Water reuse: An integral part of sustainable water resource planning

Presentation by Paul Anderson
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to the NE Illinois Regional
Water Supply Planning Group
June 26, 2007

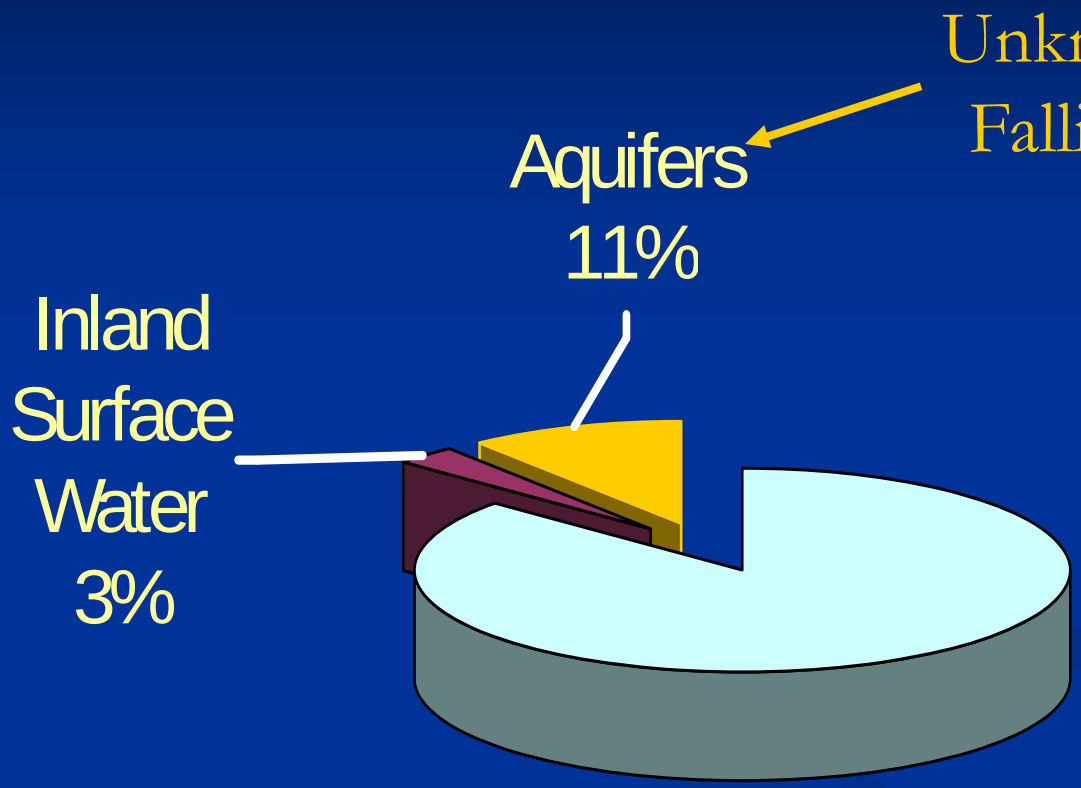
Acknowledgments

- Partners
  - Illinois Institute of Technology
  - Illinois Waste Management Research Center
  - Chicago Metropolitan Agency for Planning
- Sponsor
  - US EPA Science to Achieve Results Program
- Work conducted by
  - Yi Meng
  - Shihui Luo
  - Feng Huang

Conclusions

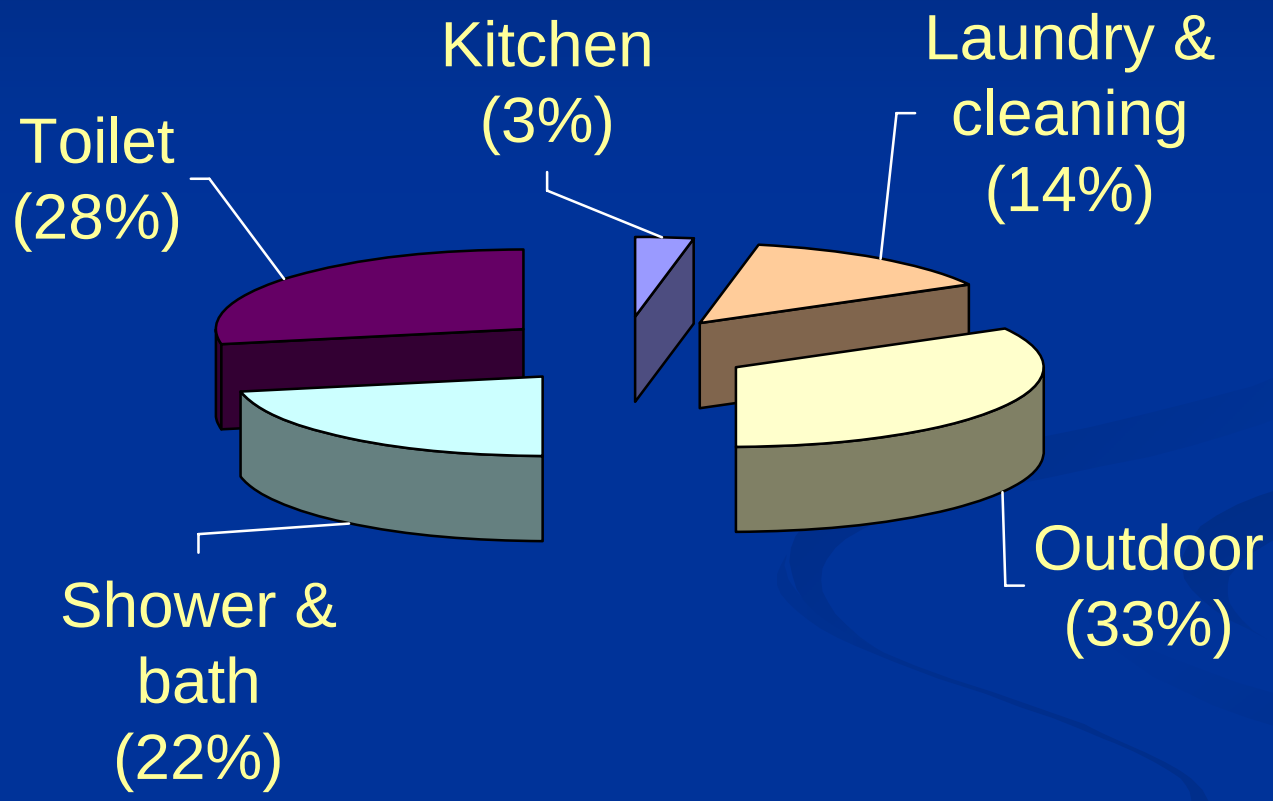
- Expect water shortages in parts of NE Illinois
- Water reuse should be part of the solution

