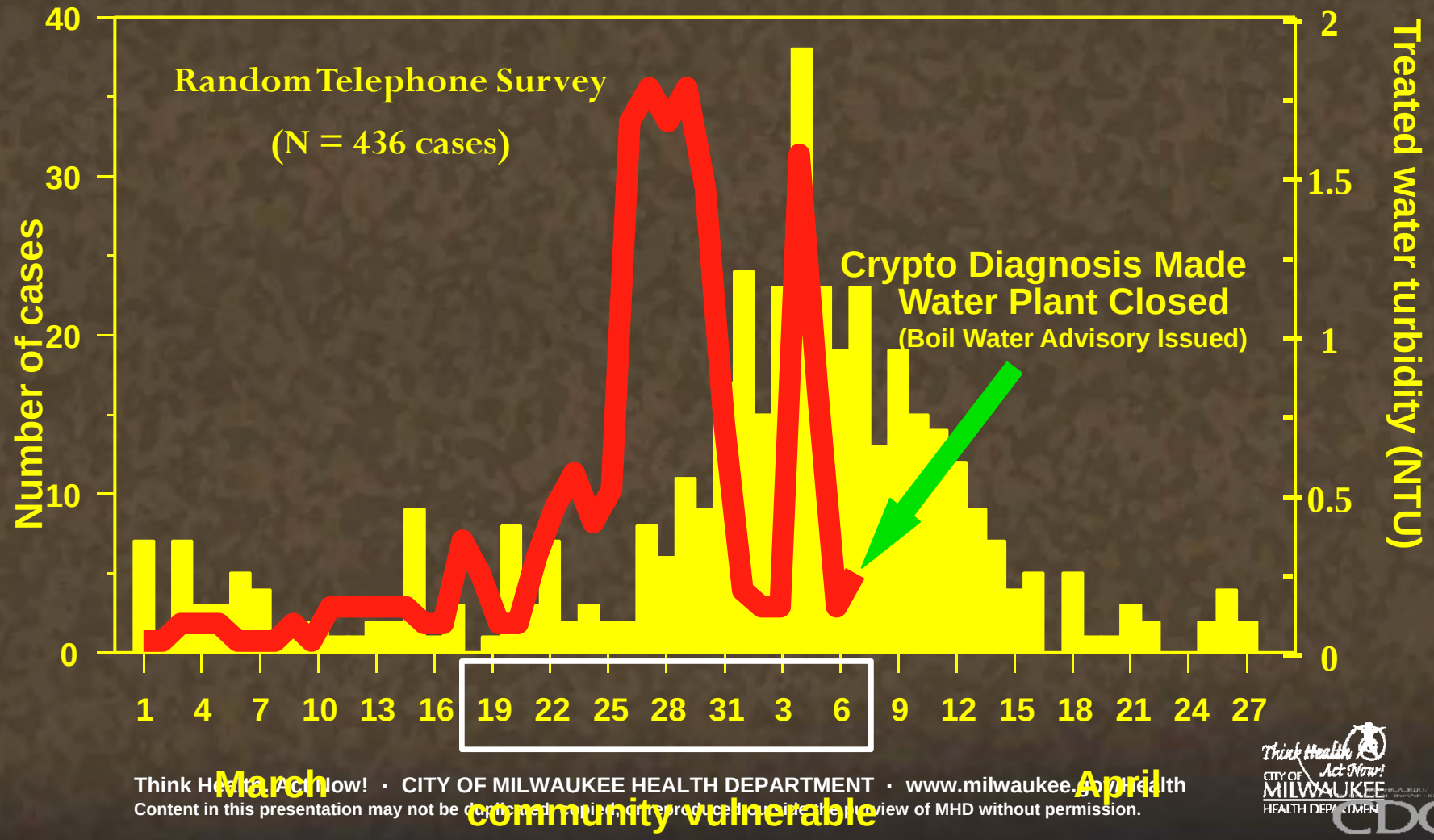
Milw. Sent., 4-6-93

Raging virus hits hard at area schools

Pharmacies short of supplies

Dates of Illness Onset & Water Turbidity (Milwaukee 1993)



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Wisconsin's E-Health Plan

- Consumer Interests and Privacy
- Patient Care
- Public Health
- Statewide Information Exchange

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Wisconsin Health Information Exchange

Microsoft Amalga

Amalga

Public Health - Emergency Dept. Events

Total: 17146

RegistrDateTime	Facility	Service	Complaint	City	Zip Code	Age	Sex
	Columbia St. Mary's - Milwaukee Campus	Emergency Medicine	HEADACHE S/P FALL	Milwaukee		58	F
	Aurora Sinai	EMR	WORK EXCUSE			30	M
	Columbia St. Mary's - Ozaukee Campus	Emergency Medicine	ABD PAIN	Mequon		64	M
	WFHC St Joseph	Emergency Medicine	UNK	MILWAUKEE		18	F
	WFHC St Joseph	Emergency Medicine	UNK	MILWAUKEE		50	F
	Columbia St. Mary's - Columbia Campus	Emergency Medicine	PASSENGER IN MVA	Milwaukee		17	F
	Aurora St. Lukes Medical Center	EMR	LEFT KNEE INJURY	Milwaukee		60	F
	Aurora West Allis Memorial Hospital	EMR	BEE STING/SWALLOW FACE	Muskego		7	M
	Columbia St. Mary's - Milwaukee Campus	Emergency Medicine	LIP SWELLING	Milwaukee		26	F
	Columbia St. Mary's - Ozaukee Campus	Emergency Medicine	BEE STING ARM	Mequon		54	M
	WFHC St Joseph	Emergency Medicine	UNK	WAUKESHA		51	M
	Columbia St. Mary's - Columbia Campus	Emergency Medicine	LT LEG PX SWOLLEN	Milwaukee		23	M
	Aurora St. Lukes Medical Center	EMR	FALL	Cudahy		94	F
	WFHC St Joseph	Emergency Medicine	UNK	MILWAUKEE		1	F
	Aurora St. Lukes Medical Center	EMR	BILATERAL EYE REDNESS	Milwaukee		3	M
	WFHC St Francis	Emergency Medicine		MILWAUKEE		21	M
	WFHC St Francis	Emergency Medicine	EVALUATION OF WORKING	MILWAUKEE		60	M
	Aurora St. Lukes Medical Center	EMR	RIGHT HIP PAIN	Milwaukee		82	F
	Aurora Sinai	EMR	COUGH, RASH	Milwaukee		1	M
	WFHC St Joseph	Emergency Medicine	UNK	MILWAUKEE		23	F
	Aurora St. Lukes Medical Center	EMR	BILATERAL EYE REDNESS	Milwaukee		5	F

Think Health Act Now!
CITY OF MILWAUKEE
HEALTH DEPARTMENT

CBS NEWS

CBS EVENING NEWS | THE EARLY SHOW | 48 HOURS MYSTERY | 60 MINUTES | SUNDAY MORNING

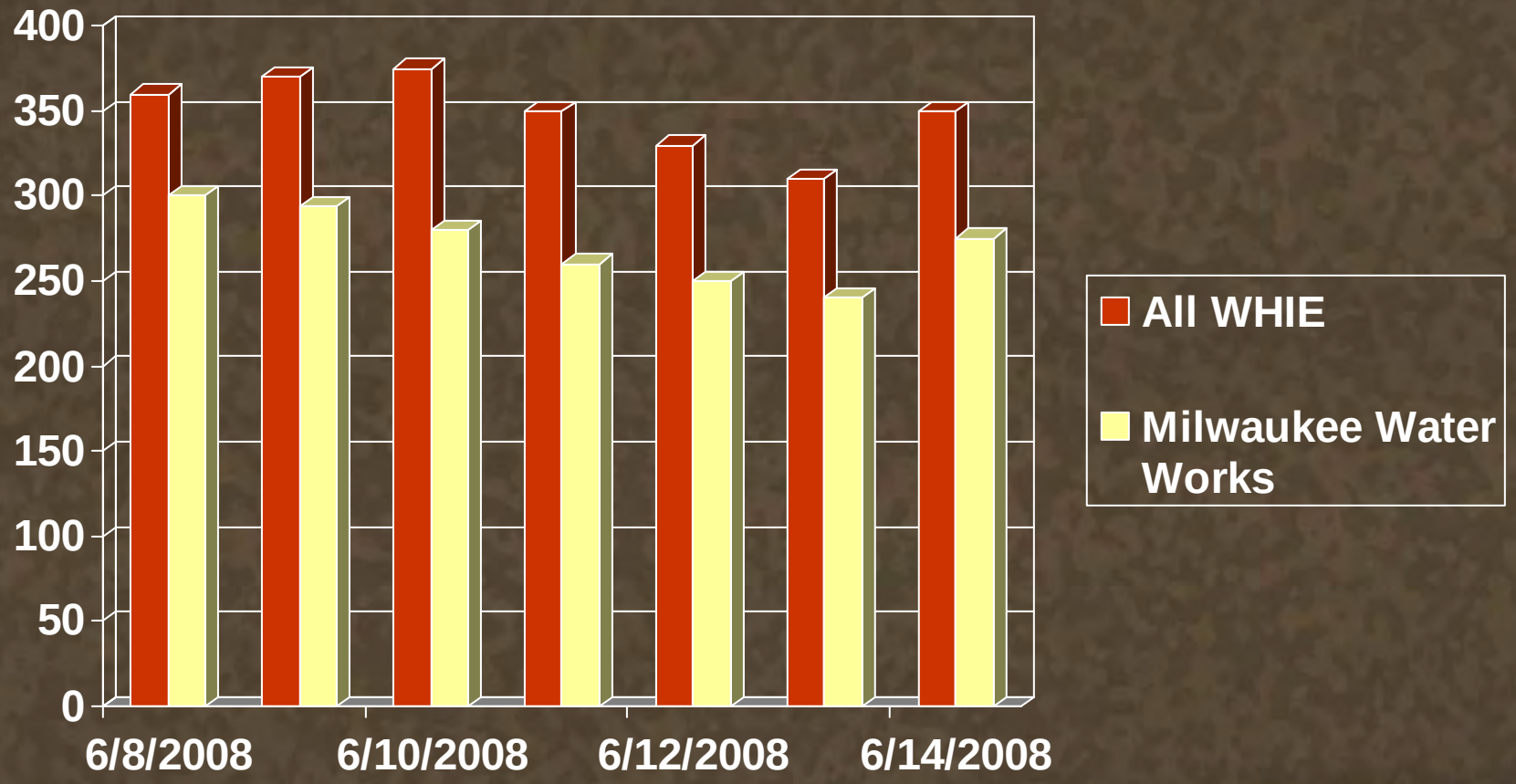
SEARCH CBS News

13 Dead In Midwest Floods; Hundreds Flee

PIEDMONT, Missouri, March 19, 2008

Comments 11

Emergency Department GI Visits



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Milwaukee
THE JOURNAL

EXTRA
FREE

Milwaukee Sentinel

DON'T DRINK *the* WATER

ONLY BOILED, BOTTLED WATER CONSIDERED SAFE

Erwin W. Gebhard photo

ED FLECHNER GETS WATER FROM THE WELL at E. Pryor Ave. and S. Superior St. while Anthony Kusz waits his turn early Wednesday. Both wanted fresh water for their morning coffee as Milwaukeeans scramble to find alternate sources of water.

City water

Milwaukee Sentinel

Safety Updates:

- Call Sentinel PressLine: 271-1118. Then press 2 and then 7233 (SAFE).
- Read Friday's Milwaukee Sentinel for latest developments.

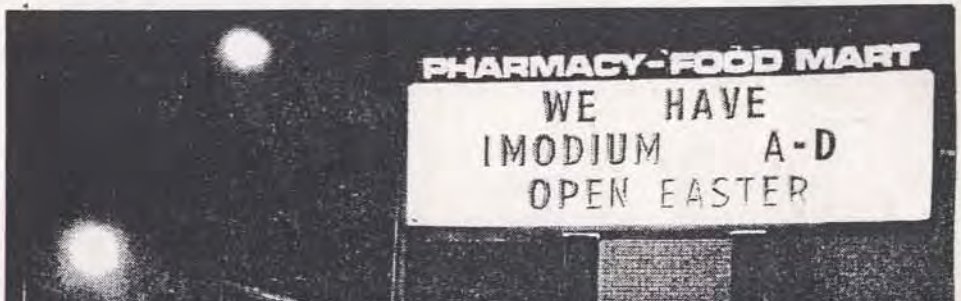
What to do with water

If you are served by Milwaukee's water system, medical experts advise the following:

- Boil tap water for at least 5 minutes before using it for drinking, cooking, making coffee or bathing infants.
- Do not use ice cubes made with tap water during the last two weeks.
- Do not brush teeth with tap water.
- Do not consume soups, soft drinks or juices made with tap water during the last two weeks.
- Water is safe for bathing or showering.
- Water is safe for washing dishes, as long as dishes are thoroughly dry before use. Dishwashers that dry the dishes may be operated safely.
- Wash hands after using the bathroom or handling diapers to avoid transmitting the organism.

Sources: Tom Taft, chairman, Infection Control Committee, West Allis Memorial Hospital; and Gerhard F. Sawall, pediatrician, Children's Hospital.

Where to call for help on water questions



Resources for Health Professionals

CDC Home | Search | Health Topics A-Z

CDC SAFER • HEALTHIER • PEOPLE™

Division of Parasitic Diseases

Drinking Water

DPD

Home
Professional Info
Public Info
About DPD
Announcements
Recent Publications
DPD Search

Health Professionals

Outbreak Response Toolkit
The following information is intended to help state and local health departments respond to outbreaks associated with diseases related to drinking water. While some downloadable documents below are cryptosporidiosis-specific, they can also be used as models when creating similar documents for other pathogens. Likewise, though this page was produced by CDC's Division of Parasitic Diseases, some of the information below can be used or adapted for use in non-parasitic drinking water-related outbreaks. All documents can be downloaded and altered as needed.

Helpful Tips for Drinking Water Outbreak Response

Generic Cryptosporidiosis Outbreak Case and Control Questionnaires (PDF document, 29 KB, requires Adobe Acrobat Reader)

from Cryptosporidium and Water: A Public Health Handbook (PDF document, 1.12 MB, requires Adobe Acrobat Reader)

Download Epi Info software

Waterborne Diseases Outbreak Report Form (PDF document, 87 KB, requires Adobe Acrobat Reader)

Sample line listing to keep track of cases [use legal (8.5" x 14") size paper for printing].
(Word, 54 KB) (Access, 11 KB [zipped])

For information on waterborne disease outbreak response, please visit the Healthy Swimming Outbreak Response page.

DPDx
The goal of DPDx is to use the internet to strengthen diagnosis of parasitic diseases, both in the United States and abroad. Users can browse through concise reviews of parasites and parasitic diseases, including an image library and a review of recommended procedures for collecting, shipping, processing, and examining

- Disinfection procedures
- Food prep
- Dishwashing equipment
- Water holding reservoirs
- Water softeners
- Bathing practices
- Drinking fountains commercial ice makers
- Renal dialysis units
- Dental offices

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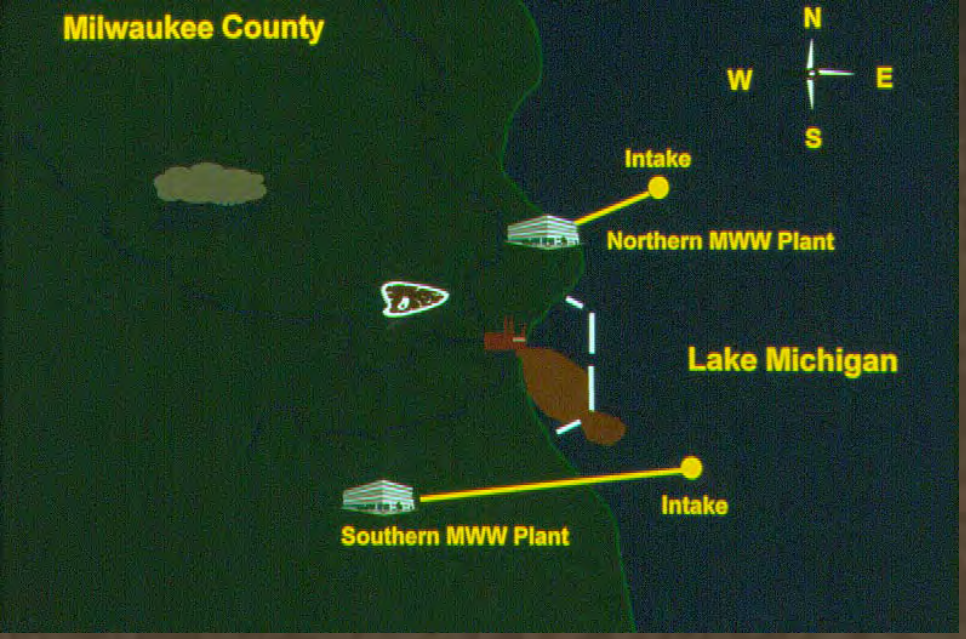
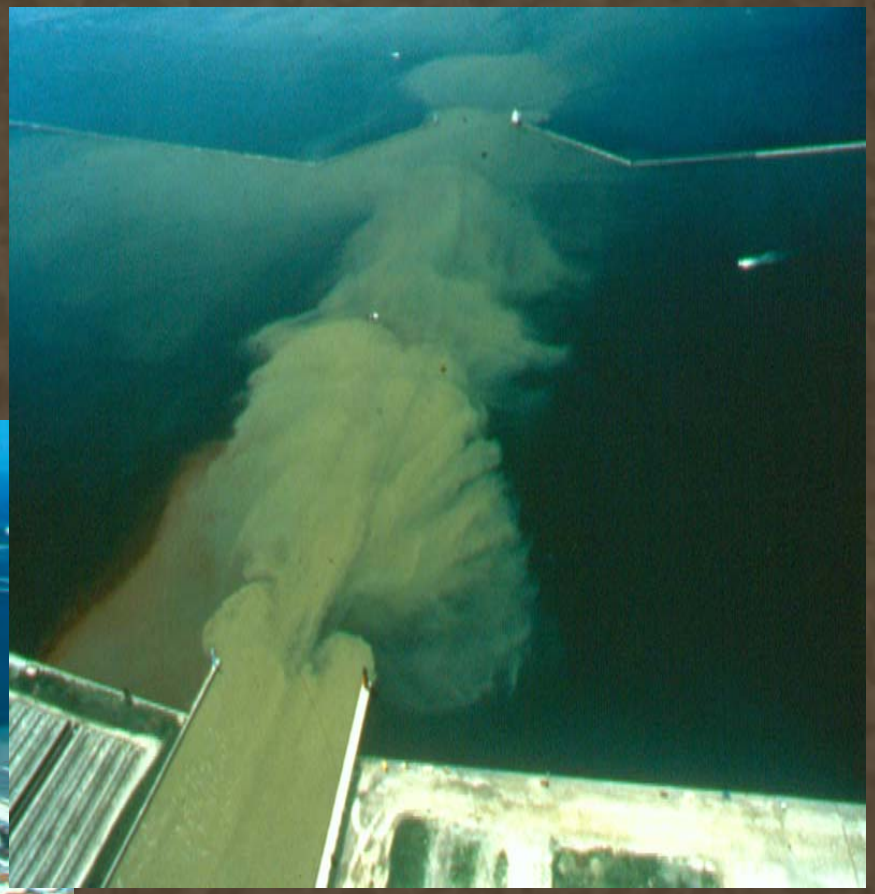
Think Health. Act Now! CITY OF MILWAUKEE HEALTH DEPARTMENT


Milwaukee County
N
W
E
S
Intake
Northern MWW Plant
Lake Michigan
Intake
Southern MWW Plant



Mapping Heavy Metal Distributions in and around Riverside Park, Milwaukee, WI

GANNON, Claire E. and KNUDSEN, Andrew C., Department of Geology, Lawrence University, Appleton, WI 54911, gannonc@lawrence.edu

A 2.5-mile impoundment sat behind the North Avenue Dam on the Milwaukee River for over 150 years, until it was breached in 1990. Upstream urban runoff and industrial pollution resulted in the deposition of heavy metal rich sediments in the slow moving waters of the impoundment. After the dam's removal, the river narrowed and returned to a more natural flowpath. The newly exposed riverbed was annexed as part of Riverside Park, enabling ecological recovery efforts on the river and riparian zones. However, these newly exposed soils are enriched with heavy metal

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Milwaukee Water Works Safe Drinking Water Report

Safe, Abundant Drinking Water.

