



Massachusetts Water Resources Authority

We're Very Much Alike:

The Boston Metro Area and NYC

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The Future of Engineering and Water Quality into the Next Century
October 20, 2005



Massachusetts Water Resources Authority

- MWRA provides wholesale water and sewer services to over 2.5 million customers in 61 communities
- MWRA was created in 1984 to assume responsibility for the water and sewer infrastructure serving greater Boston, and to end the pollution of Boston Harbor from obsolete treatment plants
- Years of under funding had left the Metropolitan District Commission understaffed, and its facilities badly in need of repair and upgrade
- MWRA was created as an independent authority charged with raising its revenue from ratepayers, bond sales and grants
- MWRA was also charged with promotion and enforcement of water conservation and planning for the future



Best Known for the “Boston Harbor Cleanup”

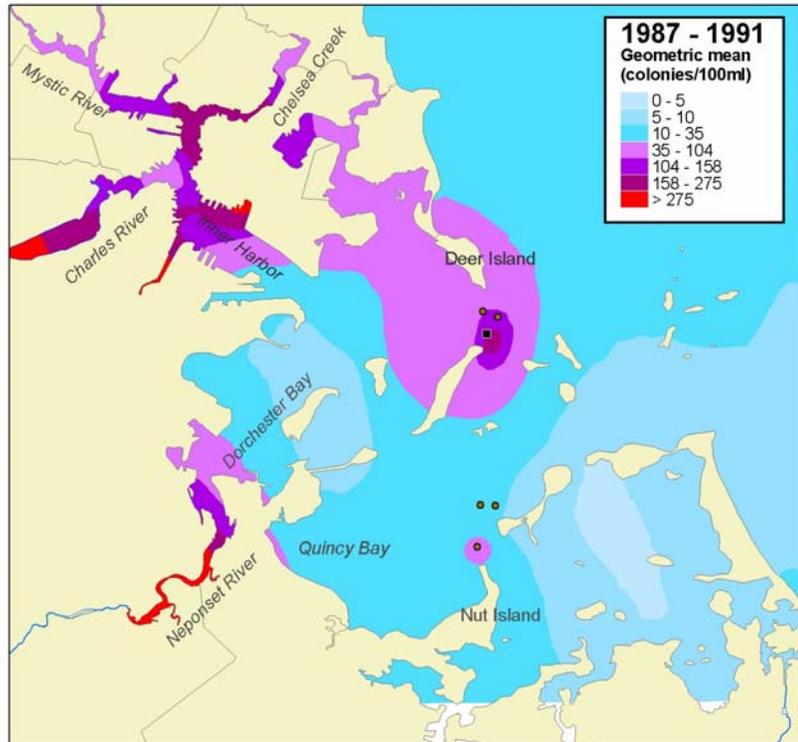




\$4 Billion Later - Boston Harbor is Cleaner

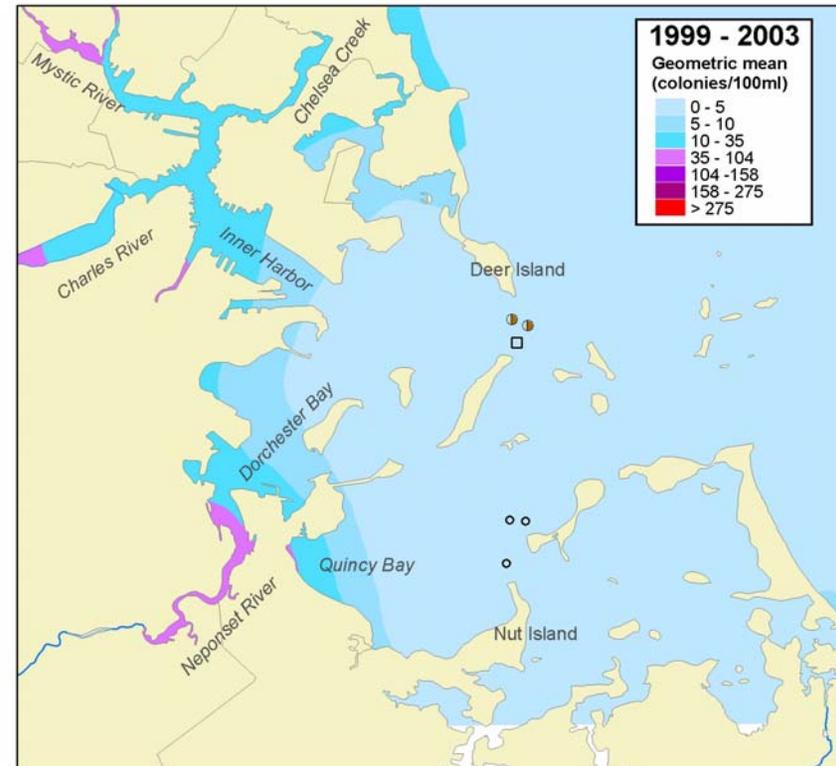
1987-1998 (Before Secondary Treatment and South System transfer)