NE Illinois: Limited water sources



Northeastern Illinois regional non-cooling water source allocation (NIPC, 2001)

We don't use water very efficiently

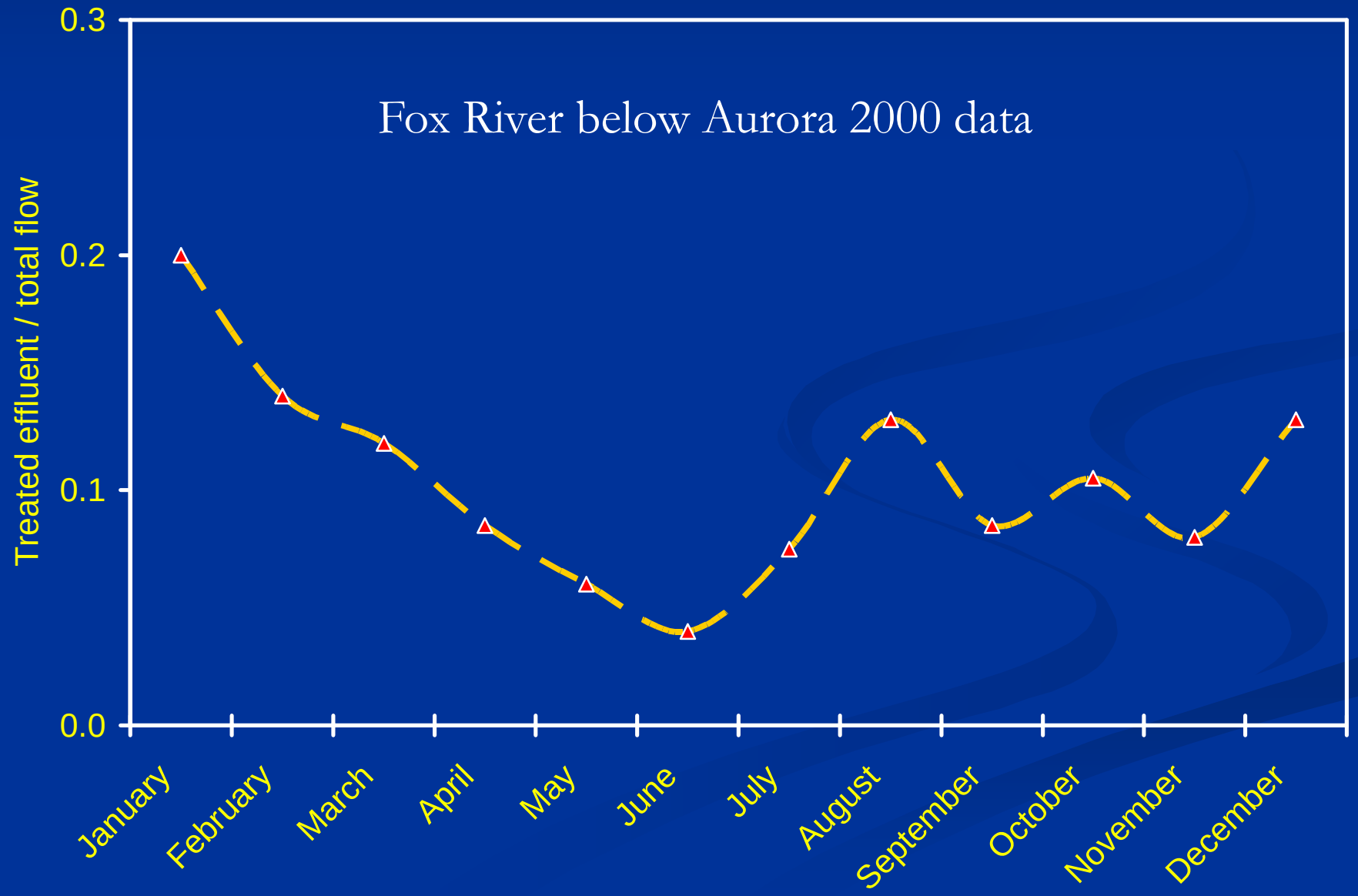


Domestic water use (USEPA, 2006)

Water shortage: What are the options?