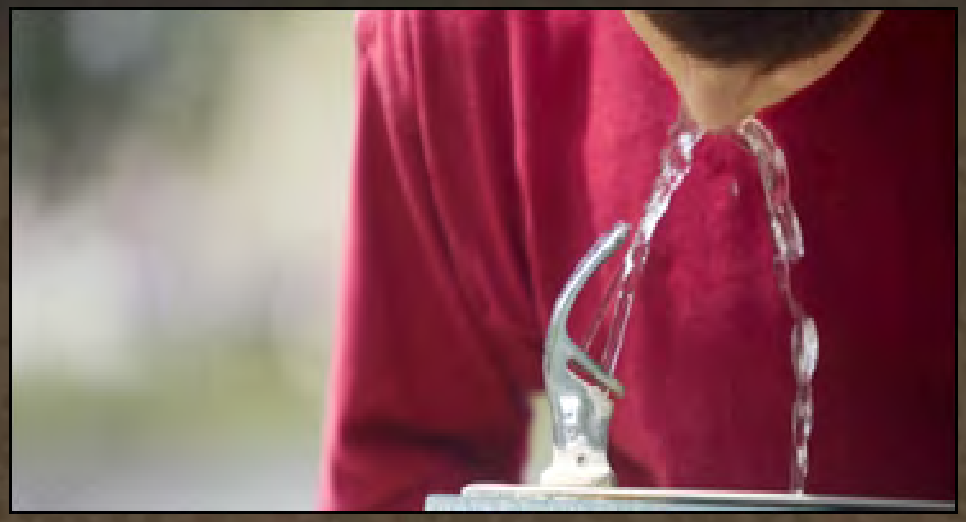
The Milwaukee Safe Drinking Water Report is a service of the Milwaukee Water Works, a national leader in providing safe, high quality drinking water. In this report, you will find:

- Information about the source of your drinking water
- The treatment process that ensures the highest quality water
- Results of water quality testing and compliance with water quality laws
- Additional educational information

The U.S. Environmental Protection Agency (EPA) requires drinking water utilities to provide an annual Consumer Confidence Report to help consumers understand where their drinking water comes from so they can make informed decisions about their health and protection of the environment. Detailed water quality information is available at the Milwaukee Water Works website, **www.water.mpw.net**.

Overview

The Milwaukee Water Works provides safe, abundant drinking



- 2008 marks the 100th anniversary of one of the most significant public health advances in US history—the disinfection of drinking water. Since 1908, much of America's drinking water has been disinfected to protect us from waterborne infectious diseases

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Protective Security Advisor
U.S. Department of Homeland Security

"Securing the Nation's critical infrastructures one community at a time"

September 18, 2008

Homeland Security

DHS Protective Security Advisor

Homeland Security Mission Areas:

- Intelligence and Warning
- Border and Transportation Security
- Domestic Counter-Terrorism
- Emergency Preparedness and Response
- Defending against Catastrophic Terrorism
- Protecting Critical Infrastructures and Key Resources

Homeland Security

17 Critical Infrastructure & Key Resource Sectors

Critical Infrastructure Sectors

- Agriculture and food
- Banking and finance
- Chemical
- Defense industrial base
- Emergency services
- Energy
- Information technology
- Postal and shipping
- Public health and healthcare
- Telecommunications
- Transportation systems
- Drinking water and water treatment systems
- National monuments and icons

Key Resources

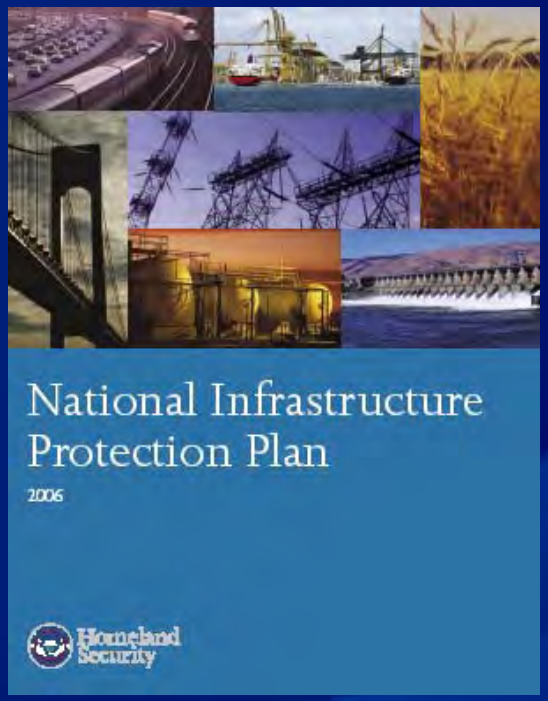
- Commercial facilities
- Dams/Locks
- Government facilities
- Nuclear reactors, materials, and waste

Homeland Security

Role in the National Infrastructure Protection Plan (NIPP)

NIPP's Goal: Enhance the Nation's protection of critical infrastructure and key resources …

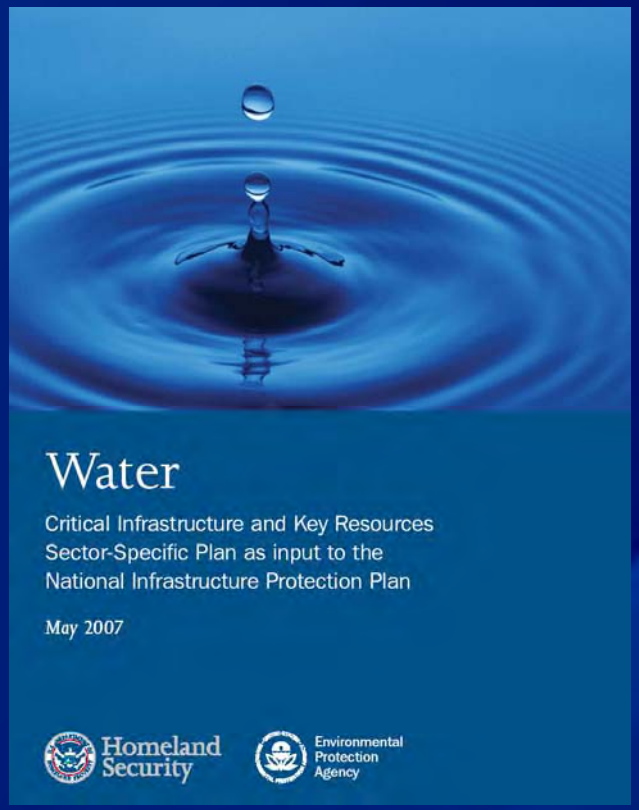
- Leading the development and implementation of NIPP Performance Measurement (metrics) process
- Chairing the Risk Management & Protective Measures Working Group
- Supporting NIPP implementation activities across all seventeen CI/KR sectors



Homeland Security

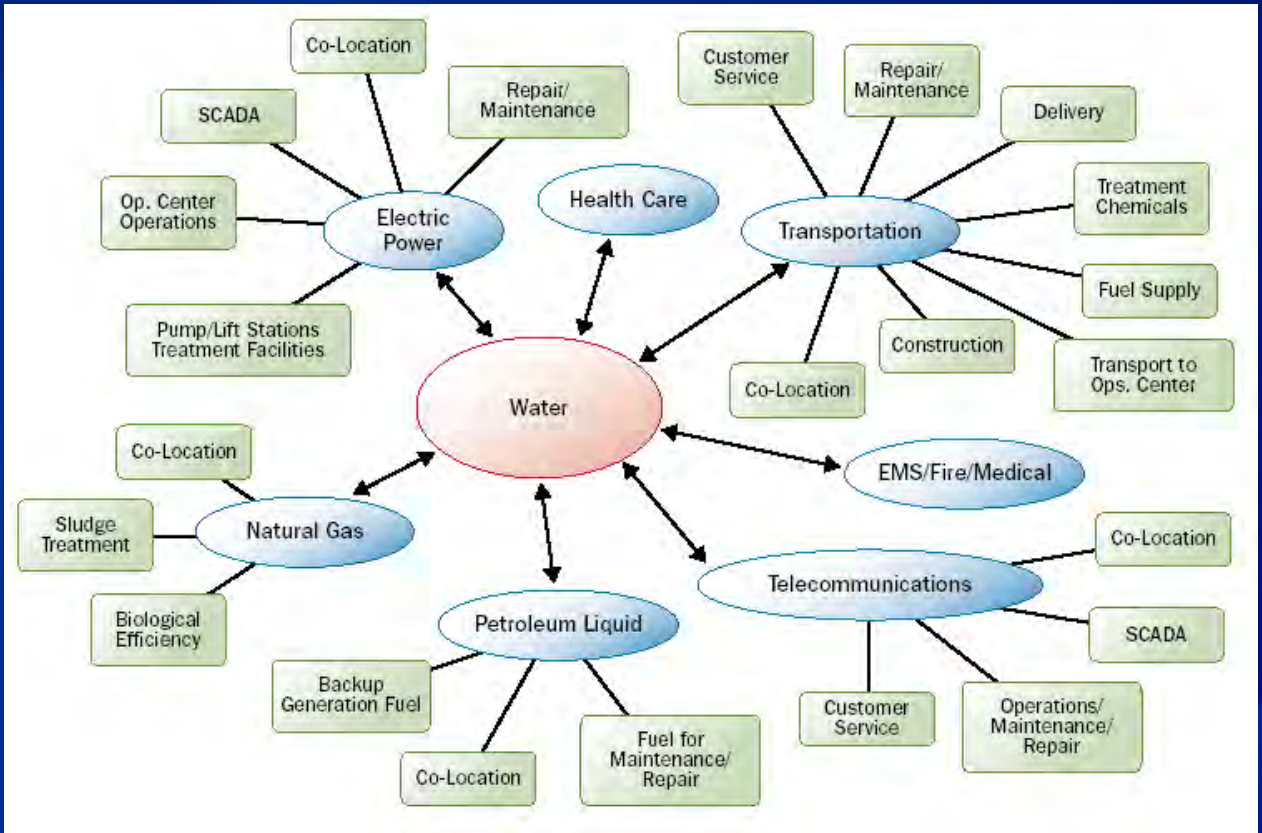
Water Sector Specific Plan (SSP)

- Developed with DHS, EPA and the Water Sector Coordinating Council
- Addresses “Response and Recovery” as opposed to just prevention
- Sector Profile / Goals
- Identifies assets, systems, networks and functions
- Assesses Risks
- Defines process for prioritizing the sector’s CI/KR
- Develops and Implements Protective Programs
- Measures Progress
- CI/KR Protection Research and Development
- Managing and Coordinating SSA Responsibilities



Homeland Security

Interdependencies



Homeland Security

Infrastructure	Infrastructure Dependency on Drinking Water	Drinking Water Dependency on Infrastructure
Agriculture	• Irrigation* • Animal drinking • Facility cleaning	
Food	• Food processing • Restaurant operation	
Transportation	• Office operations • Equipment maintenance • Common rights-of-way	• Delivery of treatment chemicals • Operations, maintenance, repair • Delivery of components, materials • Company operations • Transport of emergency responders and equipment • Common rights-of-way
Banking and Finance	• Office operations • Equipment cooling	• Company operations
Chemical Industry and Hazardous Materials	• Manufacturing operations • Office operations	• Chlorine and other treatment chemicals
Postal and Shipping	• Office operations	• Company operations
National Monuments and Icons	• Office operations • Provision of public facilities	

Homeland Security

Interdependency Case Study

*** Typically, interdependencies within the sector taken for granted or completely unknown

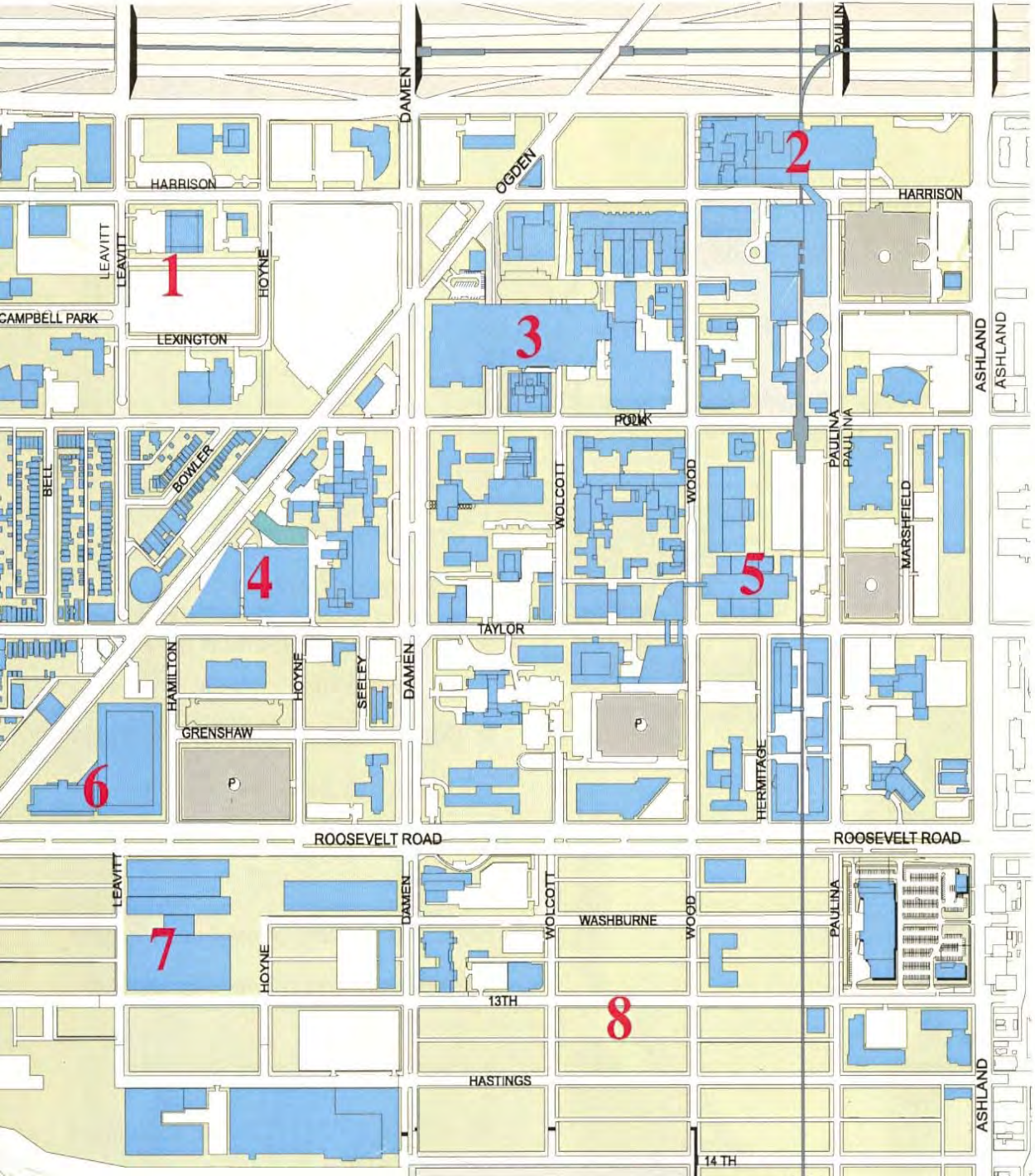
Illinois Medical District:

- Stroger, Rush, UIC, VA, Red Cross, Technology Park with over 30 companies, FBI Building, Cook County Juvenile Center
- 2,200 hospital beds
- 20,000 employees
- 75,000 daily visitors
- Largest urban medical district in the US
- Largest concentration of health care facilities and providers in the US

Generates:

* $3.3 billion in economic activity
* 50,000 direct and indirect jobs
* $80 million in annual state taxes
* $24 million in annual local taxes
* $2 billion in direct and indirect employment compensation

Homeland Security



Illinois Medical District

1. *Chicago Technology Park*
2. *Rush University Medical Center*
3. *John H. Stroger, Jr. Hospital of Cook County*
4. *Jesse Brown VA Medical Center*
5. *University of Illinois Medical Cen*
6. *Cook County Juvenile Center*
7. *FBI Building*
8. *IMD District Development Area*

ILLINOIS PUBLIC WORKS/WATER/WASTEWATER AGENCIES RESPONSE NETWORK

ILWARN

"ILLINOIS AGENCIES WORKING TOGETHER"

- Intrastate mutual aid and assistance program for water and wastewater agencies
- Designed to provide agency-to-agency response during emergency
- Mission is to support and promote statewide emergency preparedness, disaster response, and mutual assistance for public and private water and wastewater, and public works agencies
- Based on three other models, CalWARN, FlaWARN, and TxWARN; compliments existing ILEAS and MABAS models in Illinois

Homeland Security

CV/ PI/ PM Reports

DHS produced CV and PI reports for 142 different asset types; 19 of these reports pertain to commercial sector assets

- Casinos
- Conventions Centers
- Hotels
- Museums, Libraries, & Zoos
- Nightclubs
- Office Buildings
- Restaurants
- Large Public Outdoor Gatherings
- Residential Buildings
- Religious Facilities
- Schools and higher Education
- Shopping Malls
- Stadiums and Arenas
- Theme Parks
- Theatres

Homeland Security

Adobe Acrobat Professional - [CV_Energy_OilGas_Petroleum_Refineries_051123.pdf]
File Edit View Document Tools Advanced Window Help
Open Save Print Email Search Create PDF Review & Comment Secure Sign Advanced Editing
Select Text 78% How To..?
Bookmarks Signatures Layers Pages Comments

CHARACTERISTICS AND COMMON VULNERABILITIES INFRASTRUCTURE CATEGORY: PETROLEUM REFINERIES

Risk Management Division
Office of Infrastructure Protection
U.S. Department of Homeland Security

Version: November 23, 2005

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For more information about this document contact:
David Dickinson (202-282-8517 David.Dickinson1@dhs.gov)
or Wade Townsend (202-282-8740 Wade.Townsend@dhs.gov)

DHS Protective Security Advisor

- Build relationships – liaison to the private sector
- Assist State/Local Homeland Security Advisors
- Provide real-time situational awareness to DHS HQ elements
- Liaison with other HS efforts (ATAC/JTTF)
- Help facilitate PSD risk reduction activities – BZPP, SAVs, Training
- Advise state and local officials on critical infrastructure & key resources lists
- Fusion Centers
- National Response Framework (ILO)
- Special Events
- CVPIPM Papers

Homeland Security

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http://cvpipm.iac.anl.gov/

http://www.dhs.gov/infrastructuredailyreport

https://mwern.usp3.org

http://www.ready.gov

http://www.training.fema.gov/EMIWeb/IS/

Homeland Security

Metropolitan Chicago Healthcare Council
September 18, 2008

Hospitals and Water

Can’t live without it..