Elevated bacteria around outfalls, rivers, Inner Harbor, shoreline



1999 - 2003 (After Secondary Treatment and New Outfall)

Most of Harbor well within swimming criteria, most remaining problems in rivers



Average *Enterococcus* counts in Boston Harbor



But Today Is To Celebrate Drinking Water





We're very much alike (But divide by 5)

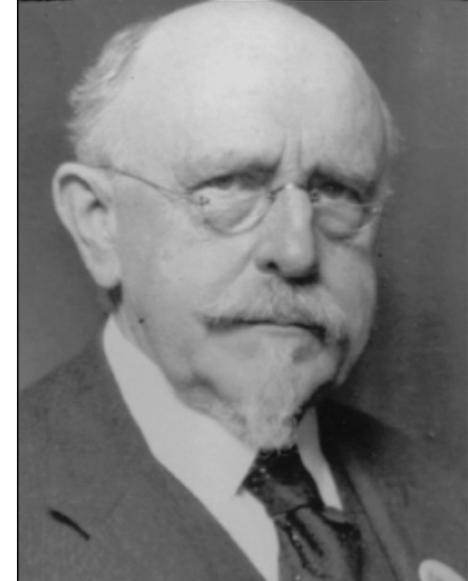
- Same Designers
 - Similar Design
 - Similar Disinvestment Patterns
 - Similar Deficiencies
 - Same Direction Forward
-
- What Can We Learn From Each Other?



Same Designers

- John B. Jervis
- John R. Freeman
- Karl R. Kennison

- Lessons learned applied in later systems
- We still learning





A Real Celebration!

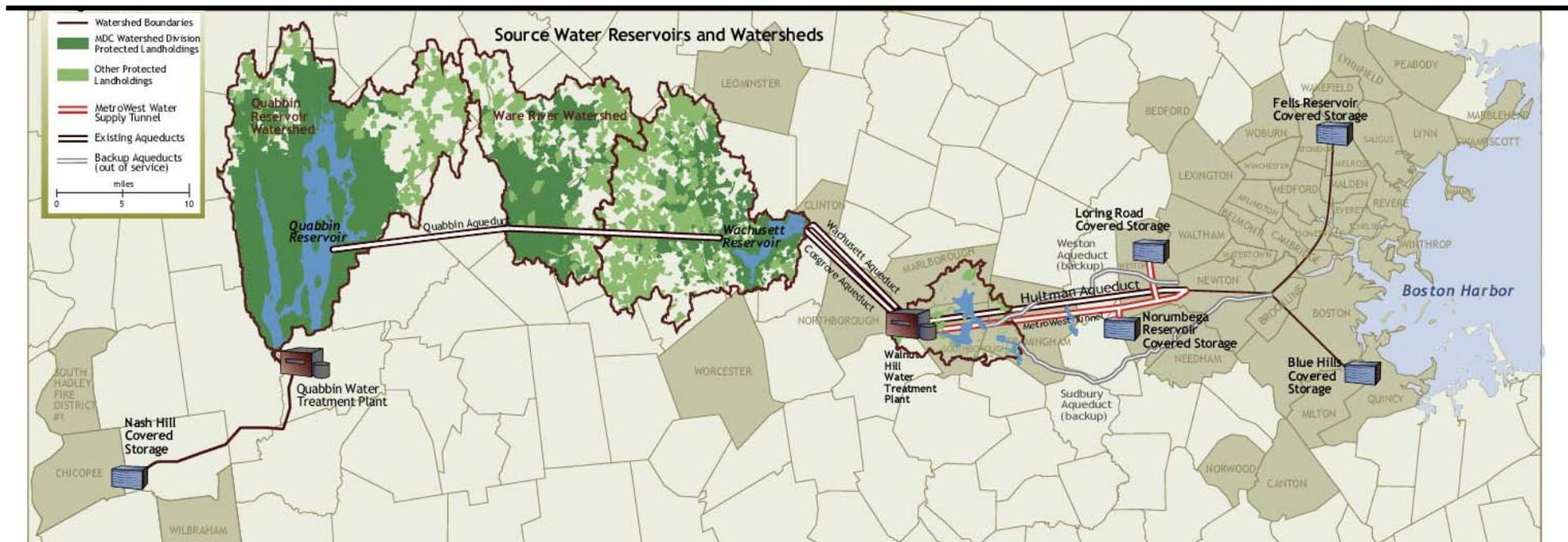
- When water from Lake Cochituate flowed into the Frog Pond on Boston Common in 1848, the dedication ceremony drew 100,000 people and was a public holiday