- Reduce growth
- Conserve water
- Develop new water sources
- Reuse treated wastewater
  - Incidental (un-planned) reuse
  - Planned reuse

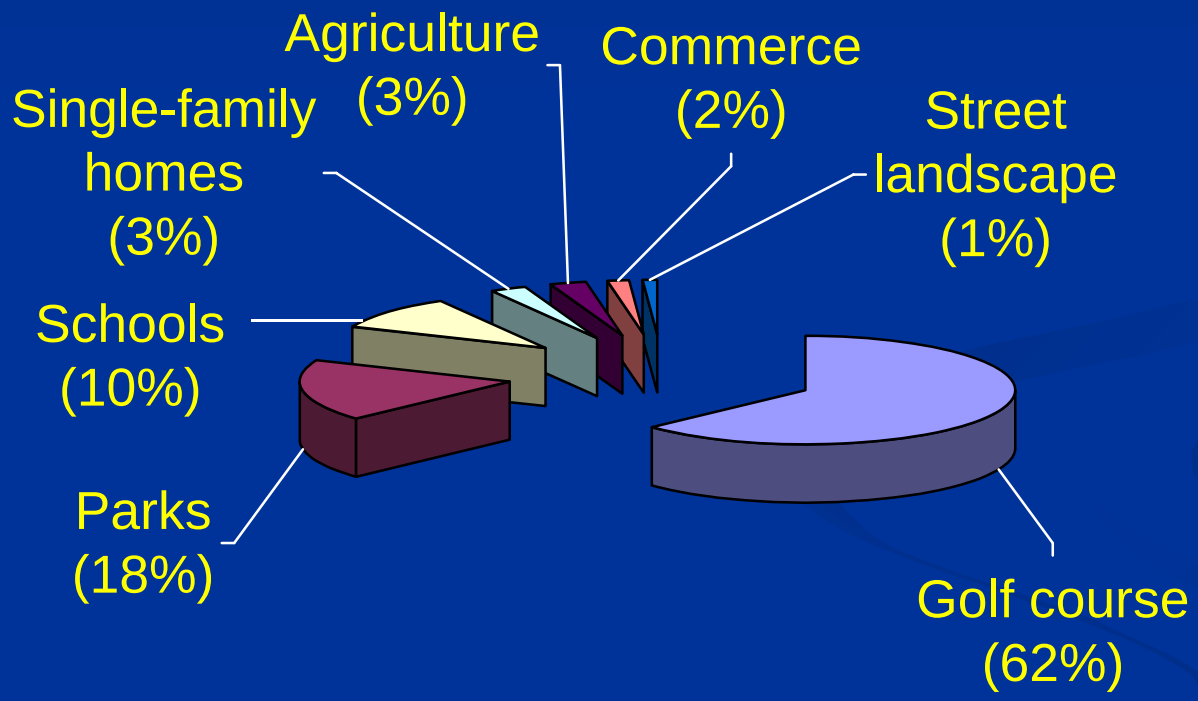
Incidental (un-planned) reuse is common



Planned water use:

Common in water-stressed states

(20 years experience in Tucson, AZ)



2004 total = 3.8 billion gallons to 750 customers

Local examples of planned water reuse

- MWRDGC (1991)
  - Total wastewater = 1,387 MGD
  - About 28 MGD reused (2%)
  - Mostly cooling water
- Fox River Watershed (2002)
  - Total wastewater = 129 MGD
  - 14 treatment systems with reuse
  - 2.5 MGD for irrigation (2%)

How can treated wastewater be reused?

- Urban water reuse (unrestricted & restricted)
- Agricultural irrigation (food & nonfood crops)
- Recreational water use (unrestricted & restricted)
- Environmental water reuse
- Industrial water reuse
- Groundwater recharge
- Indirect potable reuse

(USEPA, 2004)

What are the risks?

- Human health risks
  - Pathogenic organisms
    - Bacteria, viruses, protozoa
  - Chemical contaminants of concern
    - Pharmaceuticals
    - Pesticides, herbicides
    - Trace elements
- Ecosystem risks
  - Chemical contaminants of concern
  - Nutrients

"…there have not been any confirmed cases of infectious disease resulting from the use of properly treated reclaimed water in the U.S."

USEPA (2004)

- Are there unconfirmed cases?
- What about non-infectious disease?
- How long does it take to see effects?
- What about ecosystem risks?
- What about incidental reuse?

What are the regulations?

- Federal
  - There are no water reuse regulations
  - *Guidelines for Water Reuse* (USEPA, 2004)
- State (2004 data)
  - 25 states have regulations
  - 16 states have guidelines
  - 9 states without regulations or guidelines

Does Illinois have reuse regulations?