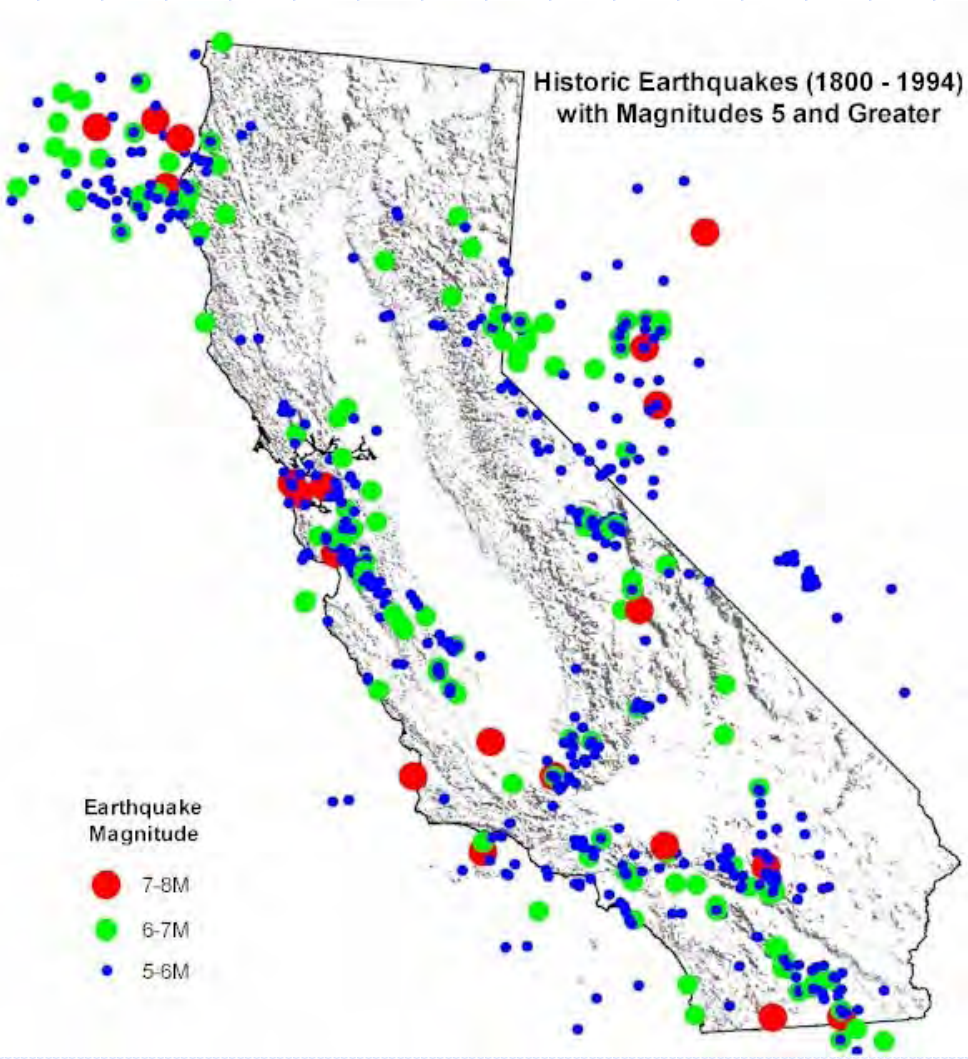
Can’t live with too much of it..

R. Jay Love, Structural Engineer
Senior Principal
Degenkolb Engineers

- Past Experience
  - Damage
    - Regional Supply
    - Equipment
    - Distributed Systems
- California Hospitals – State agency regulated
  - Design Phase
  - Review Phase
  - Construction Phase

Earthquakes - A Known Hazard

- A long history of California earthquakes
  - 1933 Long Beach
  - 1954 Kern County
  - 1971 San Fernando
  - 1979 Imperial Valley
  - 1989 Loma Prieta
  - 1994 Northridge
- Vulnerability grows with population growth



CGS

Regional Water Systems

- San Fernando Earthquake – 1971
  - Extensive damage to the regional water supply system
    - Major trunk line damage, many small service leaks
    - Van Norman Reservoir Complex
      - Supplied 80% of LA
  - Extensive damage to regional wastewater systems
    - 126,000 lineal feet of mainline sewer needed reconstruction
      - Broken pipe due to compression and shearing
      - Broken joints due to compression
      - Pulled joints

Regional Water Systems

- Kobe – 1995
  - City water system failure was core of the operational crisis in hospitals
    - Water pressure lost in minutes
    - Rooftop tank failures, broken pipes, systems drained
    - City water used to cool emergency generators pumps and compressors
      - Overheated emergency generators shut down, loss of electricity
    - Laboratories dependent on city water
      - Limited hemodialysis, autoclave, X-ray film development
  - Widespread non-structural damage
  - Water restored within 7 to 10 days
    - Trucks delivered water until service restored

"Observations of Hospital Performance in the Great Hanshin-Awaji Earthquake of January 17, 1995", OSHPD

Hospital Damage San Fernando - 1971

- Olive View Hospital
- Newly opened
- Complete loss

Legislative Response

- 1973 Hospital Seismic Safety Act (HSSA)
  - Design new hospitals to higher State standards, Title 24
  - Design Review and Permit by State agency, Office of Statewide Health & Planning Development, OSHPD
  - Construction Phase inspection and review

Legislative Intent

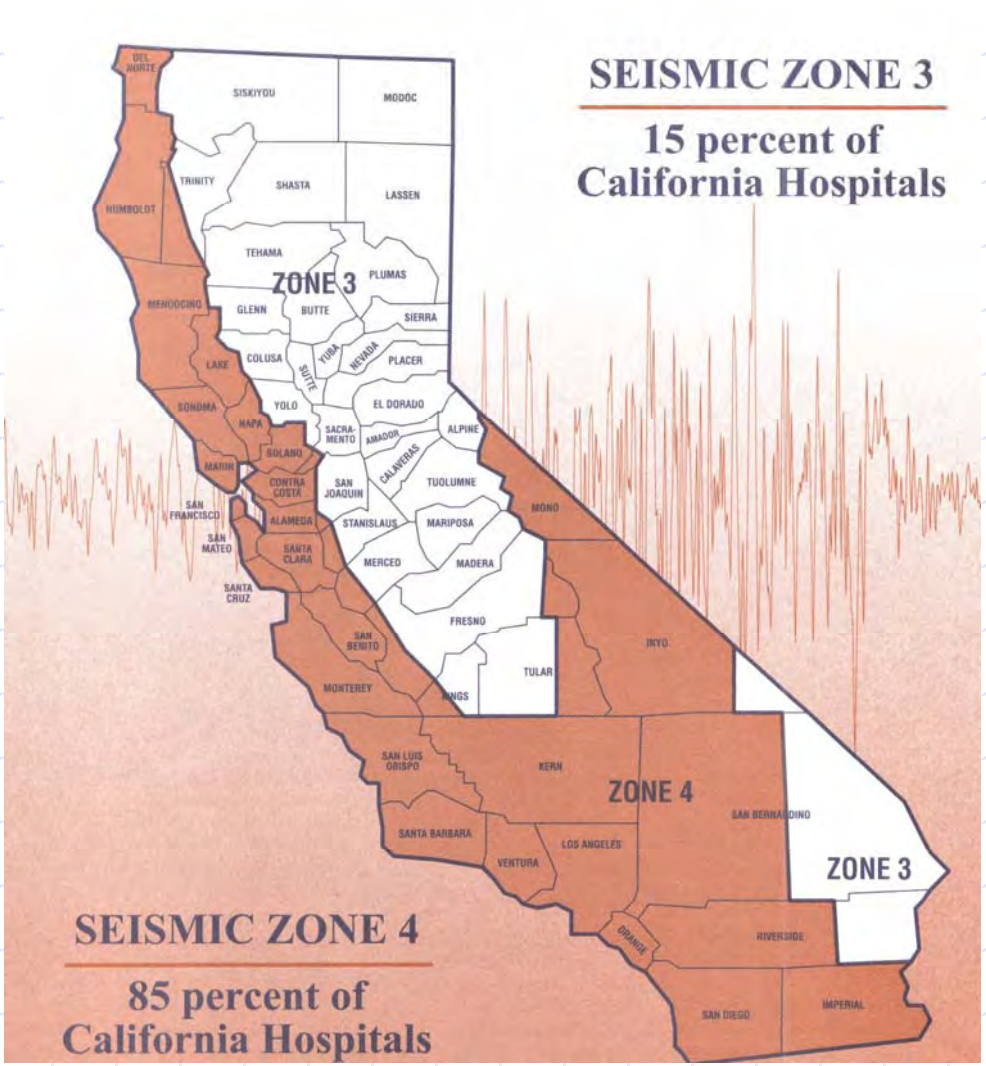
- “Hospitals shall be reasonably capable of providing services to the public after a disaster, designed and constructed to resist, insofar as practical, the forces generated by earthquakes..”
- Today’s terminology - “Immediate occupancy”
  - Minor damage that can be repaired over time

Design Code Response

- Major changes to Uniform Building Code in 1973 and 1976
  - Changes to design of concrete buildings
  - Recognition of importance of ductility, or toughness.
    - Cannot build strong enough, therefore build “tougher” structures

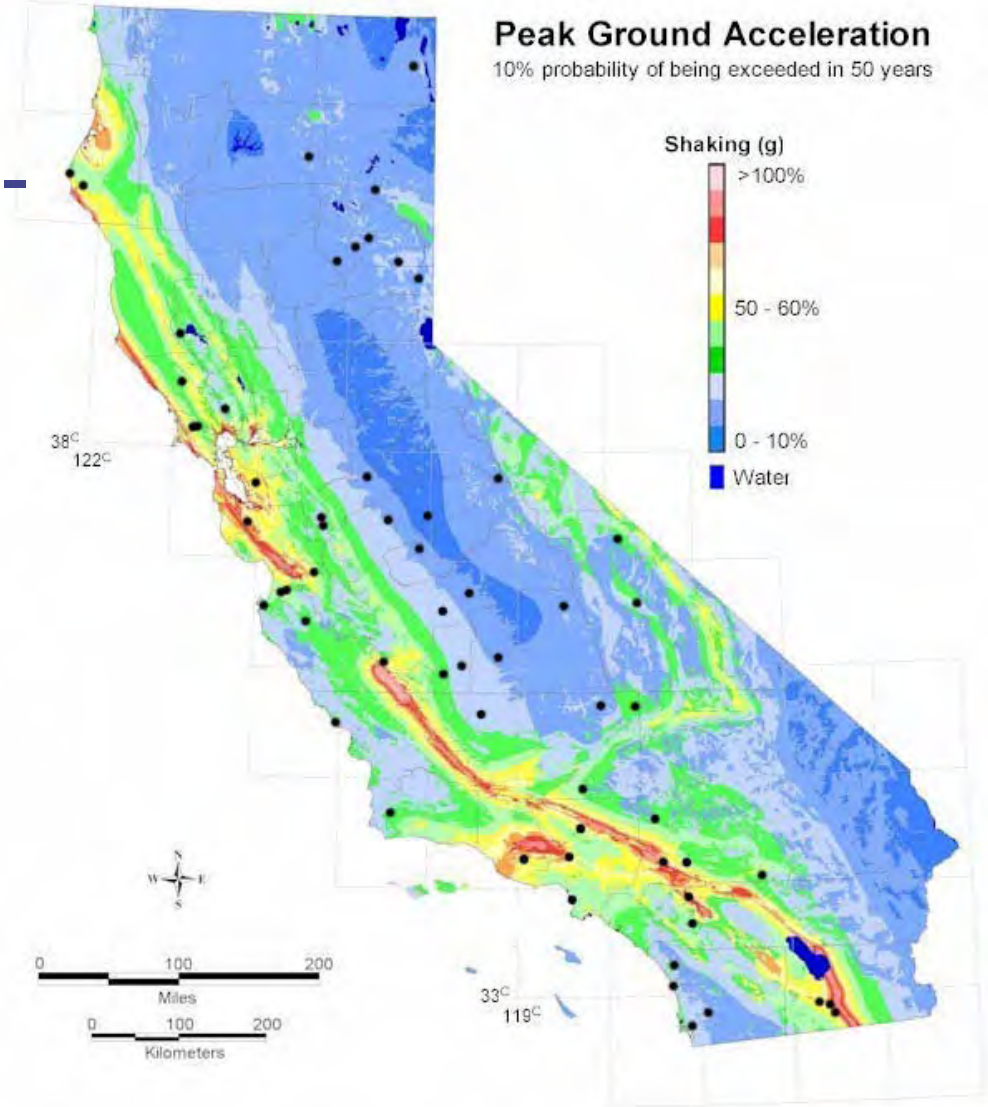
California Seismic Zones – until 2001

- Zone 4
  - Effective peak ground acceleration = 0.4 g
- Zone 3
  - Effective peak ground acceleration = 0.3 g



IBC Maps – the new "Zones"

- Design Earthquake- 10% probability of exceedence in 50 years
- A.K.A. – the 475 year event

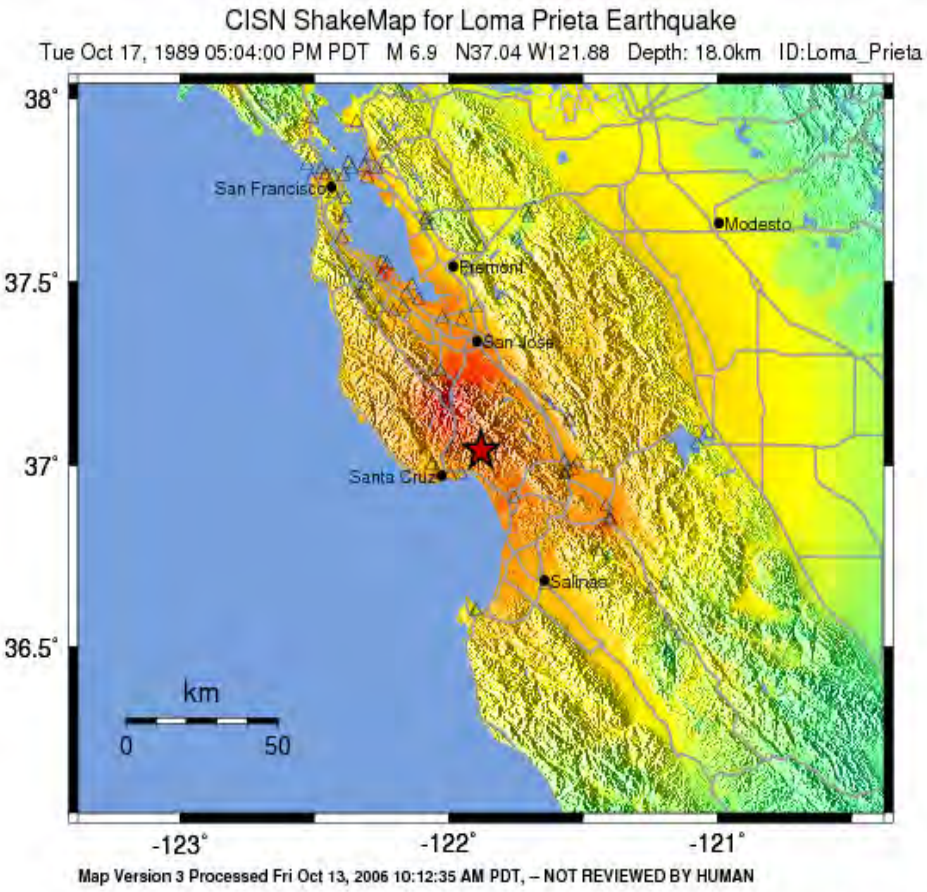


1989 Loma Prieta Earthquake

- M 6.9 earthquake 5:04 pm in the afternoon
- Hospitals – None closed immediately
  - 112 acute care hospitals in the region
  - 10 hospitals struggled with damage that affected operations
  - 3,700 people treated, 450 people admitted with quake-related trauma
  - < 25 staff injured, none seriously
  - VA – Palo Alto evacuated 250 patients to other buildings

CAHHS – "Hospital Earthquake Preparedness: Issues for Actions", 10-17-90

Hospital Damage Throughout Bay Area



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

- San Francisco
  - SF Fire Department received help from military
  - EMS – Mutual aid from Marin County
  - EMS dispatch down immediately after the event
  - Primary rescue operations complete within 24 hours
  - Water, power, elevator stoppages, and poor communications affected hospitals

Loma Prieta - Hospital Damage

- Five hospitals with long term water supply problems
  - Broken pipes, interrupted service, reduced pressure, source contamination
  - Most hospitals did not have alternative water sources
  - Truck delivery inhibited by lack of capability to tap into water system
  - No planning to prioritize water allocation

"Hospital Earthquake Preparedness: Issues for Action", CAHHS

California Association of Hospitals & Health Systems: Report Recommendations

- Seismic Upgrades
  - Educate hospitals on seismic safety importance
  - Encourage voluntary seismic upgrades
  - Focus on critical services in hospitals
  - Assure availability of financial programs to implement upgrades
    - Grants, Low-cost loans

CAHHS Recommendations

- Structural Inspections
  - Hospitals plan for inspections
    - Develop training programs for hospital engineers
    - Develop inspection checklists
    - Retain civil or structural engineers for immediate post-earthquake response
- Develop Hospital Evacuation Decisions/ Procedures
    - Appraise all factors as part of decision process
    - Benefit-risk analysis to evacuation
    - Identify alternate locations for evacuation

Has HSSA made a difference?

- 1994 Northridge Earthquake
  - Improved structural performance
  - Only a marginal improvement in nonstructural performance
  - Better focus on non-structural issues required

1994 Damage	Pre-HSSA Buildings	Post-HSSA Buildings
Major	40	9
Minor	14	22

Northridge Hospital

- Damage
  - Broken water mains cut water supply
  - Interior domestic water lines OK
  - Ruptured underground 6” fire suppression line
  - Sprinkler heads sheared off at ceiling line
  - Sewer inoperable for 3 days – off-site ruptures in wastewater system
- Results
  - 1000 patients in 5 days – triage in the parking lot
  - Redirected patients to other hospitals

“Northridge Earthquake Reconnaissance Report”, Vol. 1, EERI, April 1995

Granada Hills Community Hospital

- Water supply lost due to broken mains
- Wastewater remained operational
- Rooftop equipment damage
  - 2500 gallon domestic tank shifted on supports, breaking connected piping, water flowed to floors below
  - 500 gallon hot water tanks broke anchorages, ruptured and flooded into upper floors

VA Medical Center - Sepulveda

- Lost commercial electrical power 12 – 14 hours
  - Emergency generators operated properly until too many electrical grounds due to water leakage in the facility
  - Broken pipes flooded buildings
    - Pipes crossing expansion joints broken

Holy Cross Medical Center

- All services interrupted, patients evacuated
- Damage to partitions and ceilings caused damage to plumbing lines
- Broken lines at connection to heating coils

Olive View Medical Center

- Completely reconstructed after 1971 Earthquake
  - No structural damage
  - Facility shut down for several days, patients evacuated mainly due to water problems
  - Broken sprinkler piping, broken chilled water lines

California Response – SB 1953

- Senate Bill 1953 – Enacted in 1995
  - Based on previous legislative report with recommendations
  - Phased milestones to improve post-earthquake hospital performance
  - Applies retroactively to existing acute care hospital buildings
  - Non-structural Performance Categories (NPC)
    - NPC 2 – upgrade deficiencies necessary for safe evacuation
    - NPC 3 – upgrade deficiencies in critical care areas to improve operational capacity without evacuation
    - NPC 5 – upgrade deficiencies allow acute care operations for 72 hours without external utilities support

NPC 3 Requirements

- By 2008-2013 deadline
  - Seismically brace fluid-carrying pipes in ceiling space above critical care areas and essential support functions
    - Critical Care Areas - Emergency, Surgery, ICU, CCU, etc.
    - Essential Support Areas – Central Sterile, Central Stores, Pharmacy, Radiology, Clinical Labs

NPC 5 – Full operations

- By 2030
  - Provide on-site supply for 72-hour emergency operations, integrated into the plumbing systems
    - Domestic Water – 50 gallons per day per bed
    - Wastewater storage – 50 gallons per day per bed
  - Alternative – provide hook-ups to allow for transportable sources of water and waste disposable

Non-structural Design Issues

- Causes of Damage to plumbing systems
  - Relative Displacement
    - Provide flexible connections at equipment, expansion joints between buildings
    - Limit floor-floor “interstory drift”
      - 1% maximum interstory seismic drift for 500-year event
      - 1.7 inches per 14-foot story
  - Seismic Accelerations = Seismic Forces
    - Forces increase up the height of the building
    - Brace horizontal plumbing distributions systems
    - Brace equipment

Typical Relative Displacement Problems

- Differential movement between piping and equipment

Seismic Bracing

- Bracing forces based on:
  - Level of seismicity (spectral acceleration)
  - Weight of piping or equipment plus contents, W_p
  - Ductility (toughness) of connections to structure
  - Height of piping within structure
    - 3 times force amplification at rooftop

Piping System Bracing Exclusions

- Not required when pipe hangers are less than 12 inches long or
- Not required when provisions made to avoid impact with larger pipes or equipment
  - Pipe 1 inch diameter or less for Seismic Design Categories D, E or F
  - Pipe 2 inch diameter or less for Seismic Design Category C

Fire Sprinkler Systems

- Design & construct in accordance with NFPA 13
  - For Seismic Design Categories D, E, & F
    - Additional design force checks
    - Design strength considerations for
      - Ductile piping materials -10% reduction in assumed strength
      - Threaded connections – 30% reduction in assumed strength
      - Non-ductile materials – 90% reduction assumed strength

Special Equipment Certification Requirements

- Active mechanical equipment that must remain operable following the design level earthquake shall be certified by the vendor (no more “black box” approach)
  - Structural Analysis
  - Shake table testing, or
  - Experience data – rugged equipment

Inherently Rugged Equipment

- Emergency lighting equipment
- Fire protection and fire alarm equipment
- Horizontal and vertical pumps
- Cooling Towers
- Chillers
- Boilers
- Generators
- Air Handling Equipment & Fans
- Transformers, Motor Control Panels, Distribution Panels, low & medium voltage switchgears

Equipment Requiring Seismic Certification

- Emergency Power supply equipment
- Essential Communications equipment
- Hazard materials containers including bulk medical gas
- Smoke control equipment
- High voltage switchyard equipment
- Cooling & pre-heat coils of built-up air handlers
- Elevator equipment

Conclusions

- Hospitals cannot function without water in the right places
- Hospitals cannot function with too much water in the wrong places.
- Plumbing, Wastewater and Fire Suppression Systems are vulnerable to early, significant damage from earthquakes (and other natural disasters)
- Improved Design and Construction practices are necessary to successfully reduce damage and consequential loss of function
- Emergency Planning is essential for the stuff that just happens.