Same Design (basically)

- Well-Protected Upland Reservoirs
- Disinfection vs. Filtration
- Long Transmission Tunnels and Aqueducts
- Large Downstream Reservoir
- Large Open Distribution Reservoir(s)





Similar Disinvestment Pattern

- Episodic Major Investment in
 - New sources
 - Major transmission conduits
 - Expanded distribution systems
- Lack of Continued Capital Maintenance
 - Average \$11 million per year for decades
- Failed Followed Through on Key Plan Elements
 - Initial improvements suffice, “for now”
 - But not for long term



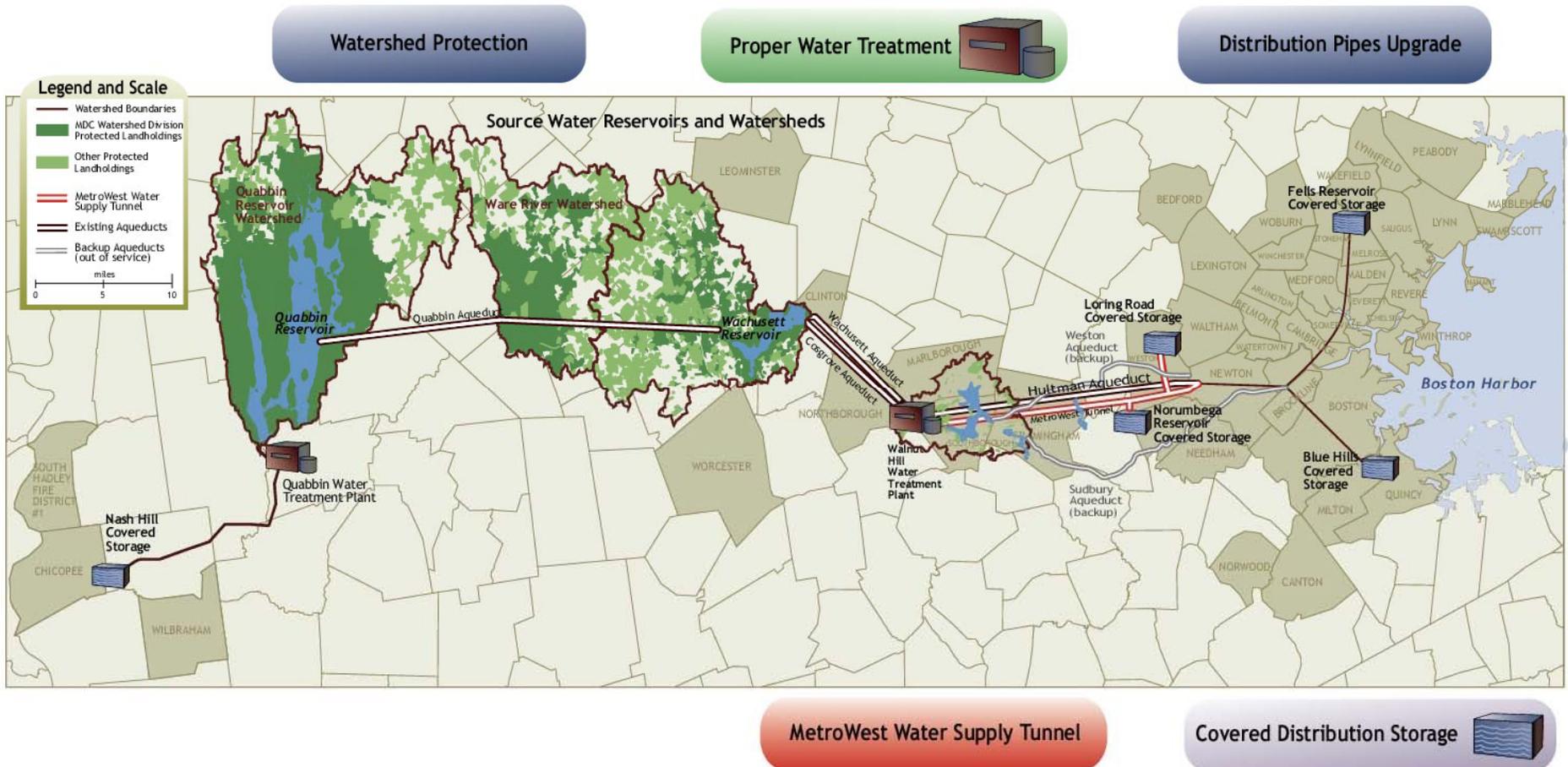
Results – Similar Deficiencies

- Watershed protection “assumed”, but not “assured”
- Treatment Unsuitable to Current Expectations
- Transmission System Dangerously Fragile
- Water Quality at Risk in Distribution System Reservoirs
- Old Unlined Cast Iron Pipes Degrades Customer Experience



A Similar Direction Forward?

- MWRA's \$1.7 Billion Integrated Water Supply Improvement Program





Watershed Protection

- Quabbin Watershed – 187 sq miles – 75% protected lands
- Ware River Watershed – 96 sq miles – 57% protected lands
- Wachusett Watershed – 117 sq miles – 56% protected lands