- State level
  - IEPA (land application)
  - Dept. of Public Health (cross-connections)
- Regional (CMAP)
  - "…recommended alternative is to evaluate a no-discharge system, such as land application."
- Municipal
  - Chicago's Water Agenda 2003
  - Village of Richmond Reuse Ordinance

Water reuse in Richmond, IL

- Mandated water reuse
  - Landscape watering and water features (except playgrounds)
  - Industrial cooling water
  - Toilet flushing (commercial, industrial, public)
  - Commercial car wash
  - Boiler feed water (commercial, industrial, public)
- Encourages use for appropriate non-potable industrial processes

Planning for water reuse in NE Illinois

54%

2 WPPs

Users

Reuse

N.B. Chicago River

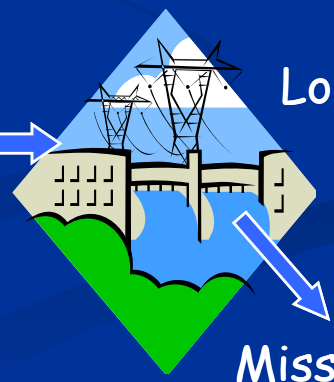
30%

Combined Sewer System

16%

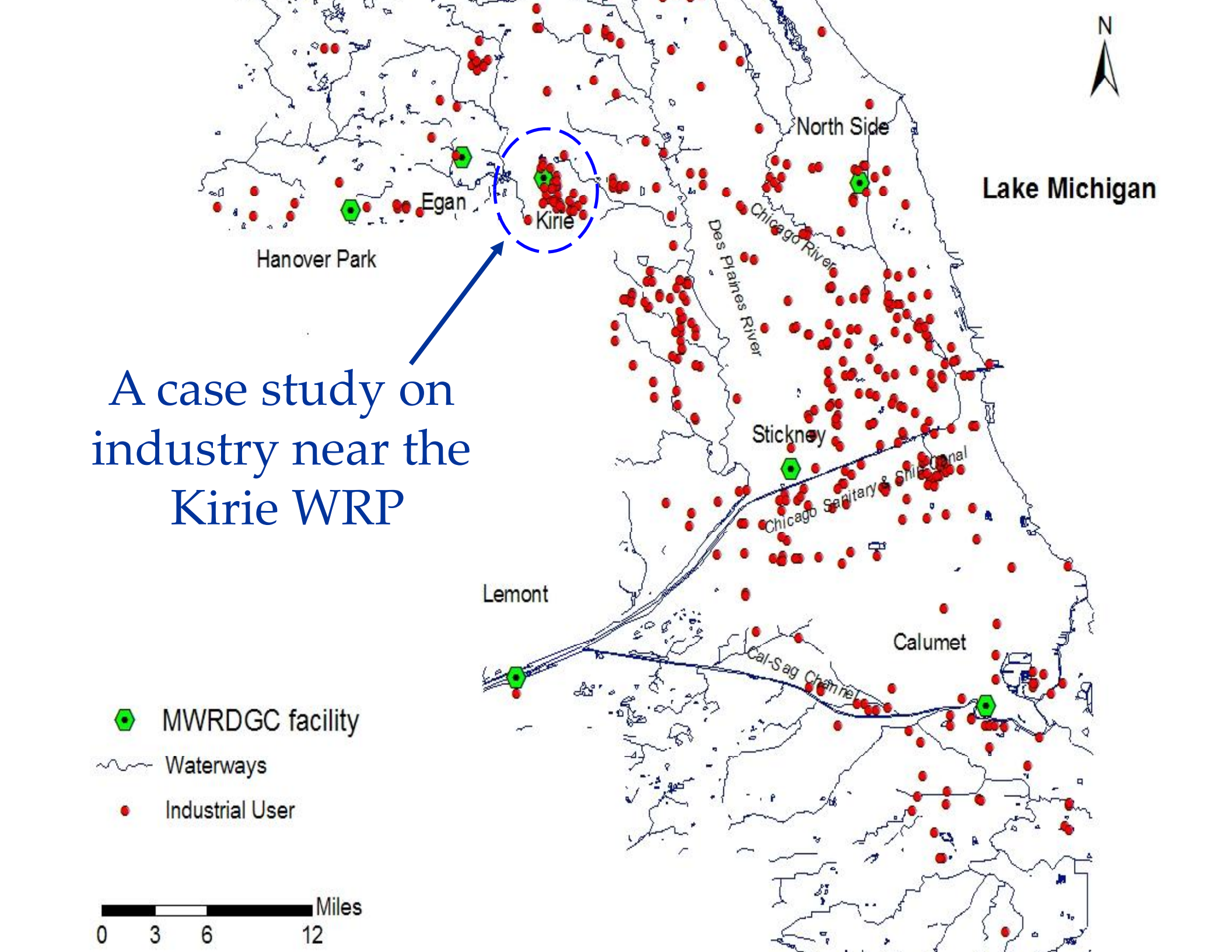
7 WWTPs

Chicago Sanitary & Ship Canal, Cal-Sag Channel



Lockport

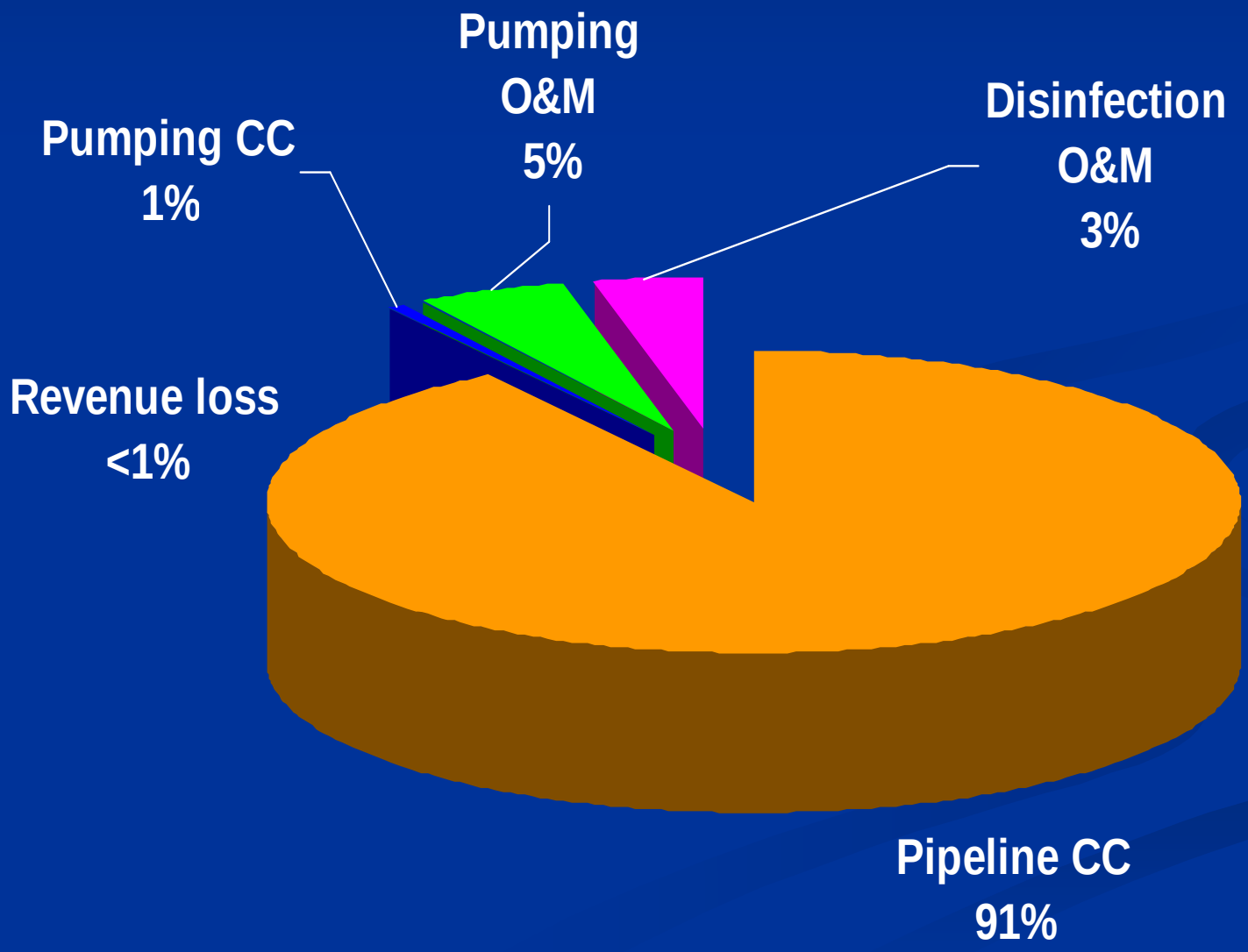
Mississippi River


A case study on industry near the Kirie WRP
N
North Side
Lake Michigan
Egan
Kirie
Hanover Park
Des Plaines River
Chicago River
Stickney
Chicago Sanitary & Ship Canal
Lemont
Calumet
Cal-Sag Channel
MWRDGC facility
Waterways
Industrial User
Miles
0 3 6 12