Can it happen here? Think New Madrid

- 1811 and 1812
  - Magnitude 8
  - Arkansas and SE Missouri
  - Sparsely populated, very few structures
- 90 % Probability of M 6 – M7 within next 50 years (Hildenbrand 1996)

Can it happen here?

- "Impact of Earthquakes on the Central USA – Mid-America Earthquake Center Report 08-02 (FEMA funded)
  - Amr Elnashi, University of Illinois
  - Theresa Jefferson – George Washington U.

HAZUS – Hazards U.S.

- Identify the hazards
  - Earthquakes, floods, hurricanes,
- Identify the Vulnerability
  - Inventory
- Combine the two to determine the losses
  - Deaths, dollars and downtime

Eight states included

- Alabama
- Arkansas
- Illinois
- Indiana
- Kentucky
- Mississippi
- Missouri
- Tennessee
- Kentucky

Inventory

- Includes built environment and population, and societal impacts
- Total assets - $6.7 trillion in total Study
- Illinois – 30% of total assets - $2,000,000 million
  - Buildings - $838,000 Million
  - Transportation - $161,000 million
  - Utilities - $1,001,000

Hazard

- New Madrid Seismic Zone
  - M7.7 on NE segment of Western Fault line
- Wabash Valley Seismic Zone
  - Illinois, Indiana
- East Tennesse Seismic Zone
  - Alabama

Central USA Scenario Events

- Tennessee – $56B direct losses
- Missouri - $40 B direct losses
- Kentucky - $45 B direct losses
- Illinois - $35 billion direct losses
  - Indirect economic losses may equal or exceed direct losses
    - Business interuption
    - Loss of market share

Inventory

- Essential Facilities
  - Schools & hospitals
  - Police and fire stations
  - Emergency Operations Centers

Population

- 8 states with 44 million people
- Illinois has over 25% of population (12.4 mil.)
  - City of Chicago – several million

Essential Facilities Damage

- Hospitals
  - Total number 249
  - Moderate Damage > 50% 3 hospitals
  - Complete Damage- 1 hospital
  - Functionality > 50% at Day 1 – 217 hospitals

Affects of the 2003 Power Outage In Cleveland

The MetroHealth System's Experience

Karen Dethloff, FASHE, CHFM, Director of Facilities Management

Marek Owca, RN, Director of Emergency Management

Disclaimers

- The speakers and The MetroHealth System do not endorse any particular product or service.

Hospital / Area Demographics

- MetroHealth Medical Center
  - Level I Trauma Center
  - Burn Center
  - Level III Neonatal Center
  - 700 bed facility
- Over 540,000 homes and businesses were without power affecting 2,900,000 people

Review Time Line

- Lost power 4:10 PM on Aug 14, 2003 on 2nd Shift
  - Emergency power came on line automatically
- Newly implemented HEICS was initiated with the opening of the HCC
- Initiated Disaster Plans and initiated contact with CFD, CPD, and later, the Water Department
- Given our location, water pressure only fell slightly towards the end of the outage

Time Line Continued

- Generators functioned normally, except for one
- Kitchen prepared sandwiches for all, per plan
- Power restored by 7:00 AM
- Boil alert in place for 24 hours

Patient Care Impacts

- Loss of power to ventilated patients
- Environment was very “hot & humid” especially on the upper floors
- Infection control issues:
  - concern over water interruption
  - high humidity
- Air Medical program grounded secondary to lack of radio communications

Mitigation Measures/Actions Taken

- Partial evacuation
  - to consolidate care areas to “cooler” climates
  - to close non-critical operations
- Medications taken to central pharmacy for proper storage
- Portable X-Ray machines utilized on an urgent basis only
- NICU Isolettes had battery backup with intermittent power

Resource Conservation

- All elective surgeries were cancelled
- All next day appointments were cancelled
- Patient care areas consolidated
- Patients that could safely go home were discharged

Issues of Concern

- Sufficient waterless hand sanitizers
- Stored flashlights had dead batteries
- Heavy demand for extension cords and flashlights
- One intermittently failing generator that affected patient floors

“It takes a village…”

- Additional staff called in and were picked up by Logistics Department
- Facilities borrowed parts from the CFD to help “cool down” a generator
- CPD sent police to support in security
- Private security contracts activated
- Ambulances placed on “stand-by”

City-wide Issues

- None of the City's primary water pumps were on emergency power
- Roads were grid locked for hours
  - people did not obey four way stop rules
  - failure occurred at afternoon rush hour
- Cell phones, public radio & TV were marginally functional making communications challenging
- Evacuation to other local hospitals impractical

Preparing for the next Disaster

- Critically review utility interruption plans
- Conduct a water gap analysis to determine core essential services, needs, capabilities and deficiencies
- Develop a process to evaluate the short term and long term impact of loss of water on patients, staff & the facility

Preparing for the next Disaster

- Understand the plans of support groups
  - Utilities
  - Critical Suppliers
  - City Services
- Integrate your plans with theirs
- Will plans be affected by the season or other conditions?
- Determine potentially weak links and brainstorm mitigation measures

Preparing for the next Disaster, determine:

- what building systems require water
- how much water is used normally;
- if the season changes will usage requirements also change;
- from where can water be scavenged, and
- possible substitution/alternative measures

Other Considerations

- What infrastructure components are <u>not</u> on emergency power
- Will your MOU work in a disaster, or will only the first hospital to reach the supplier get water, portable toilets, fans, etc.?
- Can you establish relationships with suppliers who may be outside your area
- Develop a procedure for rationing water

Other Considerations

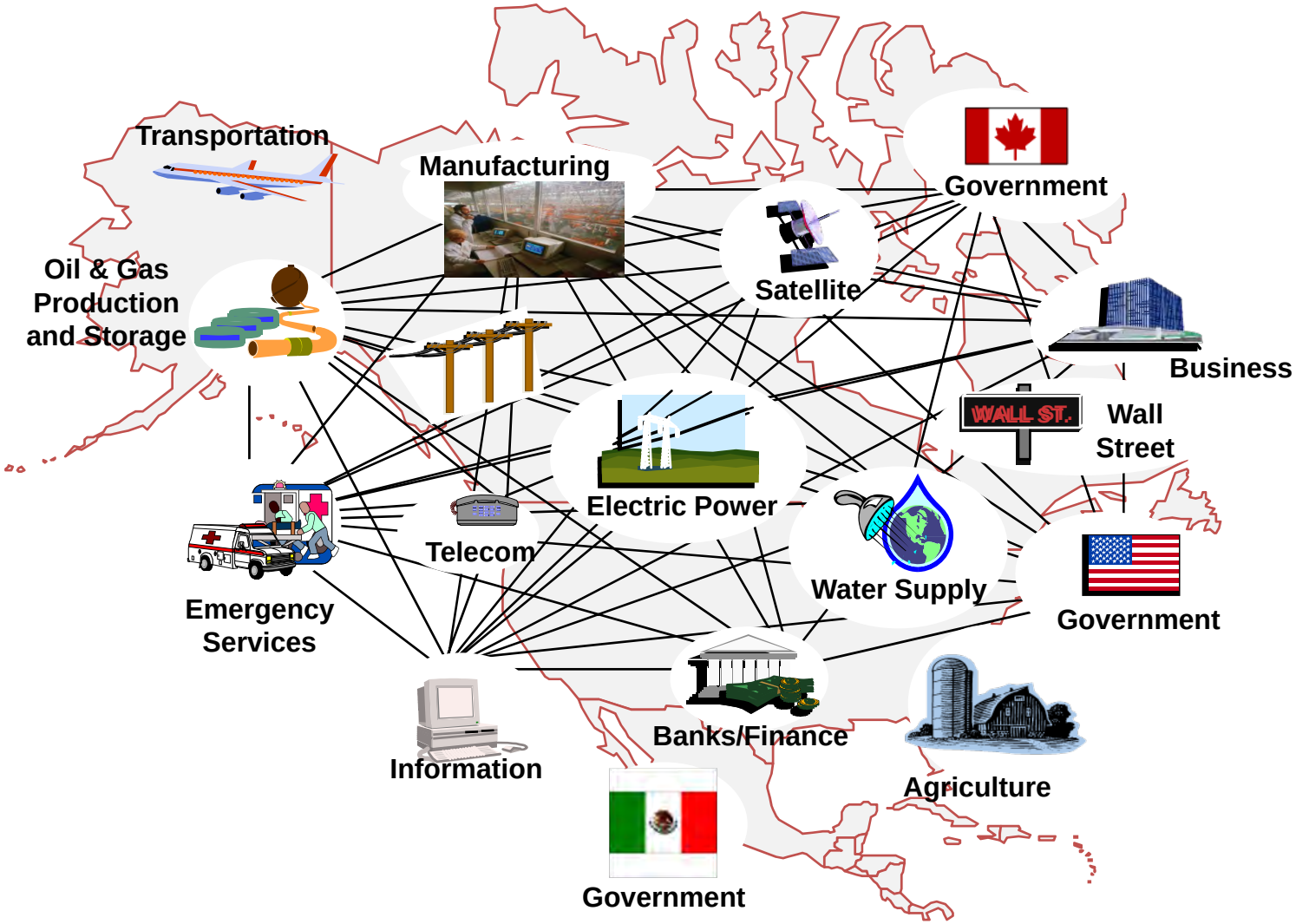
- Exercise your contingency plans in a realistic fashion; implement >one plan
  - do they compliment each other
  - is one needed to make the other work
  - are there gaps?
- Verify everything needed to be on emergency power truly is?
- Review your insurance; what's covered

Lessons Learned—Potential Solutions

- HICS works
- Consolidate operations to allow for better control
- Establish essential pre-event relationships
- Hand cranked flashlights/radios
- Kitty Litter

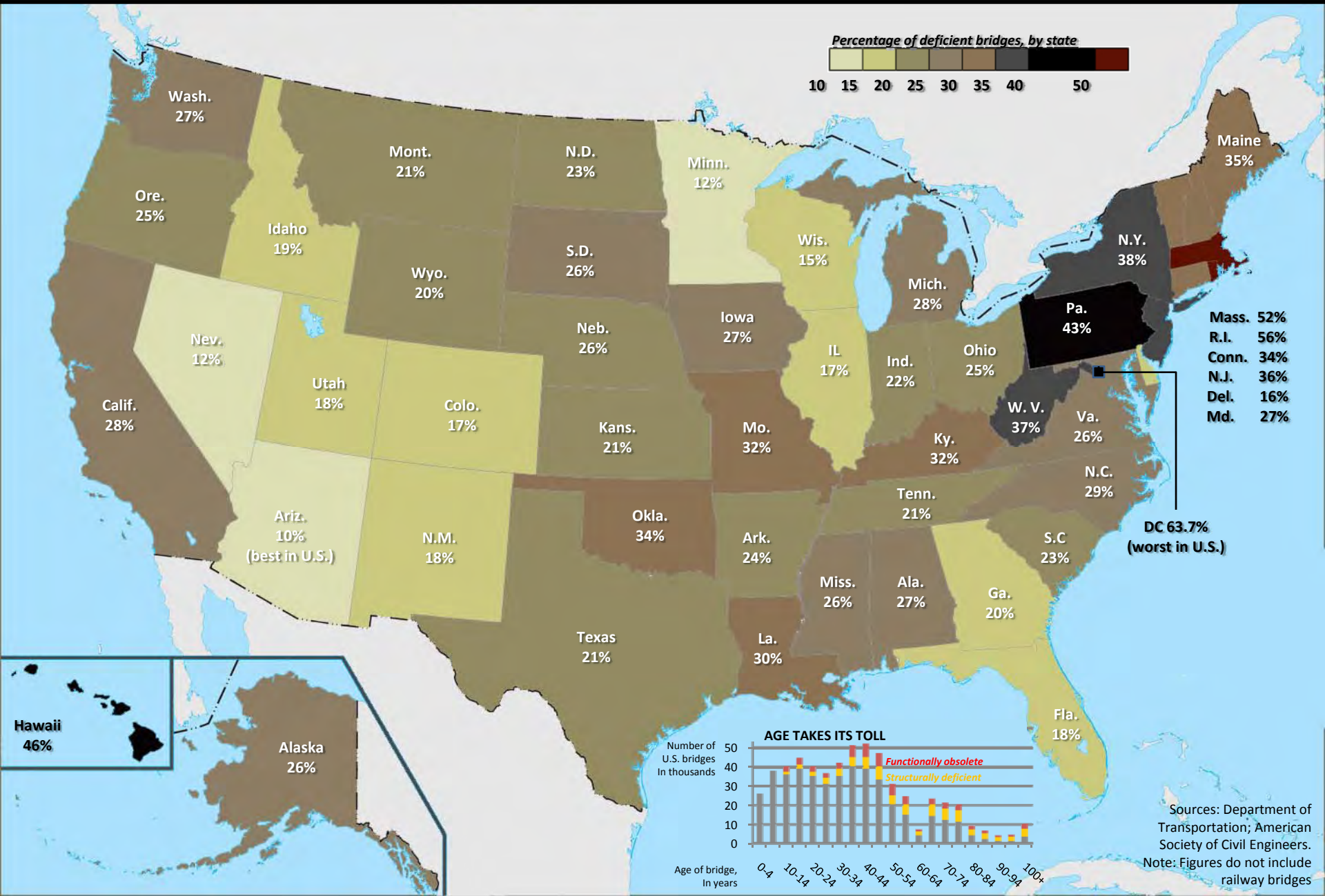
Questions

US Economic System's Critical Infrastructure: Interconnected in Growth and Risk



Age Takes Its Toll

Adaptation from Time Magazine: Coast to Coast Trouble
August 20, 2007



Sources: Department of Transportation; American Society of Civil Engineers.
Note: Figures do not include railway bridges

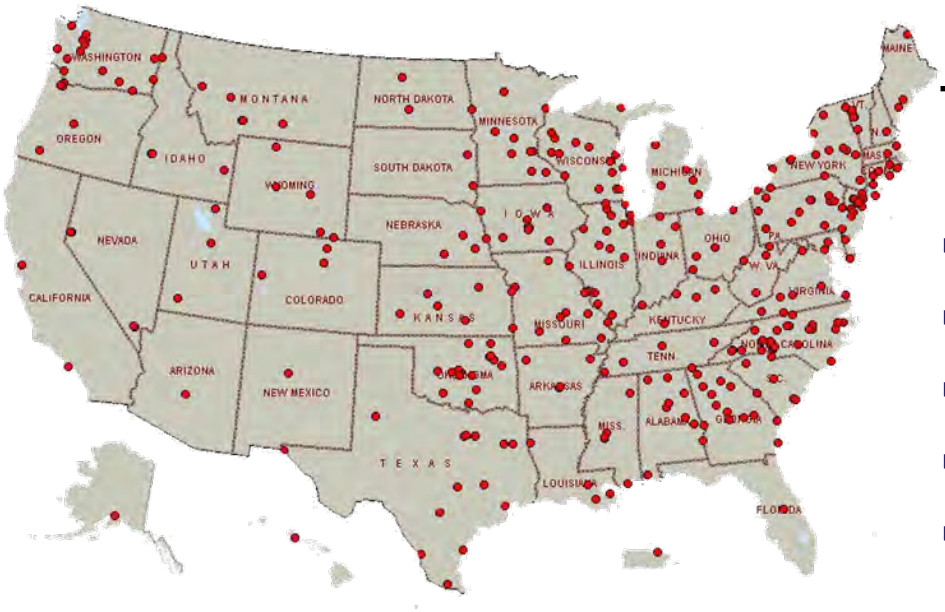
MEP • MANUFACTURING EXTENSION PARTNERSHIP

Mission Statement

"To strengthen the global competitiveness of US-based manufacturing by providing information, decision support, and implementation of innovative approaches focused on leveraging technologies, techniques, and business best practices."

NIST MEP: 1,600 Nationwide Experts /59 Centers

Lean/Operational Excellence; Continuous Growth; Sustainability



Third Party Survey Results of Clients

- **New Sales** **$2.842 Billion**
- **Retained Sales** **$3.408 Billion**
- **Capital Investment** **$2.248 Billion**
- **Cost Savings** **$1.304 Billion**
- **Jobs Created/Retained 53,219**

The **Manufacturing Extension Partnership (MEP)** is a program of the National Institute of Standards and Technology (NIST); an agency of the U.S. Department of Commerce Technology Administration. Information can be found at its website: **www.mep.nist.gov**

FY 2006 economic impact results are based on a survey of 4,726 MEP-served establishments out of 5,261 attempted.

Chicago Manufacturing Center Great Lakes Partnership Program (GLP)

- ***Vision:*** Ensure the economic vitality of the region through the effective integration of security, sustainability and innovation.

- ***Mission****:* Bring business and government leaders together to advance resilience and solutions for national, homeland and economic security challenges.

- ***Operation****:* Test and deliver services through the NIST MEP network.