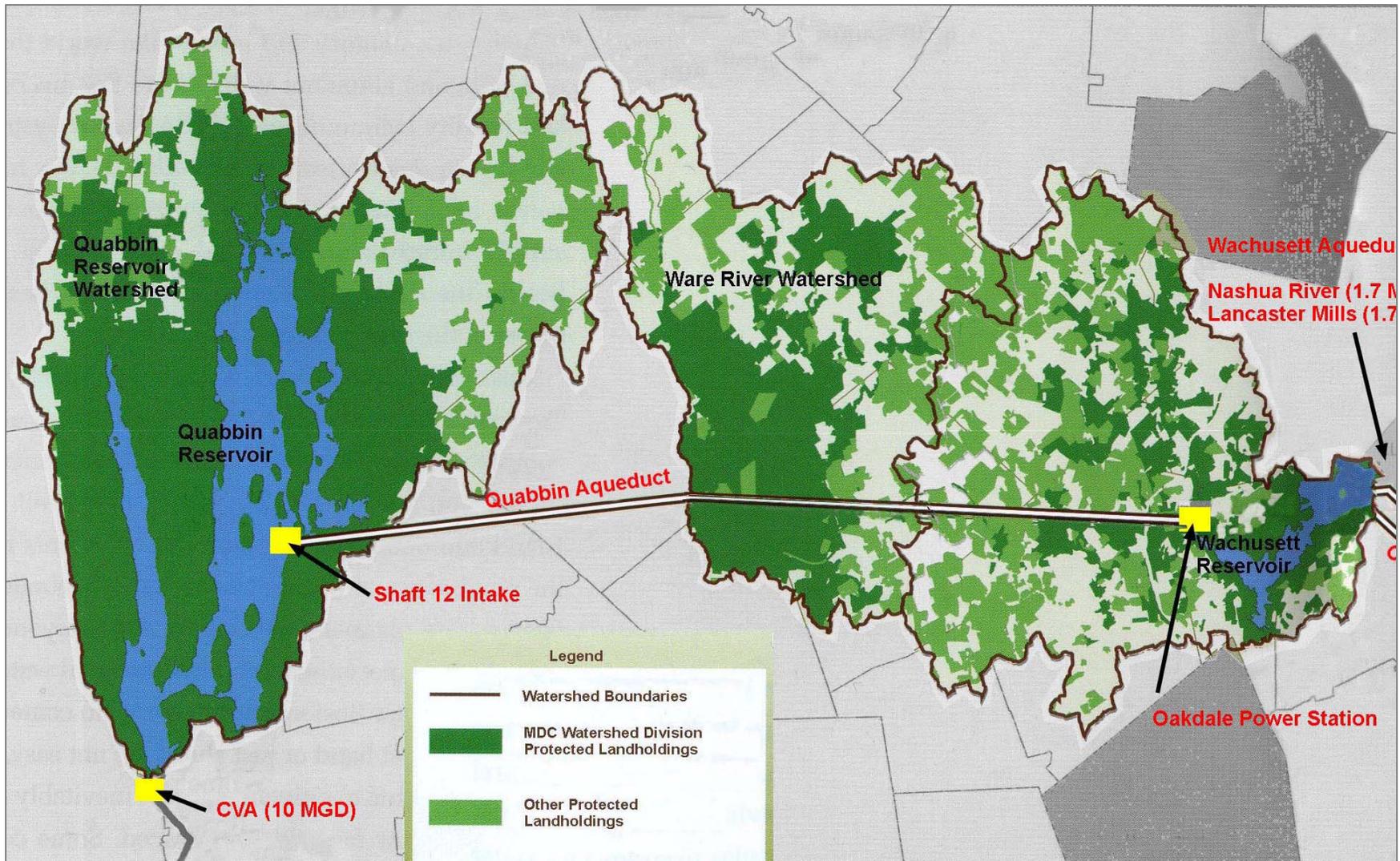


Protection Overview

- Aggressive Land Acquisition and Control
 - Wachusett Watershed – From 7% to 30% Owned
 - Overall - 43% Directly Owned, Plus 20% More
 - Total of 75% Owned, Protected from Development or Controlled by Regulation
- Critical Areas Sewered – Discharge Out of Basin
- Virtual Elimination of Cattle and Intensive Agriculture
- Water Fowl and Aquatic Mammal Management
- Public Access Restrictions and Watershed Rangers
- Water Quality Monitoring and Response Actions
 - Low levels of pathogens
 - Little response to storm water



Watersheds Are well Protected, and Improving





Modern Treatment – Decision Process

- Dual Track Consent Order (1993)
 - Design Filtration AND
 - Improve Watershed Protection
 - Decide in 1998
- Ozonation w/ and w/o Filtration Designed,
- Upgraded Chlorine/Chloramine As Well
- 1998 Decision -- Resources Allocated by Priority
 - Ozone/chloramination
 - New Tunnel
 - Cover Reservoirs
 - Pipeline Rehabilitation