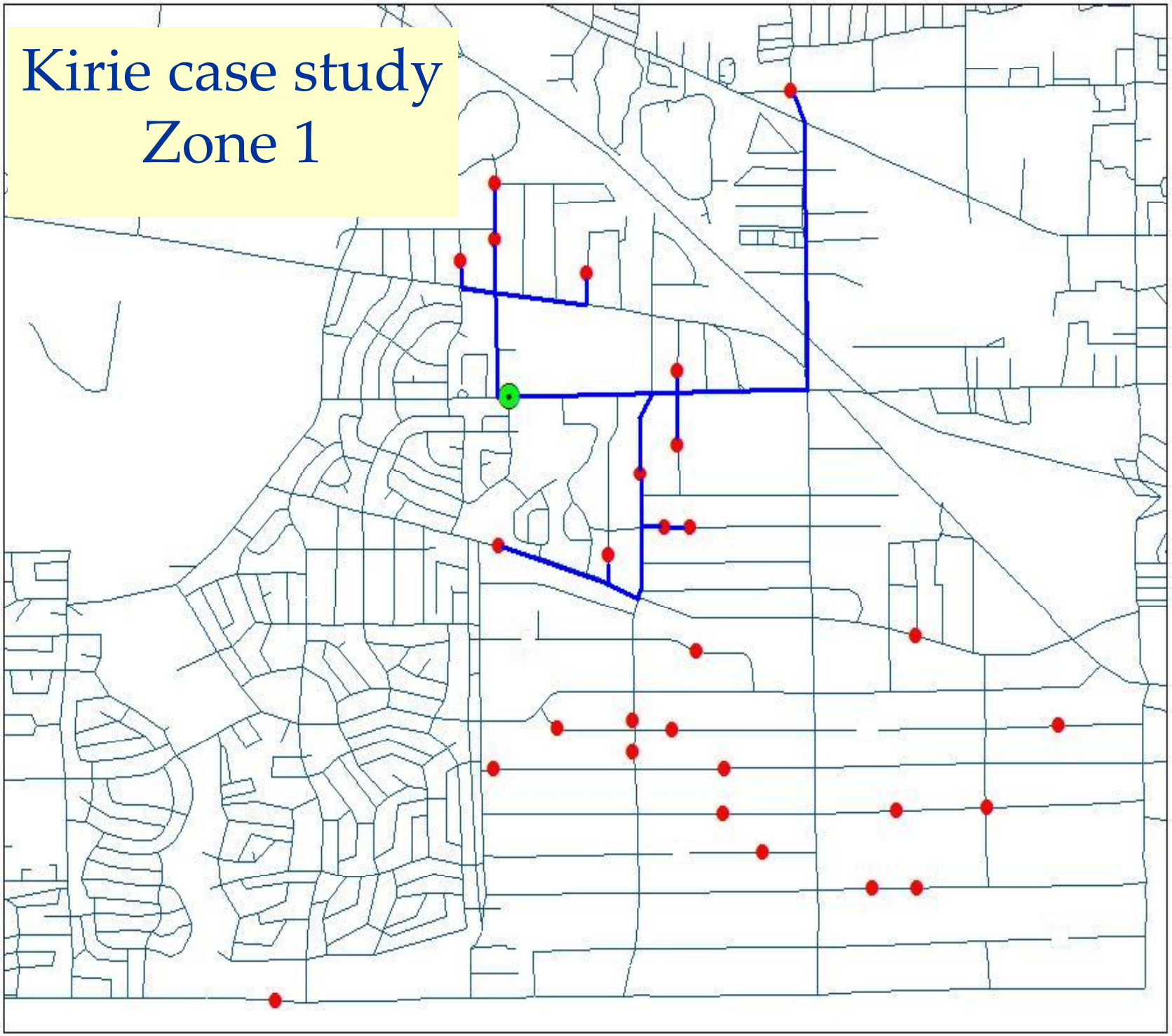
Is wastewater reuse economical?

- Objective:
  - Minimize cost
- Constraints:
  - Demand
  - Mass balance
  - Capacity
  - Water withdrawal
  - Water quality