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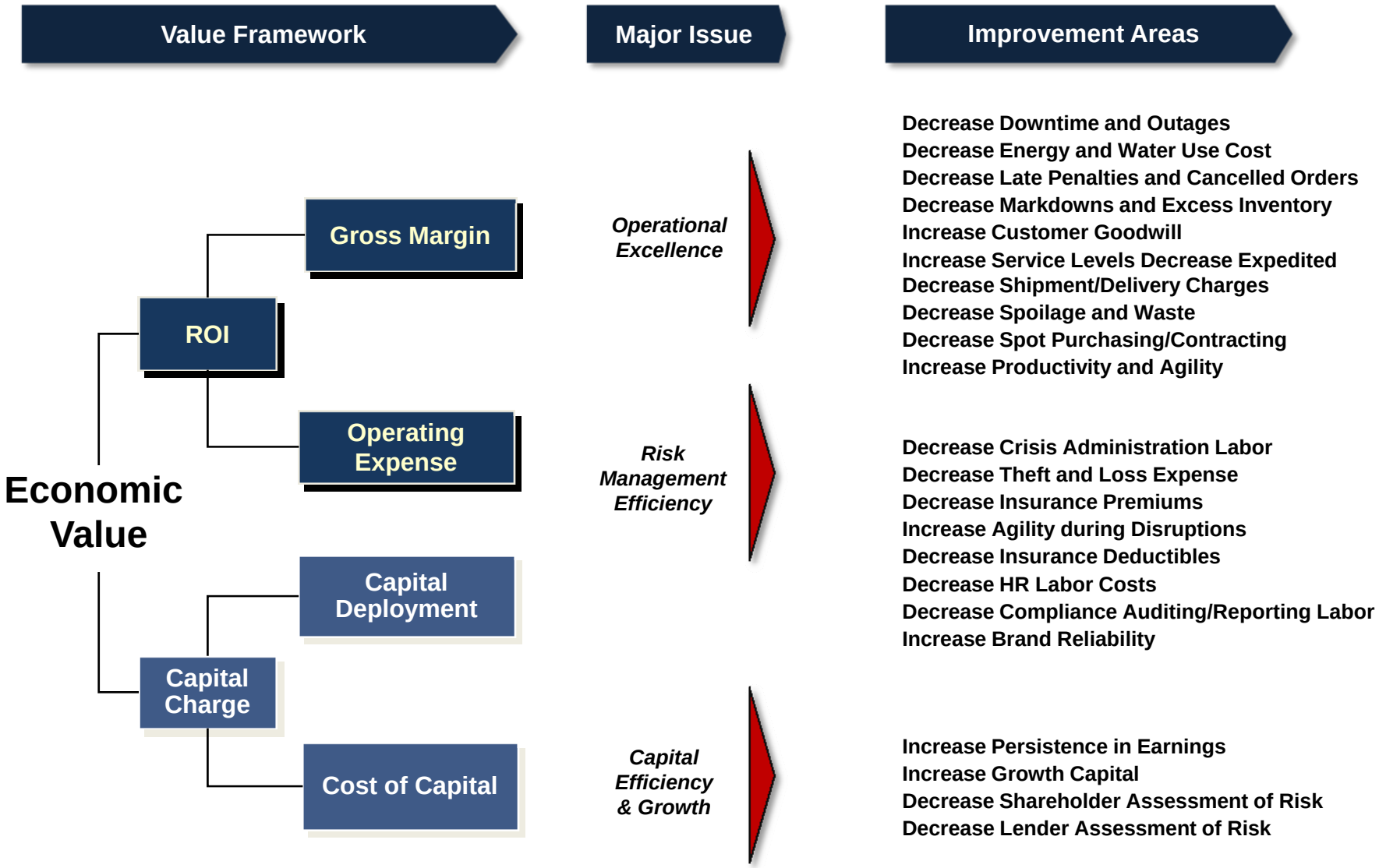
Manufacturing Financial Drivers

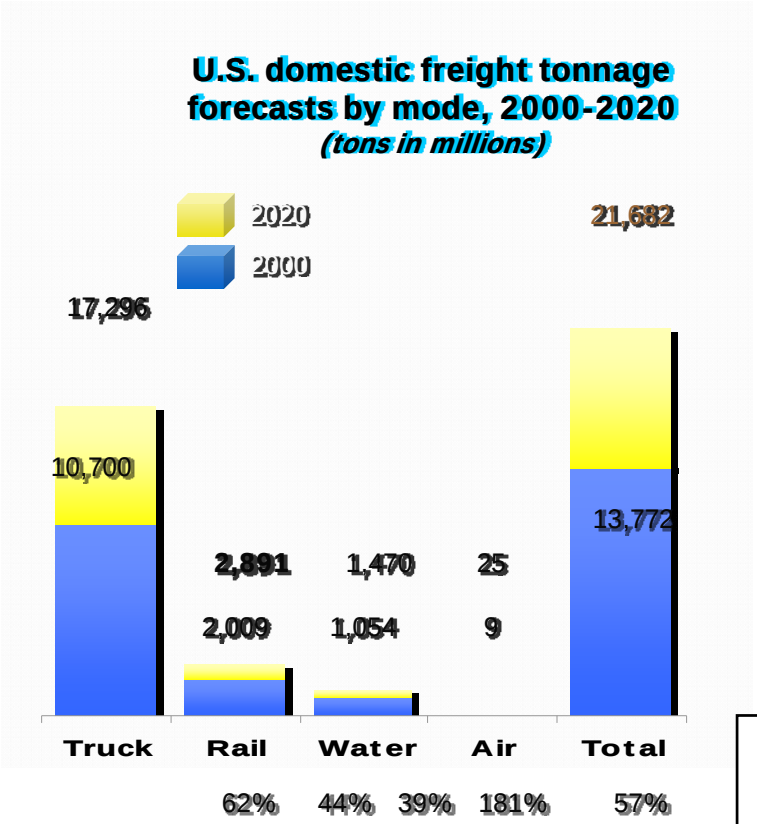


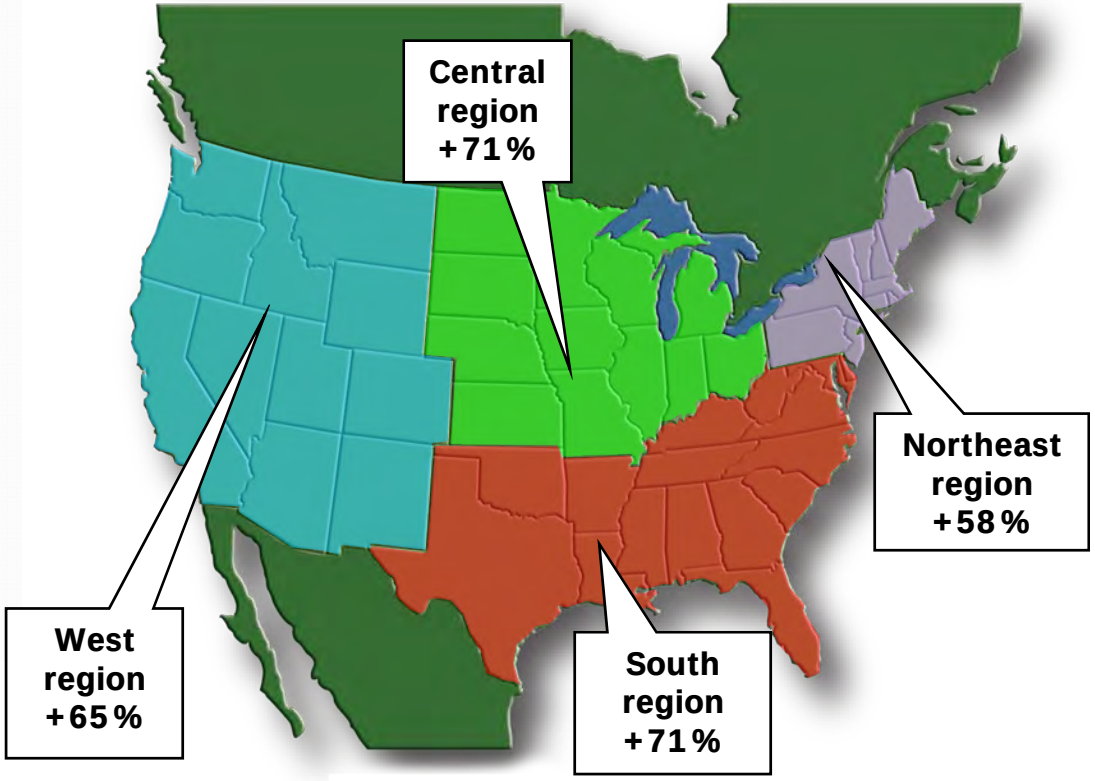
Why Invest in Resilience?

- The 2003 energy blackout in the northeast: $7- $10 billion in lost opportunity and recovery expenses.
- World Bank projection: global freight bill will quadruple by the year 2020 to $14 trillion.
- Triple Bottom Line – is a growing competitive advantage soon to be a requirement

© Chicago Manufacturing Center

U.S. domestic freight tonnage growth forecast, 2000-2020



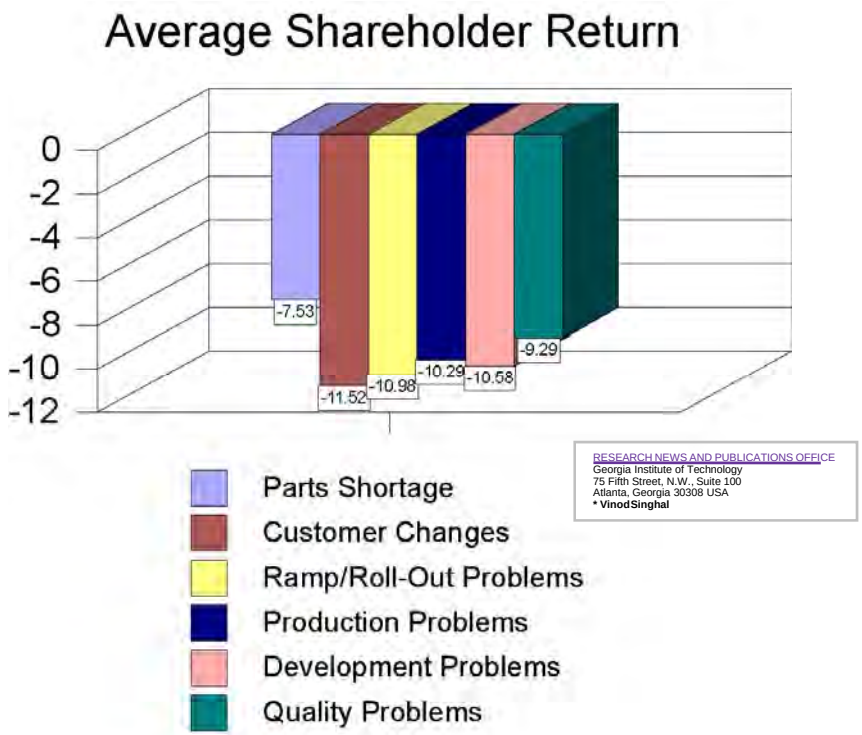


Chicago - Freight & Distribution Center

- Interchange of all six Class-One North American railroads and six U.S Interstates
- 50% of U.S. rail freight passes through Chicago's rail yards
- 37,500 rail carloads and 417,000 truckloads of freight leave Chicago each day
- Consistent construction activity has grown the warehouse/distribution inventory to 525 million sq. ft. (48,774,100 sq m)

Develop solutions to build continuity of operations

"When a supply chain malfunction is announced, stock prices plunge an average of 8.62%, and shareholder wealth decreases by $120 million or more per company. "*

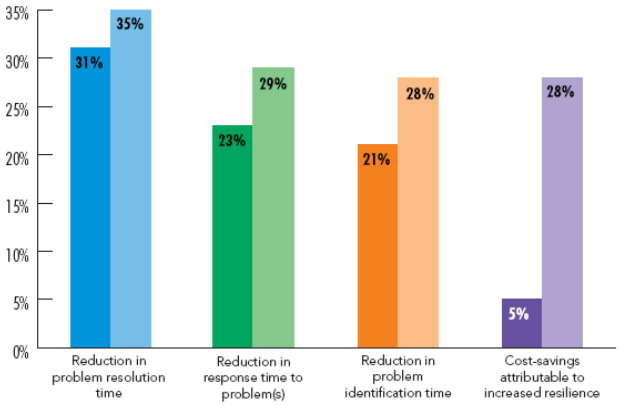


Average market-adjusted shareholder return by the six most cited reasons for supply chain glitches. Results are the stock market reaction the day information about supply chain problems was announced.

A recent study of increased investment in supply chain security found additional benefits to that area of business activity for the 11 manufacturing companies participating in the study:

- 38% reduction in lost cargo
- 37% reduction in product tampering
- 14% reduction in excess inventory
- 47% improvement in on-time delivery
- An increase in customer satisfaction leading to 26% reduction in customer attrition
- 20% increase in new customers

Benefits Related to Resilience: Actual and Expected Results



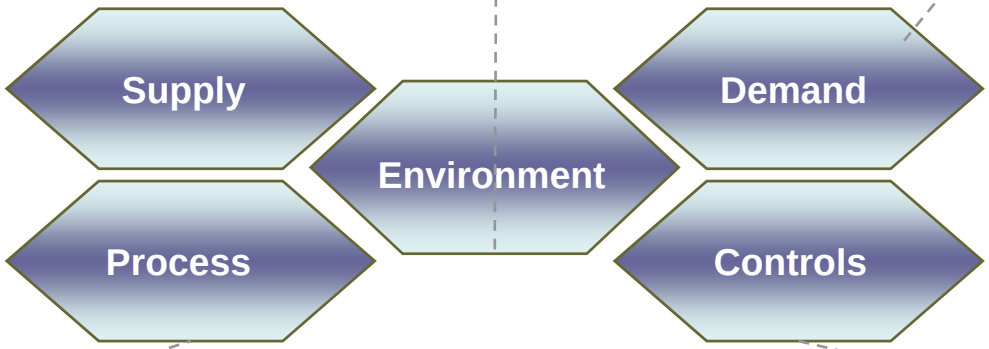
Source: The Manufacturing Institute and Stanford University, July 2006

…an emerging, holistic way to address risks

- Fire/Flood
- Weather
- Natural Disaster
- Terrorism
- Regulation & Legislation
- Macro Economic (e.g. Interest Rates, Exchange Rates, GDP Growth, Business Cycles)
- Infrastructure Congestion
- Geopolitics

- Supplier Quality
- Supplier Concentration (regional or #)
- Supplier Dispersion
- Transportation Capacity & Pricing
- Visibility
- Multi-Tier Coordination
- Fuel Prices
- Raw Material Availability & Pricing
- Lead Time Length & Variability

- Price
- Features/Specifications
- Volume
- Visibility
- Multi-Tiered Coordination
- Customer Dispersion
- Lead Time Length & Variability
- Transportation Capacity & Pricing
- Seasonality



- Business Ethics
- Supply Chain Security
- Customs
- R&D Efficacy
- Third-Party Providers
- Global operations
- Recruiting & Retention
- Professional Development
- IT

- Contracting
- Theft/Shrinkage
- IP Loss
- Product Defect/Recall
- Business Rules
- SKU Proliferation
- Financial Controls (SOX)
- Credit
- General Scandals
- Workplace Violence
- Cyber

Sustainability + Preparedness = Resilience

- Interdependencies require systems-wide approach
- Resource constraints compound security issues:
  - Energy
  - Water
  - Logistics
  - Raw Materials
- How can an “All Hazards Approach” leverage the market demand for “green” branding in companies by linking sustainability and preparedness?
- DHS could partner with US DOC, MEP to pilot a national manufacturing preparedness initiative through the MEP national network. Rapidly develop solutions for mid size suppliers and related firms to build regional resilience.

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Water Sustainability at Baxter

September 18, 2008

Jenni Cawein

Sr Manager, Corporate EHS Engineering

Baxter Healthcare Corporation

Leading Supplier of Healthcare Products

- 2006 Global Sales $US 10.4 Billion
- 46,000 employees in more than 250 facilities
- 67 manufacturing facilities in 28 countries
- Local presence in more than 110 countries

Baxter's Global Manufacturing Facilities

Baxter

Product portfolio

Medication Delivery

- Drug Delivery
- Anesthesia
- Nutritional Products
- Oncology

Renal

- Dialysis Products
- Dialysis Services
- Disease Management

BioScience

- BioPharmaceuticals
  - Recombinant
  - Plasma
- Vaccines
- BioSurgery
- Blood Therapies

Major Operations include:

- Plastics Extrusion
- Molding
- Filling
- Sterilization
- Chemical Compounding
- Assembly
- Packaging
- R&D
- Warehouse and Distribution

Baxter

Baxter is recognized by or affiliated with a number of sustainability-related organizations or programs, including:

EPA GREEN POWER PARTNER

2007 WORLD'S MOST ETHICAL COMPANIES WWW.ETHISPHERE.COM

MOST SUSTAINABLE CORPORATIONS GLOBAL 100

Green Suppliers Network

CRO's 100 Best Corporate Citizens 2008

CLIMATE LEADERS U.S. Environmental Protection Agency

CCX Chicago Climate Exchange

06 Member of Dow Jones Sustainability Indexes DJSI

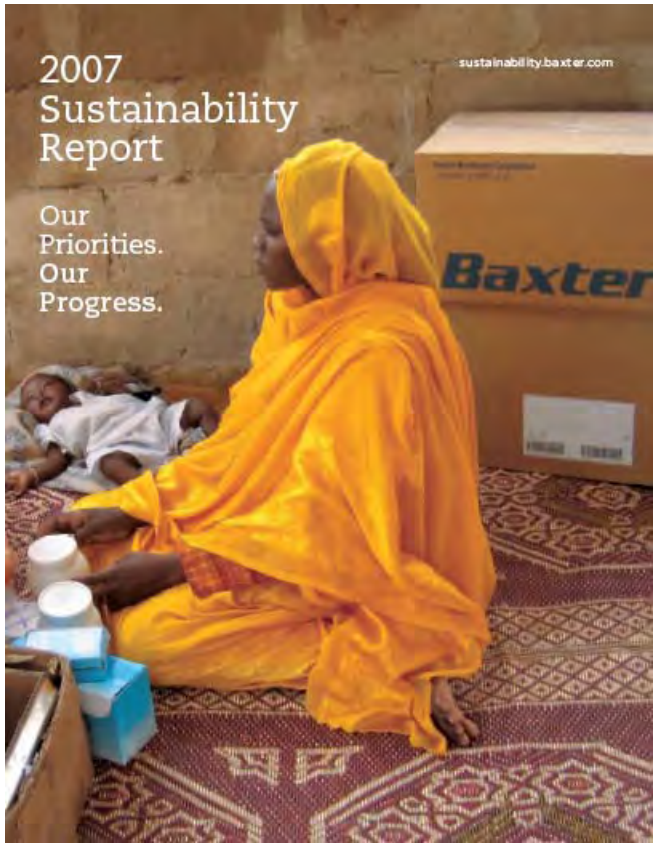
GRI Organisational Stakeholder

PerformanceTrack Corporate Leader U.S. Environmental Protection Agency

Named to the Dow Jones Sustainability Indexes (DJSI) for ten consecutive years

Selected as 2008 DJSI Medical Products Category Leader

Baxter just released 9th annual Sustainability Report



Water Sustainability – Why?

- Water is Baxter's base business
- We fill >2 million bags per day with water-based solutions
- Water usage exceeds 3.7 billion gallons annually
- Corporate responsibility to protect water resources
- Some interest from outside stakeholders
- Our water is expensive!

Water Sustainability: conservation

- Our water life cycle is short….

Supply

↓

Processing ← **Today's focus**

↓

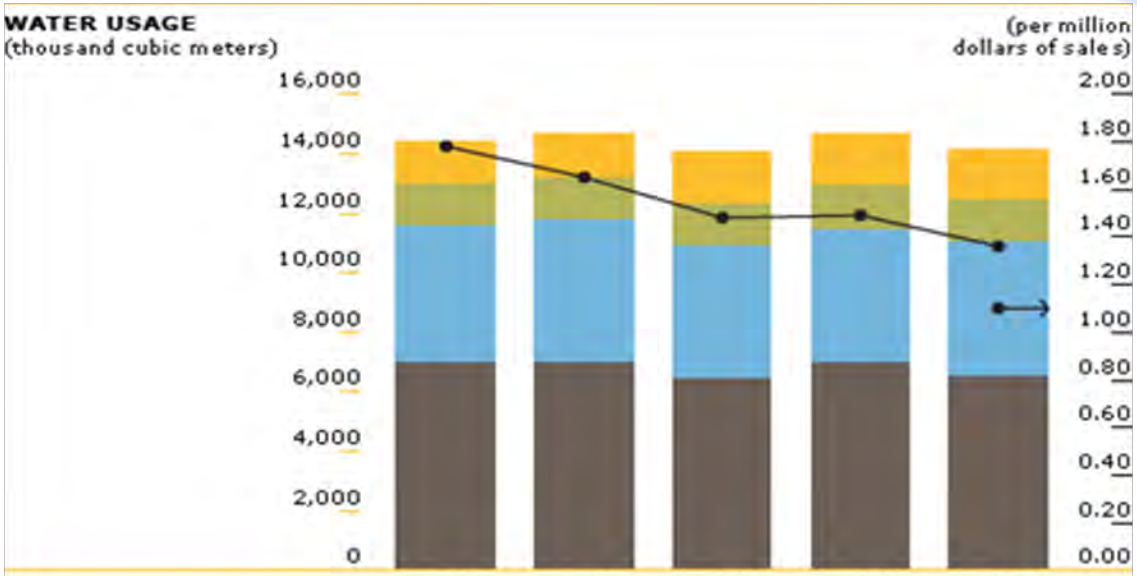
Patient

Reduce cost and increase efficiencies

Water Conservation

Baxter

Company goal:
Reduce water usage by 20-percent indexed to revenue from 2005 baseline by 2010

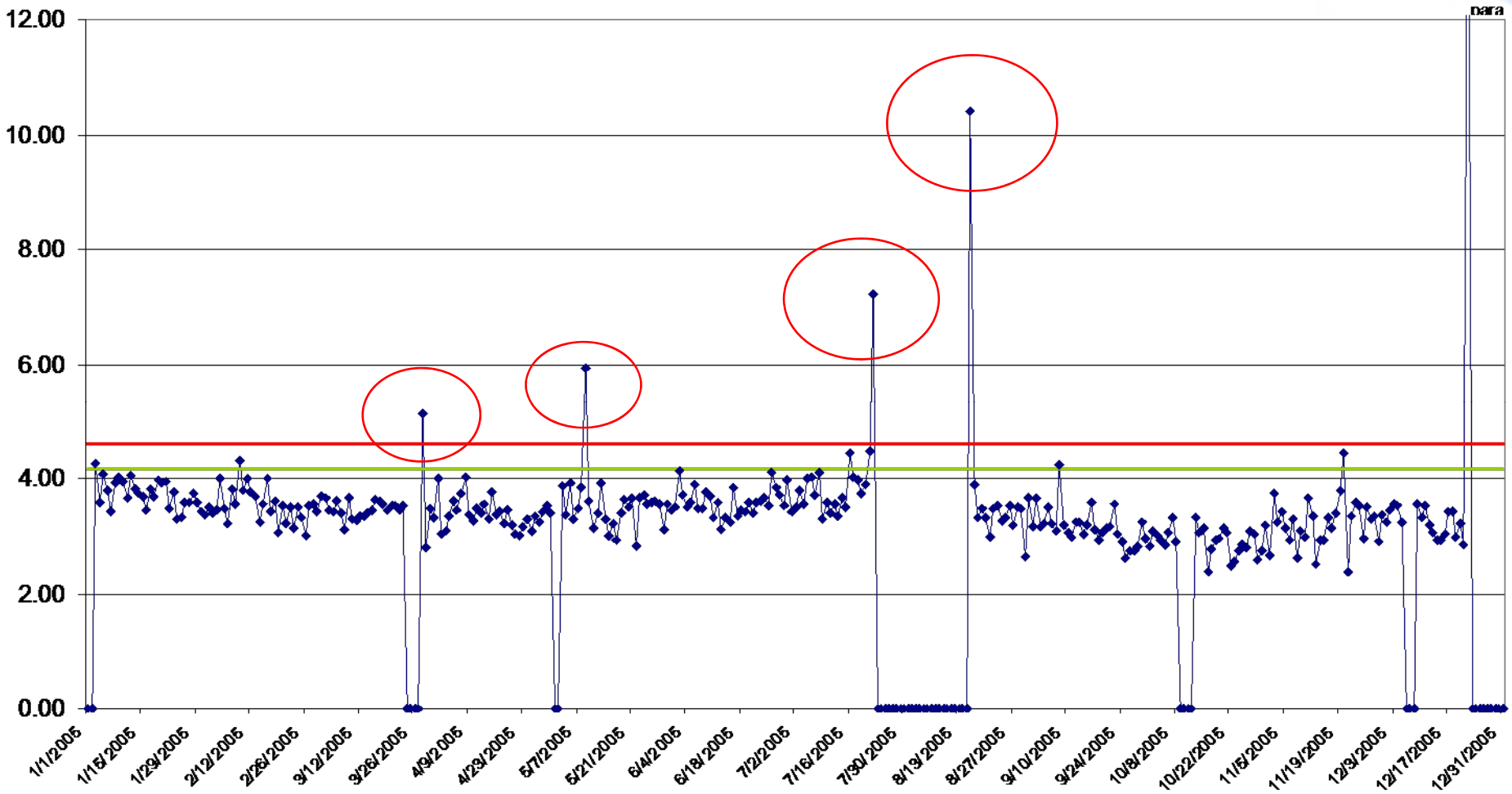


	2002	2003	2004	2005	2006
Asia	1,429	1,514	1,727	1,779	1,689
Latin America	1,391	1,400	1,406	1,470	1,383
Europe	4,598	4,757	4,485	4,444	4,519
North America	7,014	7,042	6,468	7,022	6,546
Total	**14,431**	**14,713**	**14,085**	**14,716**	**14,135**
Thousand Cubic Meters per Million Dollars of Sales	**1.78**	**1.65**	**1.48**	**1.49**	**1.36**
2010 Goal	Reduce water usage by 20 percent indexed to revenue				

Baxter has become known for applying unusual techniques to reduce water consumption such as…

Water Consumption 2005

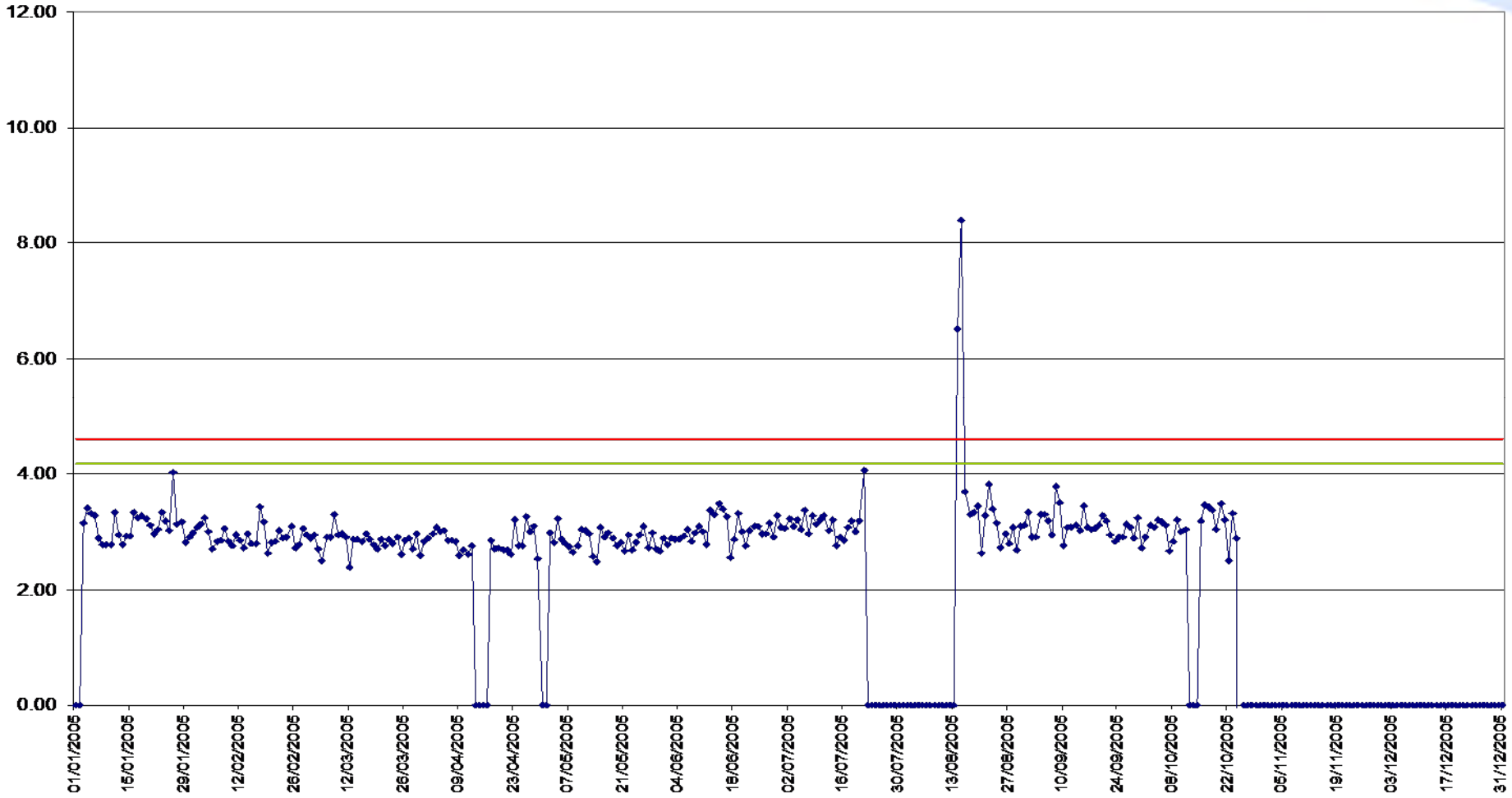
(m3 consumed per 1000units per day)



…applying 6 sigma tools to understand consumption…

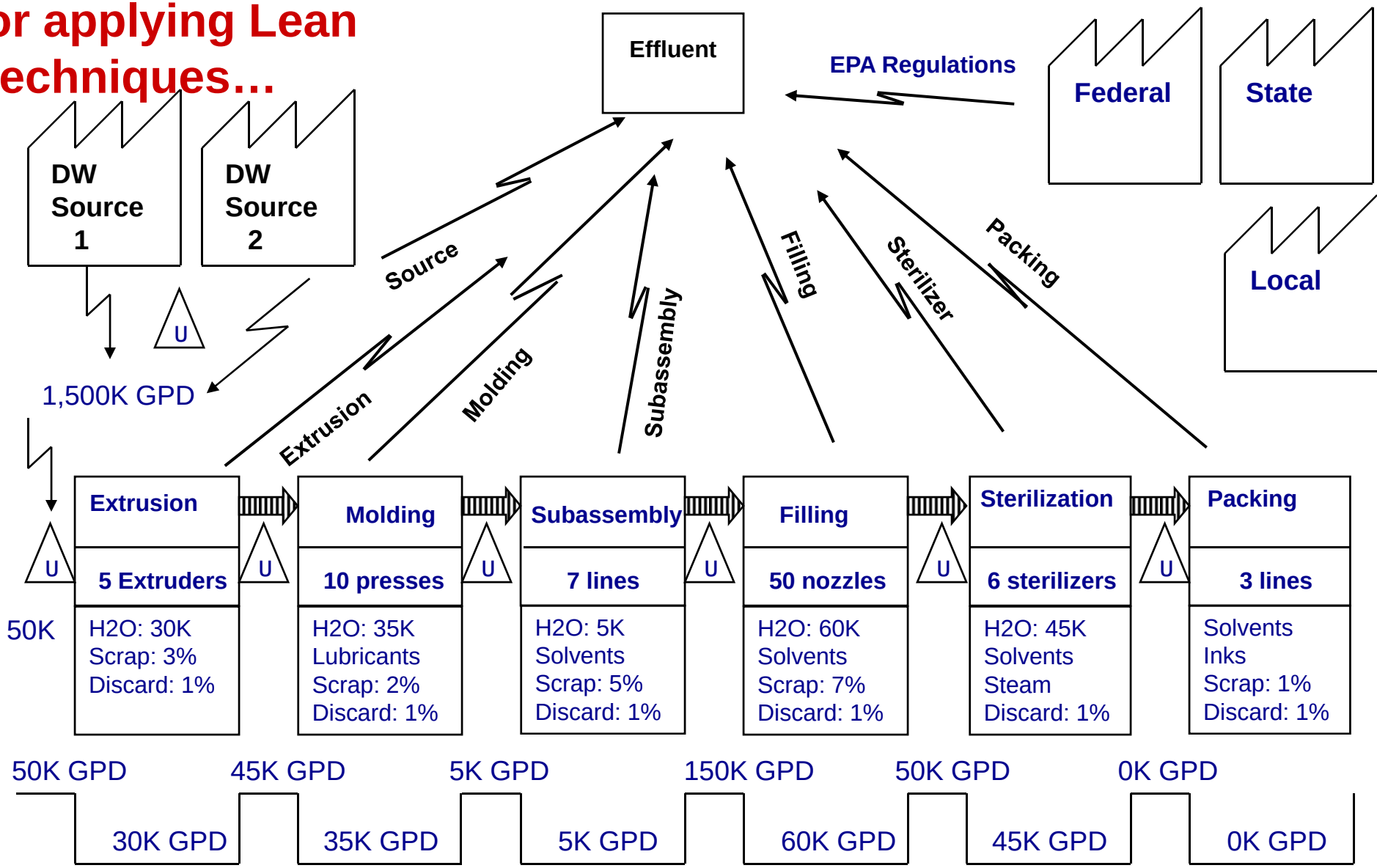
Water Consumption 2006

(m3 consumed per 1000units per day)



…and reduce it…

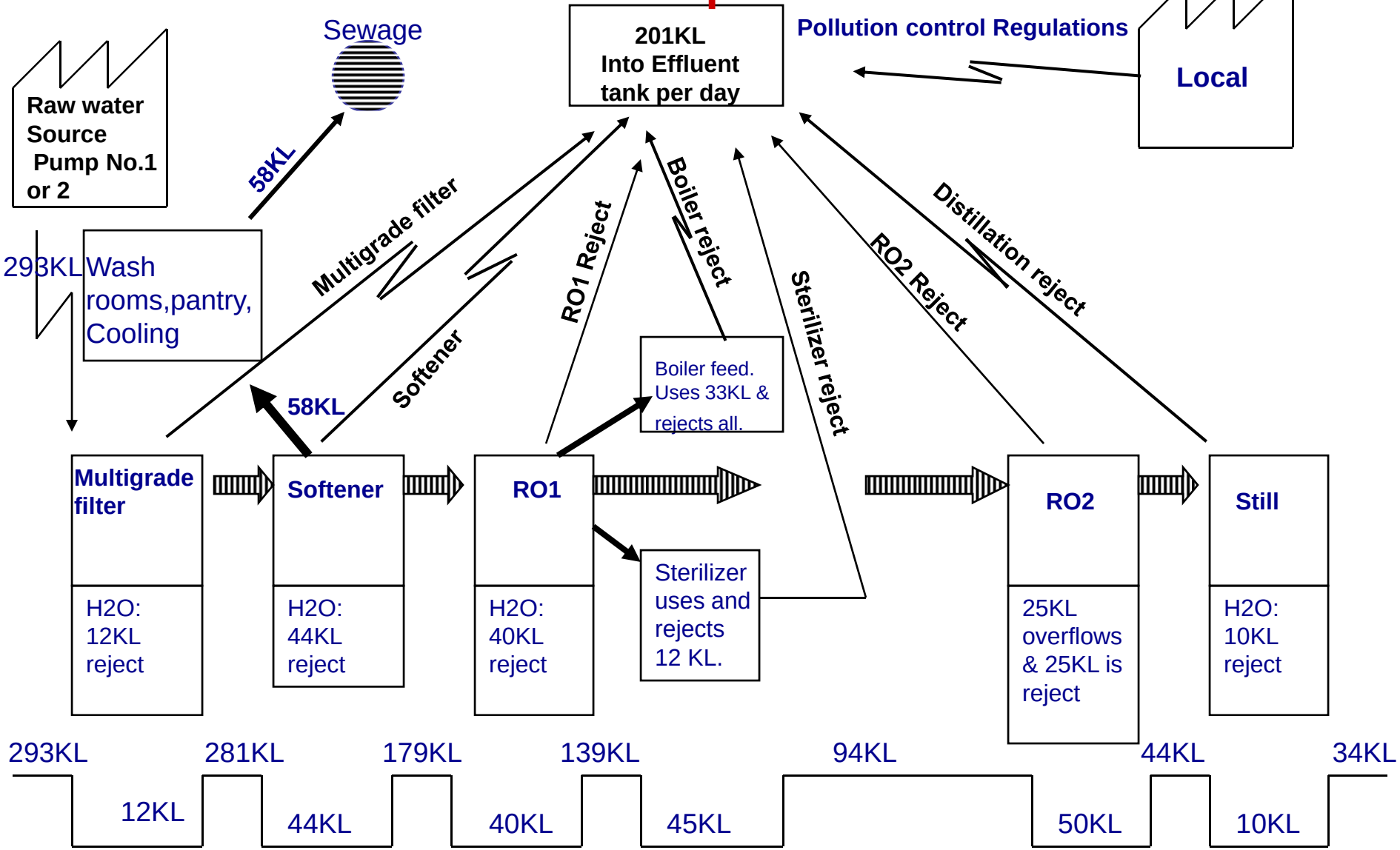
or applying Lean techniques…



Total H2O Usage GPD = <u>301K Gallons Per Day</u>
Total Need Per Day = <u>175K Gallons Per Day</u>

..like Value Stream mapping

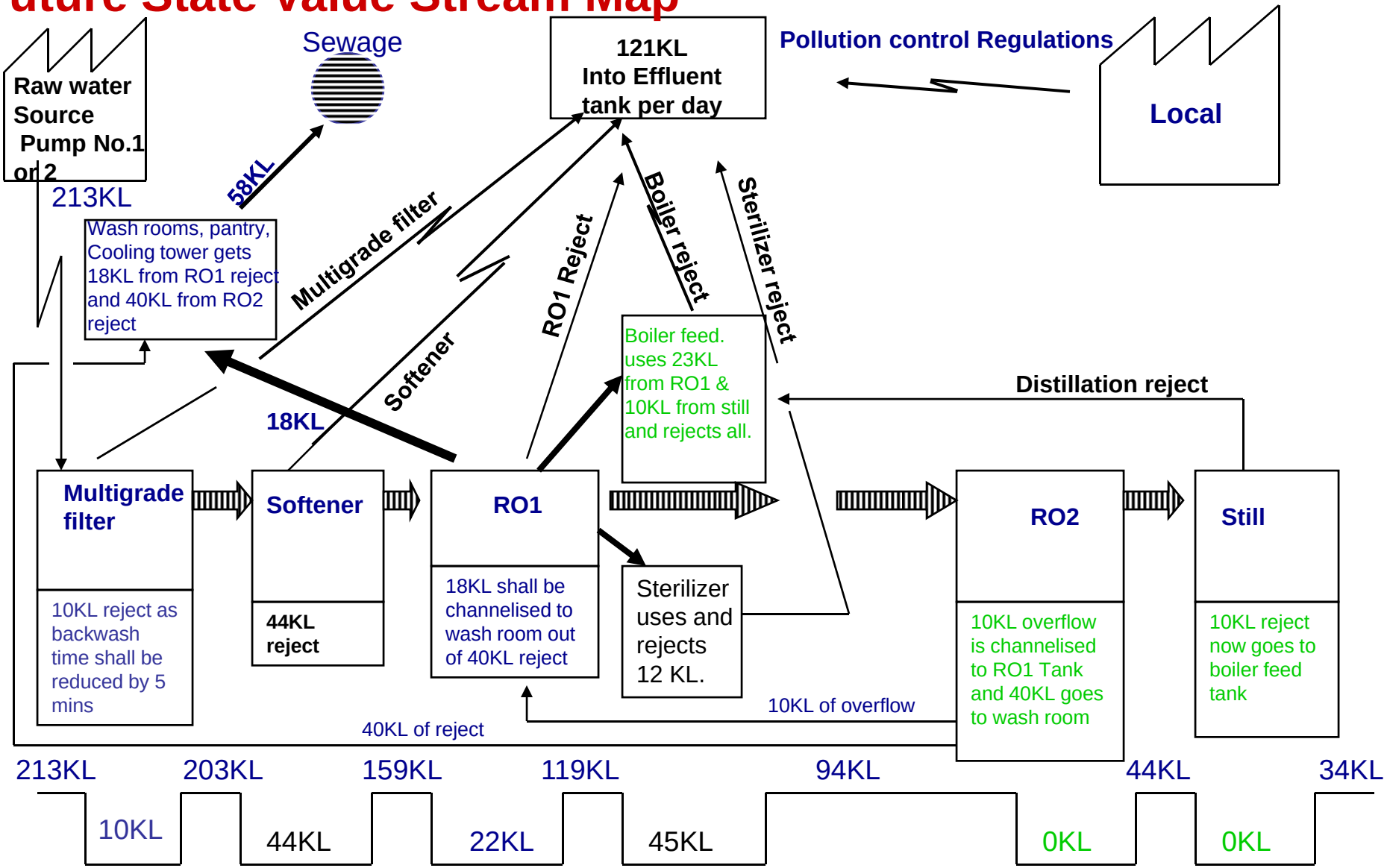
Current state value stream map



Initial Usage (KL/day) = 300KL Per Day
Product Need Per Day = 34K L Per Day

……in various ways…

Future State Value Stream Map



Usage goal (KL)	= 213KL / day
Achieved usage	233KL / day
Product Need	= 34K L / day

to reduce usage (in this case 40%)