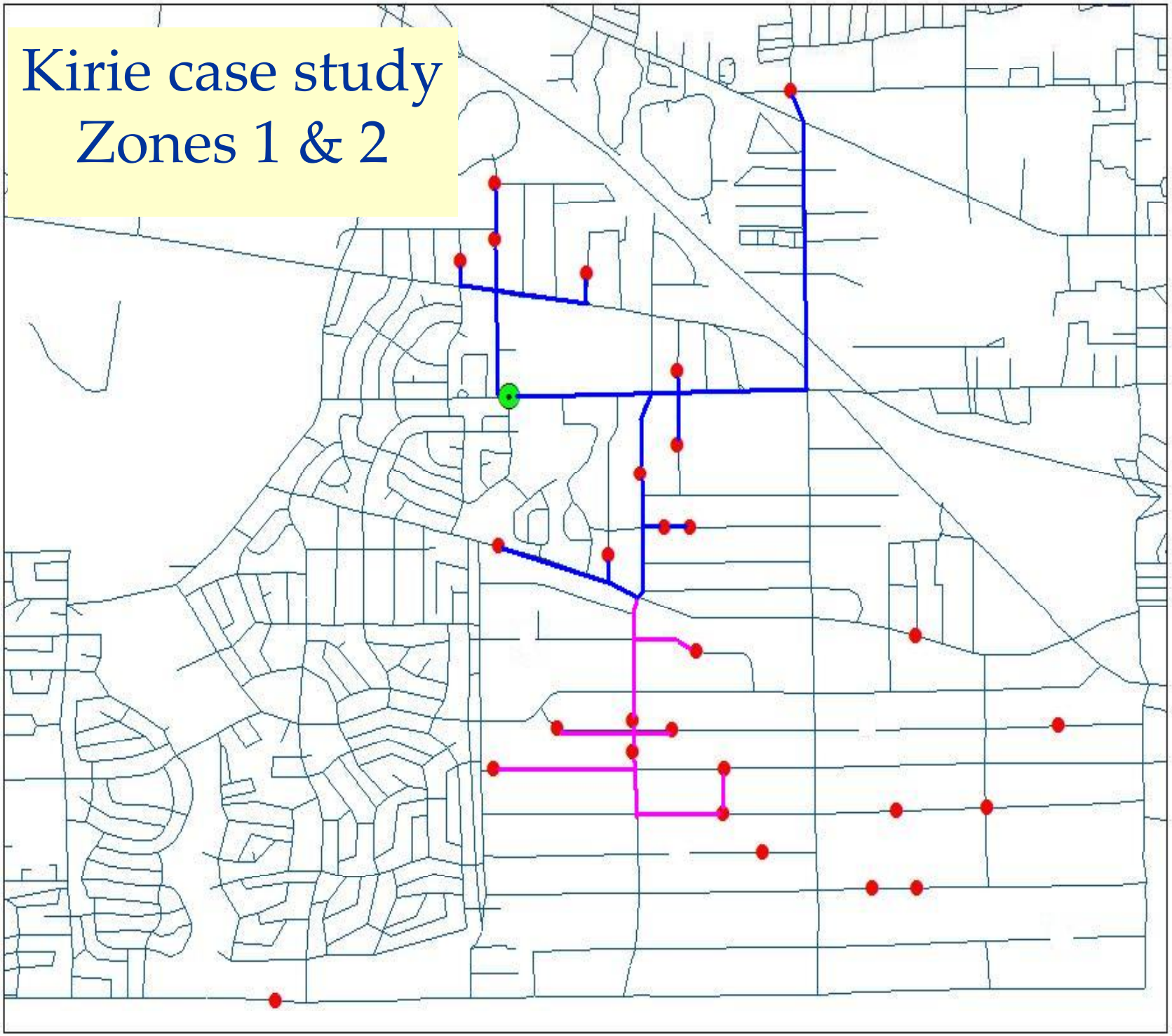
Pipeline costs dominate



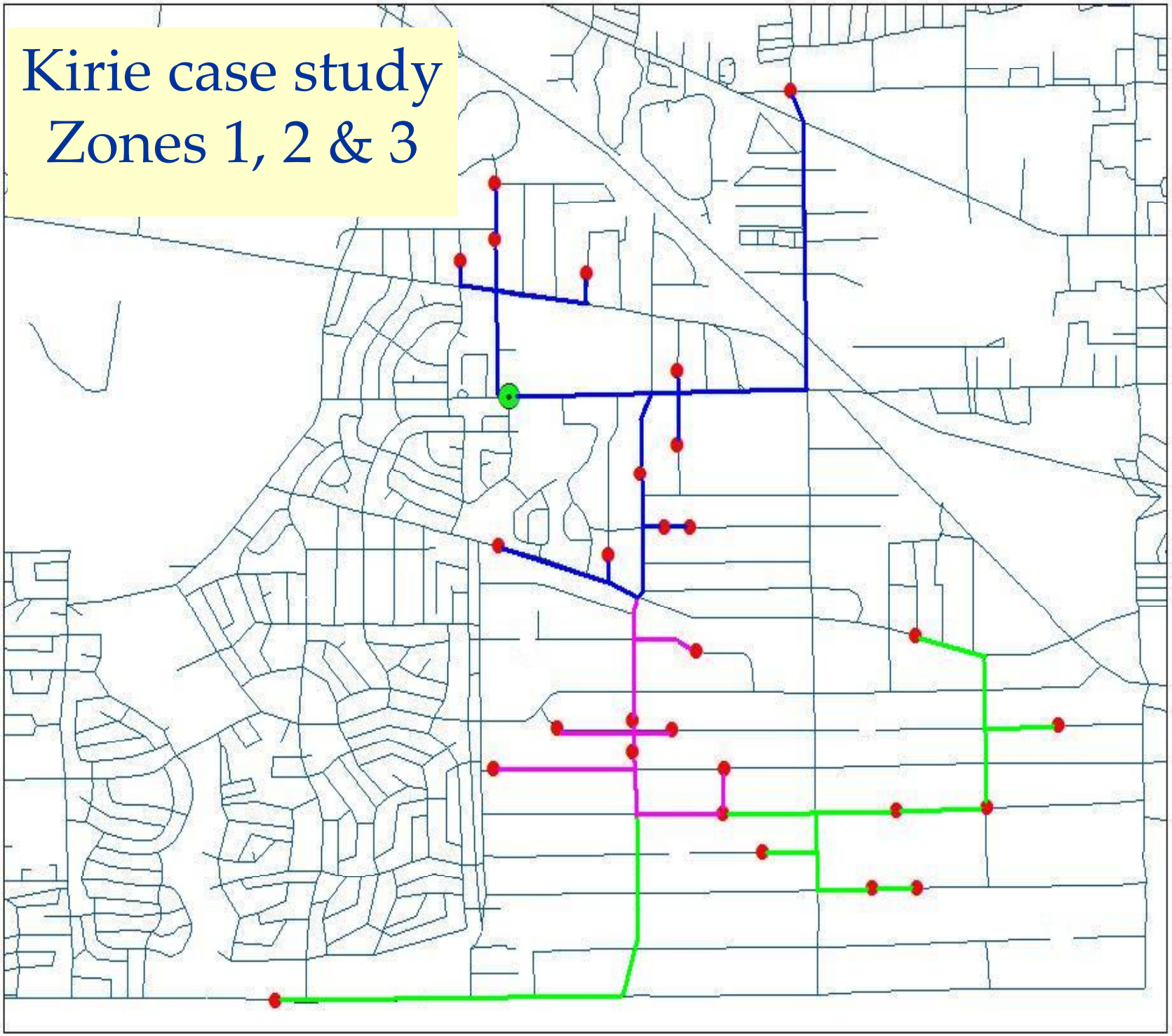
Kirie case study Zone 1



Kirie case study
Zones 1 & 2

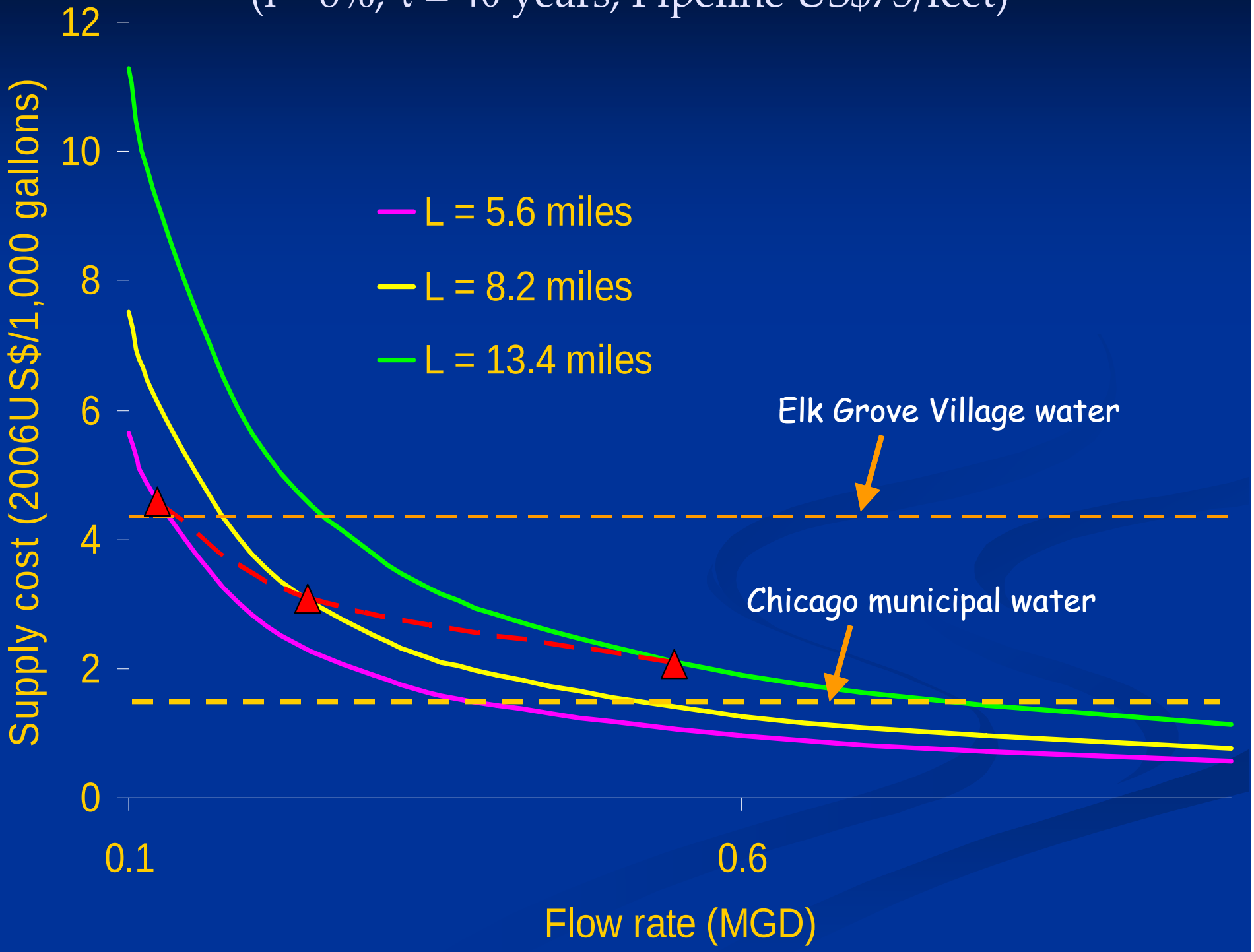


Kirie case study
Zones 1, 2 & 3



Cost depends on volume & distance

(i = 6%, τ = 40 years, Pipeline US$75/feet)



Chicago reuse study summary

- Pipeline installation costs dominate
- Spatial relationships affect supply cost
- Reuse can be cost effective
- Chicago is an unusual case study
  - Municipal water is very cheap
  - Reuse offers no economic incentive to MWRDGC
  - Chicago's successful water conservation efforts

Barriers to reuse

- Universal
  - Public perception
  - Existing infrastructure
  - Contaminants (pathogens, trace organics)
- Specific to NE Illinois
  - Proximity to Lake Michigan
  - Water shortage is recent phenomenon
  - Retrofit required
  - Cold winters
  - Public water supply is inexpensive

Incentives for reuse

- "New source" addresses shortage
- Reliable
- Keep high quality water for high quality needs
- Reduces loading to surface waters
- Can be economical