Water Conservation focuses on:

- Understanding consumption
- Understanding true costs
- Understanding and implementing opportunities to reduce waste G

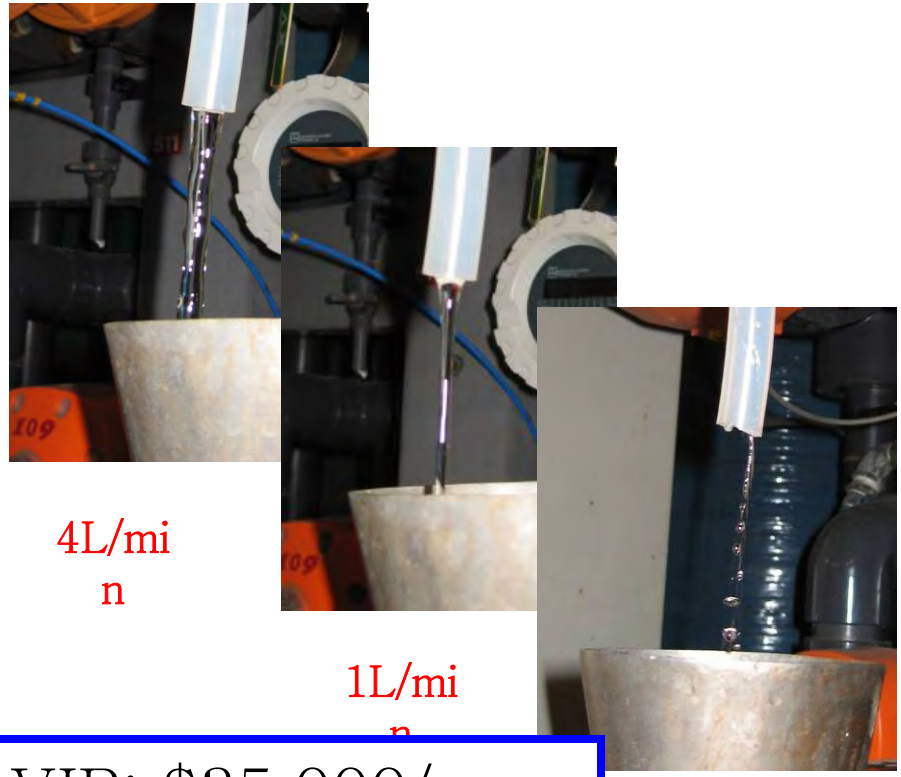
We've learned there are huge untapped opportunities. G

Water LEAN some examples

Open valves of DI water (5 DI + 6

Can we reduce ?

Yes → close the valve G



4L/min

1L/min

0,08L/min

VIP: $35,000/year

Water LEAN some examples

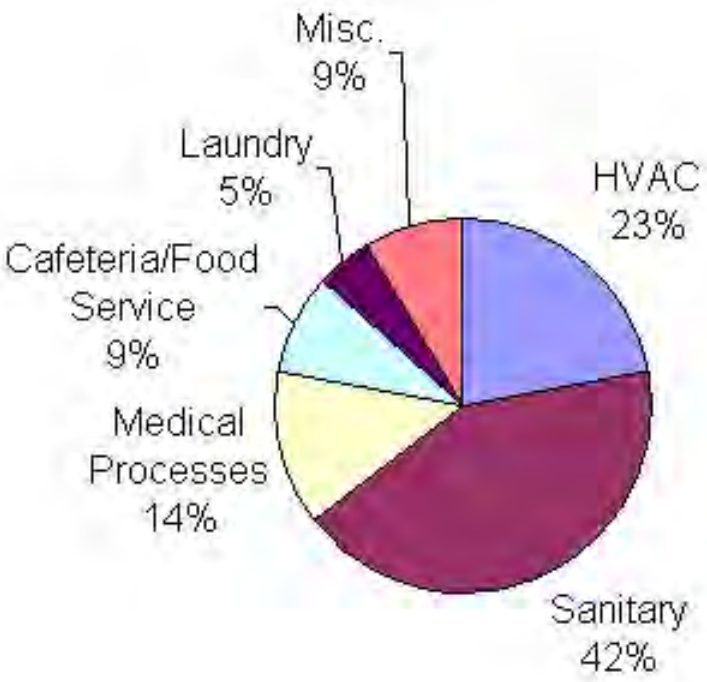
Open valves WFI 80°C on stills

Can we reduce ?

Yes → close the valve G

Opportunities for Hospitals!

- Healthcare systems typically top water users in communities
- Each drop of warm or hot water billed 3 times
  - Incoming fresh water
  - Sewer charges
  - Energy to heat the water
- 5 major areas:
  - Sanitary
  - HVAC
  - Medical processes
  - Cafeteria/food service
  - Laundry



Source: Massachusetts Water Resources Authority, 1996. Facilities include hospitals with 138-150 bed capacities, in-patient admissions of 5,100-11,600 per year and annual water use ranging from 15-67.2 million gallons.

Recommend Similar Approach

- Understand where and how hospital is using water
- Look for major consumption patterns, spikes and higher or lower than expected consumption in specific areas
- Take advantage of low-cost opportunities to increase efficiency
- Review maintenance procedures to ensure leaks are found and repaired
- Ensure janitorial staff shut off all faucets and report leaks immediately

From: " Saving Water Counts in Energy Efficiency" by Clark Reed, U.S. EPA at www.energystar.gov

Examples

- Sanitary: low flow shower heads and faucets (*US Federal Energy Managmenet Program found Veterans Affairs hospital in Portland OR could save $17,000 per year with payback less than one year*)
- HVAC: maintenance and operation of heating and cooling systems, upgrading pumps, compressors etc. *(Norwood Hospital in MA reduced water bled from cooling tower and saved 600,000 gallons and $4,000 per year with no capital investment*)
- Medical Equipment: sterilizers, cooling systems for CAT scanners, vacuum pumps etc. *(U of Washington retrofitted 50 sterilizers and autoclaves with water-saving kits, saving 2.6 m gal and $250,000 per year)*
- Cafeteria: steam cookers, dishwashing machines, pre-rinse spray valve rates, etc. (*typical dish washer pre-rinsing 3 hours per day – if you replace 2.6 gpd valve with a 1.6 gpd valve, save 66,000 gallons per unit with huge energy savings as well)*

From: " Saving Water Counts in Energy Efficiency" by Clark Reed, U.S. EPA at www.energystar.gov

Water Sustainability: risk management

- Our water life cycle is short….

Supply

↓

Processing

↓

Patient

← **Increasing focus**

Risks from contaminated water supplies

Risks from public perception and community need

Risks to our suppliers

U.S. news / Environment

Categories

U.S. news

Scientists predict Southwest mega-drought

Climate models indicate region will be as dry as Dust Bowl for decades

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Last Updated: Tuesday, 19 October 2004, 17:20 GMT 18:20 UK

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Water scarcity: A looming crisis?

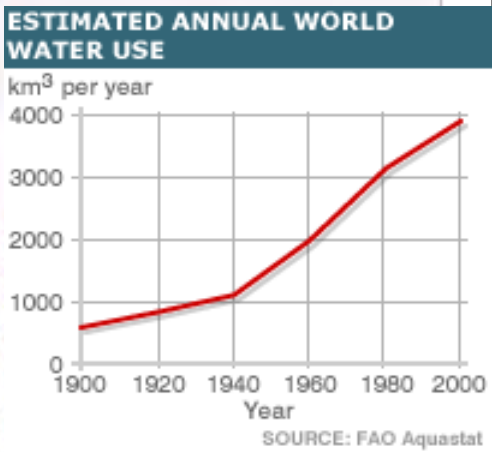
As part of *Planet Under Pressure*, a BBC News Online series looking at some of the biggest environmental problems facing humanity, Alex Kirby explores fears of an impending global water crisis.

By Alex Kirby
BBC News Online environment correspondent

The world's water crisis is simple to understand, if not to solve.

The amount of water in the world is finite. The number of us is growing fast and our water use is growing even faster.

A third of the world's population lives in water-stressed countries now. By 2025, this is expected to rise to two-thirds.



Natural Disasters
GeorgiaDrought.org

Current Drought Conditions
October 25, 2007 - View this Power Point presentation

Quick Links
- Climatological Data
- Climate Outlooks
- Glossary
- News Archive

Business Get article background

Coca-Cola

In hot water

Oct 6th 2005

From *The Economist* print edition

The world's biggest drinks firm tries to fend off its green critics

New Baxter sustainability steering committee adopted the following goals

By 2010, evaluate potentially vulnerable watersheds associated with Baxter facilities and establish aggressive water conservation goals for high risk areas.

By 2012, implement two projects to help protect vulnerable watersheds and provide communities with enhanced access to clean water.

There are numerous data and information gaps

We've begun, but still have a long way to go….

Baxter

e.g. Facility Wastewater Risk Profiles

Microsoft Excel - Wastewater Profiles.xls

File Edit View Insert Format Tools Data Window Help

Arial 10

E24 =

	A	B	C	D	E	
13	Oil & Grease					
14	Temperature	<30 degrees C	<30 degrees C	<30 degrees C		<30 degrees C
15	Ammonia (NH3)		3 mg/L	5 mg/L	6 mg/L	30 mg/L
16	Kjeldhal Nitrogen		7 mg/L		15 mg/L	
17	Total Phosphorous		4 mg/L	1.5 mg/L	2 mg/L	
18	Metals					
19	Any Exceedances in the last 12 months?	Yes. Facility indicated that they have had sporadic exceedances of BOD limits.	Yes. pH probe failure caused a significant upset condition in spring 2006. Additionally, facility is not able to consistently meet nitrogen discharge limits due to the use of glycine in the manufacturing process	No. Facility is well operated / controlled and consistently meets effluent limits.	No. Facility is well operated / controlled and consistently meets effluent limits.	No
20	Any near exceedances in the last 12 months?		Unknown	No. Facility is well operated / controlled and consistently meets effluent limits.	No. Facility is well operated / controlled and consistently meets effluent limits.	No
21	Remaining Hydraulic or Organic Capacity	Based on dissolved oxygen concentration in the aeration basin, it is possible that the treatment plant is nearing its organic loading limit.	Hydraulic capacity is nearly maxed out. Facility is looking to expand treatment plant in 2007.	Facility appears to have sufficient hydraulic and organic treatment capacity.	Facility has reduced hydraulic loading of treatment operation. Should have sufficient hydraulic and organic treatment capacity for the foreseeable future.	Not Applicabl
22	Influent monitoring?	Yes	Yes. Facility monitors flow, pH, COD, BOD	Yes		Not Applicabl
23	Age of treatment system	Major upgrade in 2002 / 2003	Old, but was expanded twice since 2000.	Unknown, but appears to be fairly new (<10 years old)	Old, but well maintained.	Not Applicabl
24	Facility Changes or Expansions?	None currently planned. Plant manager wants to continue to increase production, but there is no definitive plan in place to achieve this increase.	Production growth within operations projected to increase significantly. Future treatment plant upgrade must take into account projected growth from these departments.	None discussed.		Anticipated pr associated wi
25	Issues	Wastewater treatment plant appears to be nearing its organic treatment limit. Facility has initiated a greenbelt project to reduce tank heels and scrap solution that will reduce organic loading. Additionally, facility made a recent modification to reduce shock loading associated with large volumes (>300 Liters) of discarded solution	Wastewater treatment plant cannot remove nitrogen from wastewater. Treatment plant does not have sufficient capacity to adequately handle projected increases in production.	None	None	Facility needs impacts to eff conservation
26						
27	Risk					

Sheet1 Sheet2 Sheet3

Draw AutoShapes

Ready

Key Messages

- Water resources are increasingly being put under greater and greater pressure globally
- A good place to start is to begin understanding usage patterns – simply mapping out water usage (water balances) and tracking data will illuminate opportunities
- Focused attention on water conservation will:
  - Help save energy
  - Help save cost
  - Help reduce risk from water disruptions

Opportunities for public/private partnerships

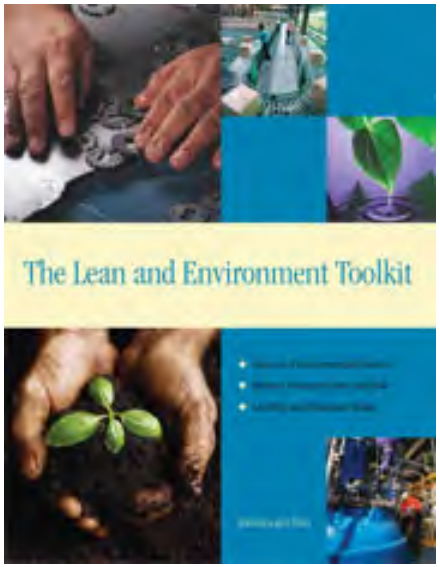
Creating and testing tools (e.g EPA's Lean and Environment or Lean and Energy Toolkit)

There is a tremendous amount of information online for hospitals! Try googling "hospitals and water efficiency"

Developing data and information

Strengthening security of delivery systems

e.g. public utilities



Help conserve….understand….and plan!

Metropolitan Chicago Healthcare Council

GE Water & Process Technologies Company Data

- ✓ Technology, Training, Resources of $2.6 Billion Company
- ✓ 200 Engineers in Trevose, PA for added support
- ✓ $70 Million Yearly R&D Budget
- ✓ Over 1000 Patented Products
- ✓ Customer Operating Cost Savings over $1 Billion
- ✓ ISO9001 Certified
- ✓ 40,000 sq ft Laboratory for sample analyses
- ✓ Provide Service to over 350 Hospitals in the U.S.

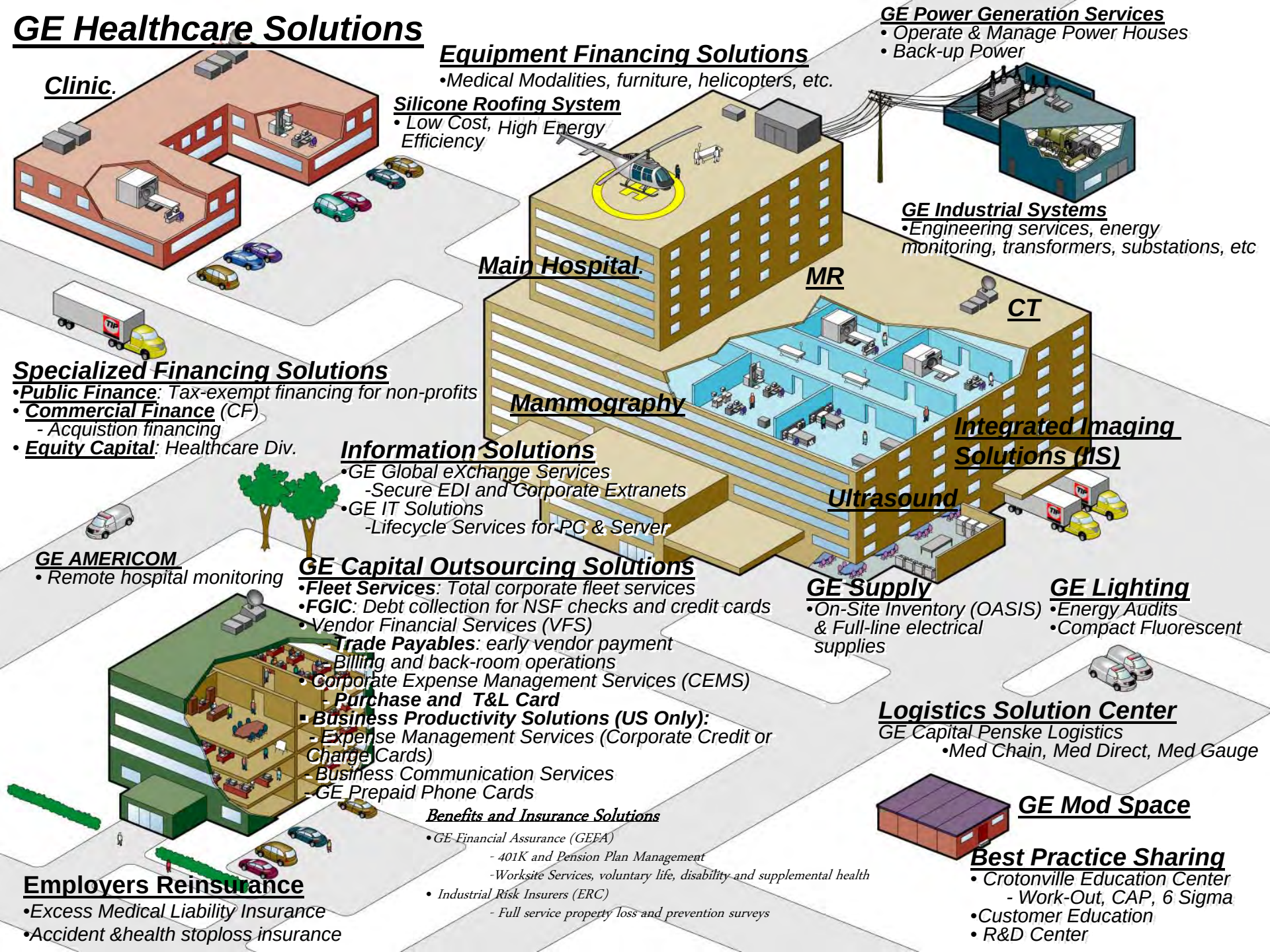
Including all the *Advocate Hospitals in the Chicagoland area*

imagination at work

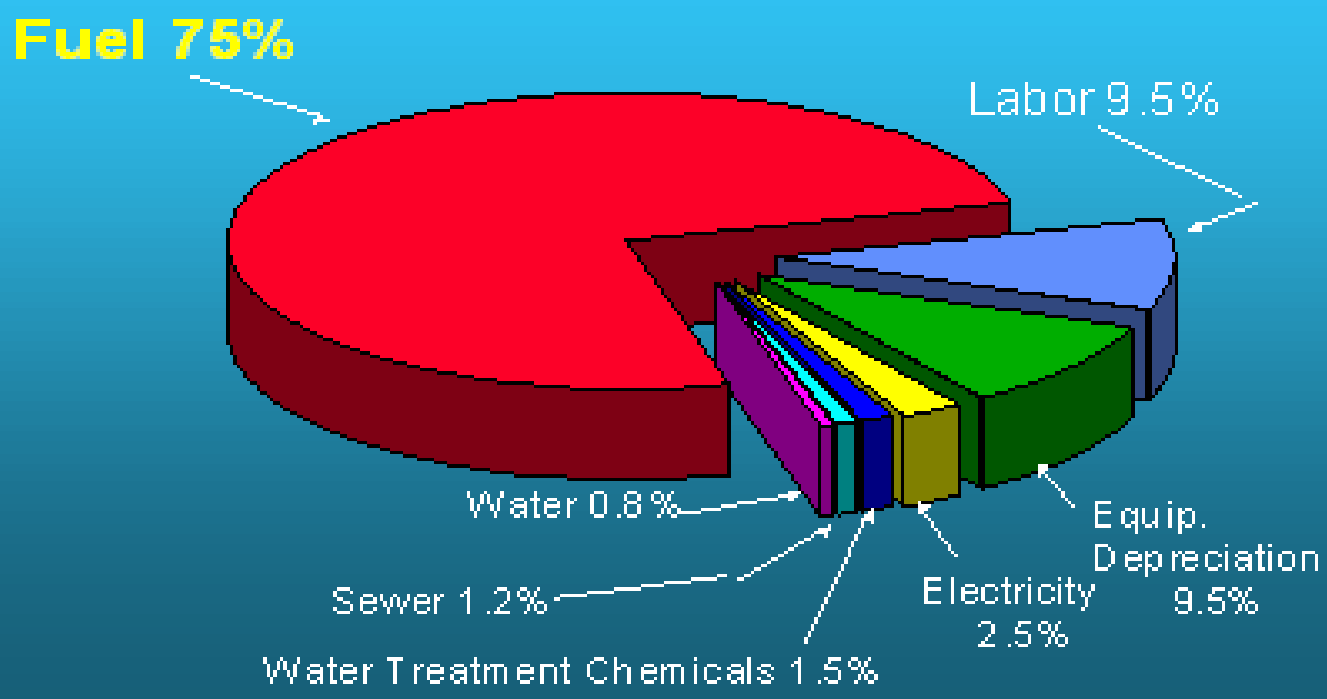
GE Water & Process Technologies Specializing in:

- ✓ Boiler equipment pre-treatment: softener, dealkalizer, reverse osmosis, blowdown controllers
- ✓ Boiler Water chemical treatment
- ✓ Cooling tower equipment: softener, reverse osmosis, orp controllers, conductivity controller
- ✓ Cooling tower chemical treatment: legionella minimization, scale and corrosion prevention
- ✓ Legionella risk minimization programs: testing, consulting, and prevention
- ✓ Water re-use and water minimization programs using patented equipment offering

GE Healthcare Solutions



Typical Boiler Plant Cost Factors



Reverse Osmosis Equipment

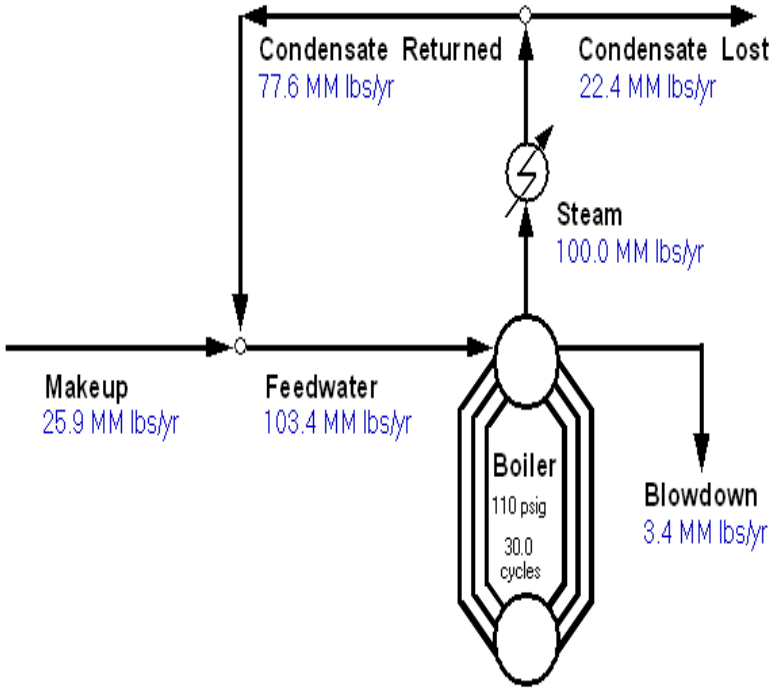
Reverse Osmosis enables us to remove up to 99% solids from your make-up water source

Used as pre-treatment for boiler feed not only allows you to minimize blowdown, but it will also optimize your fuel efficiency

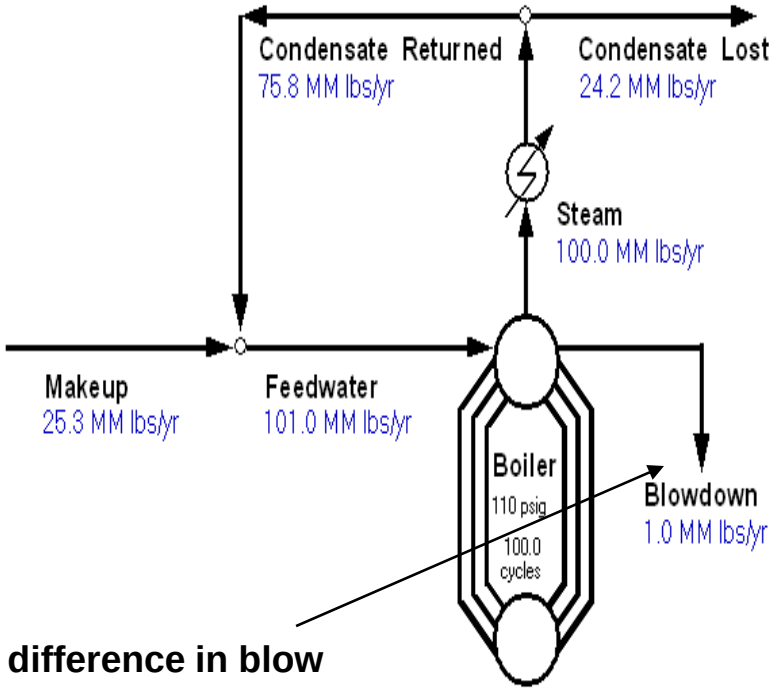
The pressurized feed water flows across a membrane, with a portion of the feed permeating the membrane.. The filtered stream is the **'permeate"** because it has permeated the membrane. The second stream is the **'concentrate"** because it carries off the concentrated contaminants rejected by the membrane. By removing 99% of all ions, we can increase your feed water cycles. Typical boiler systems that have softeners as the only source of pre-treatment operate at 25 feed water cycles An installation of a RO would enable you to run your feed water cycles up to 100. This will drop your boiler blow down percentage from 10 down to 1%

STEAM MASS BALANCE on 100 MM Lbs.

BOILER ON SOFTENED MU



BOILER ON SOFTENED/RO MU



The difference in blow down is 2.4 MM lbs of water or 300,000 gallons per year

imagination at work

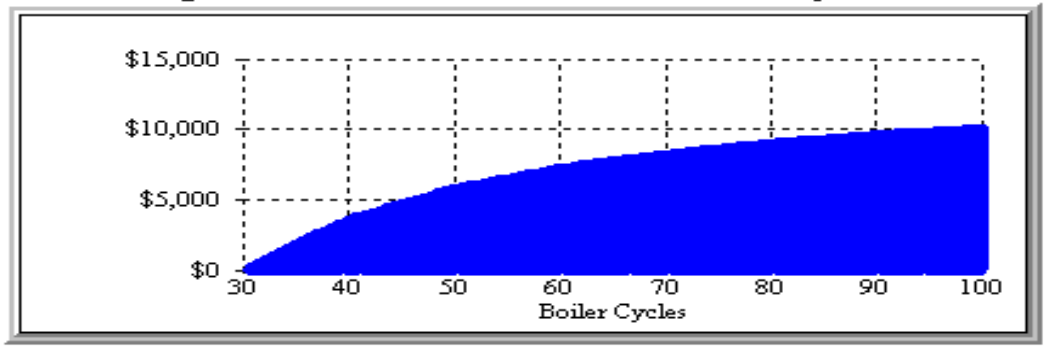
FUEL SAVINGS

Asscociated with Reduced Blowdown

CCR Opportunity: Increasing Boiler Cycles

Increase cycles from 30 to 100
Total Savings: $10,084 per year

Savings as a Function of Increased Boiler Cycles:

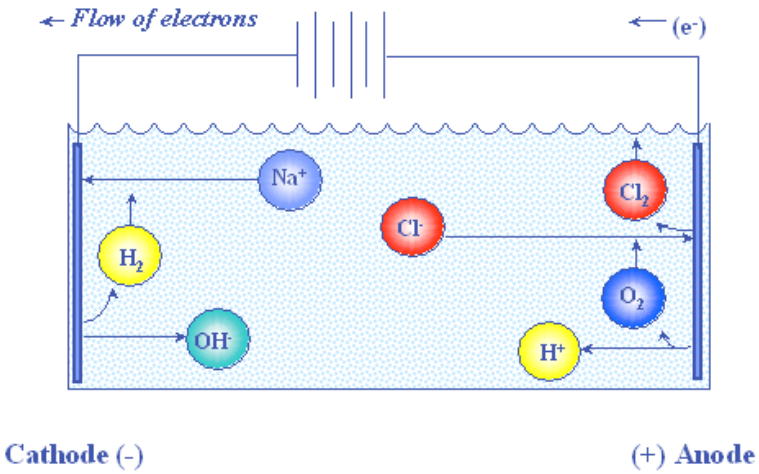


FW Cycles	Makeup (MM gal/yr)	Blowdown (MM gal/yr)	Fuel (mcf/yr)	Makeup Cost ($/yr)	Sewer Cost ($/yr)	Fuel Cost ($/yr)	Total Cost ($/yr)	Total Savings ($/yr)
30	2.48	0.41	136,524	$9,923	$0	$1,365,237	$1,375,160	$0
40	2.37	0.31	136,200	$9,499	$0	$1,362,004	$1,371,503	$3,657
50	2.31	0.24	136,009	$9,248	$0	$1,360,091	$1,369,339	$5,821
60	2.27	0.20	135,883	$9,082	$0	$1,358,826	$1,367,909	$7,252
70	2.24	0.17	135,793	$8,964	$0	$1,357,928	$1,366,893	$8,268
80	2.22	0.15	135,726	$8,876	$0	$1,357,258	$1,366,134	$9,026
90	2.20	0.13	135,674	$8,808	$0	$1,356,738	$1,365,546	$9,615
100	2.19	0.12	135,632	$8,754	$0	$1,356,323	$1,365,076	$10,084

EDR & RO Concentrate for Tower MAKE-UP

What is EDR ?

Electrodialysis is an electrochemical separation process in which ions are transferred through ion exchange membranes by means of a DC voltage



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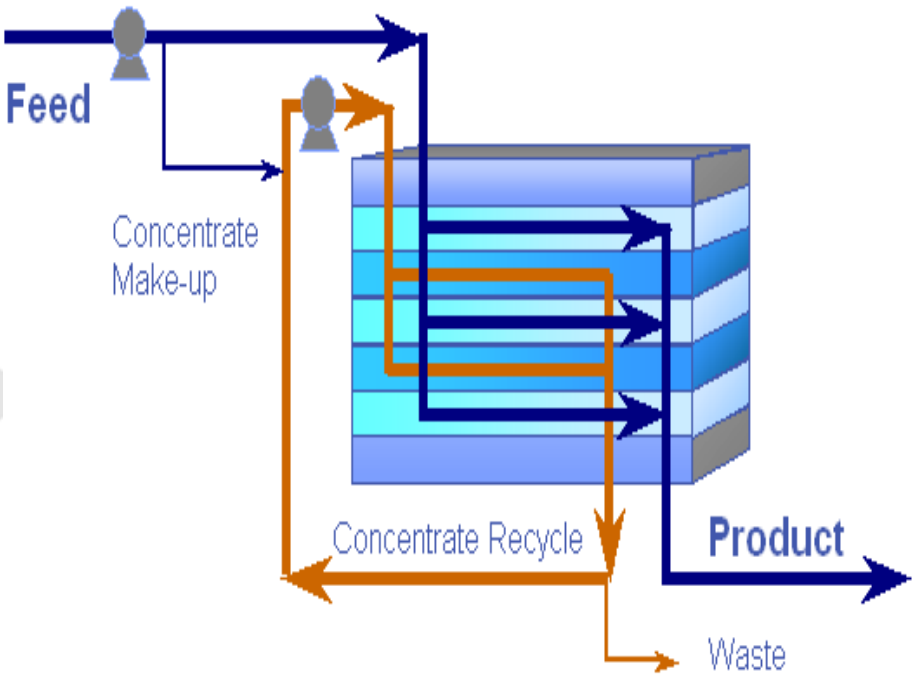
Benefits of EDR

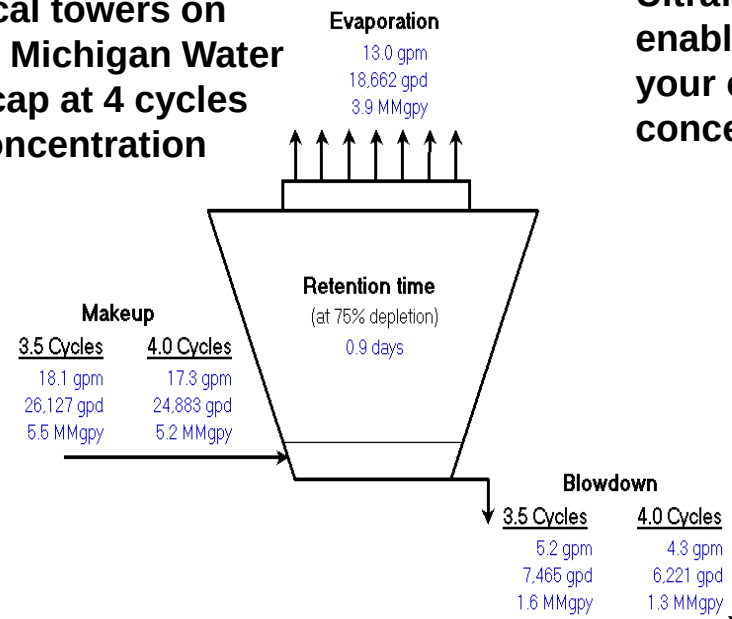
1. High Water Recovery, up to 95%
2. Salt (TDS) removal between 40 to 90%, which can be controlled by adjusting applied electricity
3. No Silica removal, so it can handle silica levels up to 140 ppm
4. Ability to handle higher loads of TSS (Total Suspended Solids) and not require media filtration
5. Typically no chemical addition, since the reversal of electrical current helps minimize scale
6. Chlorine Resistant membranes, can handle 0.5 ppm continuous and spikes up to 25-50 mg/l for disinfection purposes.



COOLING WATER MASS BALANCE

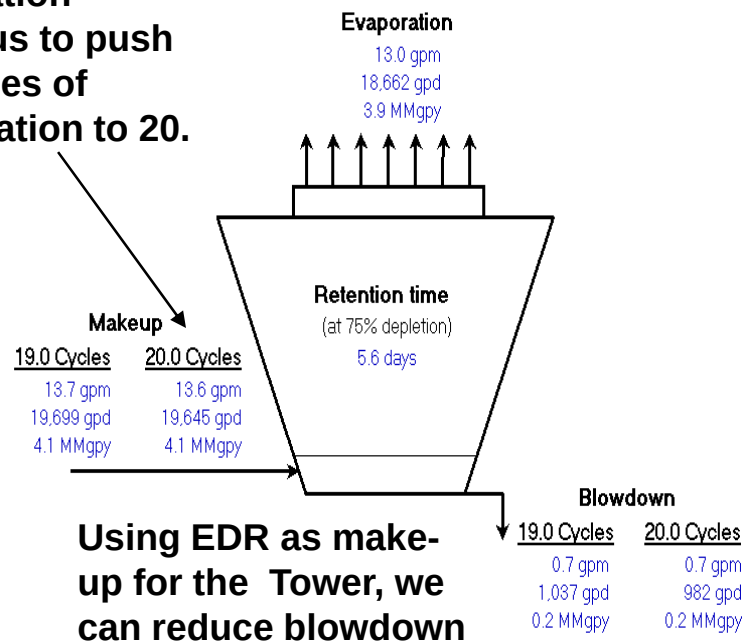
Tower on City Water

Typical towers on Lake Michigan Water will cap at 4 cycles of concentration



Tower on RO Concentrate & EDR

Ultrafiltration enables us to push your cycles of concentration to 20.



Using EDR as make-up for the Tower, we can reduce blowdown by as much as 85% or 1.1 MM gallons annually.

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Metropolitan Chicago Healthcare Council

GE WATER

Documented Customer Savings:

-$1 Billion in net operating costs saved

-12.5 Billion gallons of water saved

-225,000 tons of solid waste eliminated

-30,000 tons of air emissions removed

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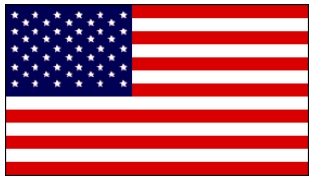
Proof not Promises

Metropolitan Chicago Healthcare Council

Thank You for the Opportunity.



imagination at work

Hospital and Water Sector Interdependency Summit - Keeping Patients Safe

Feedback from September 18, 2008 Meeting

1. **Please check that which best describes your professional affiliation:**

14 – Hospital	0 – Federal Government
1 – Professional Organization	0 – Business Industry
1 – Local Government	1 – Other (Water utility)
2 – State Government	

Total Evaluations Collected = 19
Total Summit Participants = 75

2. **What Information did you find most useful?**
   - The Milwaukee and Cleveland experiences
     - Input from Marek Owra and Karen Dethcloff
     - Problems not anticipated
     - Mistakes made
     - Lessons learned
     - Recovery planning – "Cleveland had a good plan for loss of power, but a weak plan in case of a loss of water"
   - Water Infrastructure
     - City of Chicago Department of Water Management
     - Metropolitan Water Reclamation District of Greater Chicago (MWRDGC)
     - Treatment and Use
   - Water Efficiency/Conservation
     - Financial benefits
     - Baxter's LEAN
   - Open discussion period
   - "Everything was beneficial. It was a great opportunity to start thinking (and planning"

3. **Did the speakers provide useful information on important subject matter?**
   - Yes = 15
     - "Useful" information was offered on energy and water use, though "the hard part is implementation." The "informative" handouts were appreciated, as well as, the "clear" presentations by speakers.
   - Most = 3
     - Participants would have liked to have heard more specific recommendations on "how to protect and insure clean water in our local hospitals" by experienced states. A couple of participants were not satisfied with "sales pitches" by Baxter and GE.
   - No = 0

4. **<u>What session topics were the most relevant to you and your organization, and why?</u>**
   - Case Studies: Cleveland and Milwaukee
     - Aids in Chicago emergency preparedness planning
     - Problems other hospital have noted – what to expect
     - Actions taken and described
     - Identifying potential failures
     - Continuous testing to be better prepared
   - Water Infrastructure
     - Treatment
     - Use
     - The city's ability to support hospitals during an outage
     - Identifying potential complications
   - Water conservation
   - "The talk about a hospital drilling a well in the city was interesting"
   - MWRDGC's talk in regards to the sewer system – learning how critical a few pumping stations are to the system
   - Specific focus on areas such as, nursing, food & nutrition, environmental services, sterile processing, etc.
   - "All, GE was a bit too technical"
   - R.O. machines

5. **<u>Was the summit well-organized? Do you have suggestions for improving future meetings?</u>**
   - Yes = 18
     - Summit was described as "very well organized", with specific "kudos" offered to "Mr. Jack Hickey" and "Ms. O'Neill." Participants were appreciative of moderators "keeping to the time schedule." "The section make-up was appropriate and speakers/subject matter complimented each other."
     - Suggestions included incorporating more information on "terrorist threat to supplies" and "contingency planning", avoiding "corporate sales pitches" and "vendors", and making more time for "group discussion/workshop."
   - No = 0

6. **<u>Is there any information that you expected or wanted to hear at the Summit but did not hear? If so, what do you feel was missing?</u>**
   - Yes = 6
     - Where to get potable water if hospital supply is contaminated (facility specific)
     - Full scale evacuation procedures. Many hospitals currently practicing limited evacuations in case of fire (i.e. "horizontal evacuation"). In case of extended water shortage, may need to prepare for hospital-wide evacuation.
     - Information from experienced hospitals with success in their emergency preparation
     - Information on terrorist threat to supplies and contingency planning
     - Specific information geared towards a specific department
     - Patient safety issues and complications during outages/disasters
   - No = 7

7. **<u>Please add any additional comments or recommendations:</u>**
   - Everything was very informative, good speakers
   - Boiling water in an emergency in a 700 bed hospital with an occupancy of 2,000 at any given time is not only impractical but impossible
   - I would like to see guidelines for facilities that want to hook up tankers as an alternate water supply
   - Open discussion at end was more useful than anticipated
   - Now that you have tackled regional infrastructures and case histories would be useful if more sessions was workshop format that focused on developing concrete response plans
   - If possible focus a little more on specific implications of the food and nutrition/dietary department
   - Very interesting information; speakers were very knowledgeable. Good forum discussion