Modern Treatment – The Plant

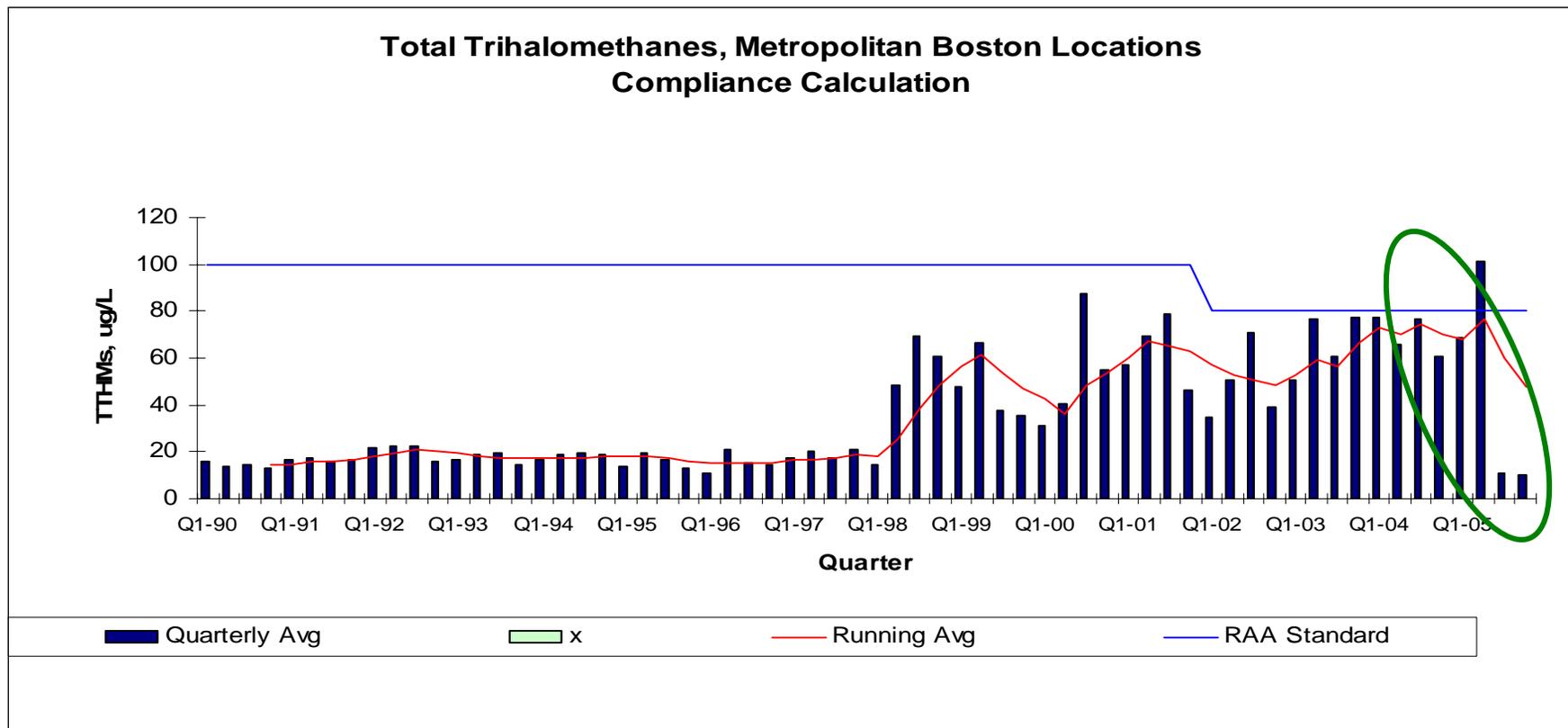
- 405 MGD John J Carroll WTP in service July 27, 2005
- Chlorine Replaced by Ozone as primary disinfectant
- Treatment Consolidated From 3 to 1 locations
- Chloramines for Residual Disinfection
- Corrosion Control and Fluoridation





Modern Treatment – The Results

- 2-log *Cryptosporidium* Inactivation Target
- 90% Reduction in THMs
- Better Taste and Odor Control





Modern Treatment - Next Steps

- Will Easily Comply With Stage 2 D/DBP Rule
- Long Term 2 Enhanced Surface Water Treatment Rule will require:
 - Second Primary Disinfectant
 - Nationally Based Disinfection CT Requirements
- MWRA Plans to Add Ultraviolet Light Disinfection
 - Watching NYC Closely



Upgrading the Transmission System

- MWRA Owns About 150 Miles of Tunnels and Aqueducts
- Focus On The Single Most Vulnerable Link
- Review and Assessment of Other Elements
- Much Longer Term Plans For Upgrading Them



Inadequate Transmission System

- In 1936, the Legislature approved the construction of a two barreled high-pressure aqueduct to deliver water to the greater Boston area
- One barrel of the aqueduct system - the Hultman Aqueduct - was completed
- But work on the second barrel did not resume after World War II
- Since then, 85% of Boston's water supply was provided without redundancy





Hultman Aqueduct Leaked as Well

- 18 Significant Leaks Along the 19 mile Length
- Could Not be Taken Out of Service for Inspection or Repairs
- Appurtenant Facilities in Poor Condition
- Fear of Undermining and Catastrophic Failure





Repairs to the Worst Leak Gingerly Undertaken





Contingency Planning for Catastrophe

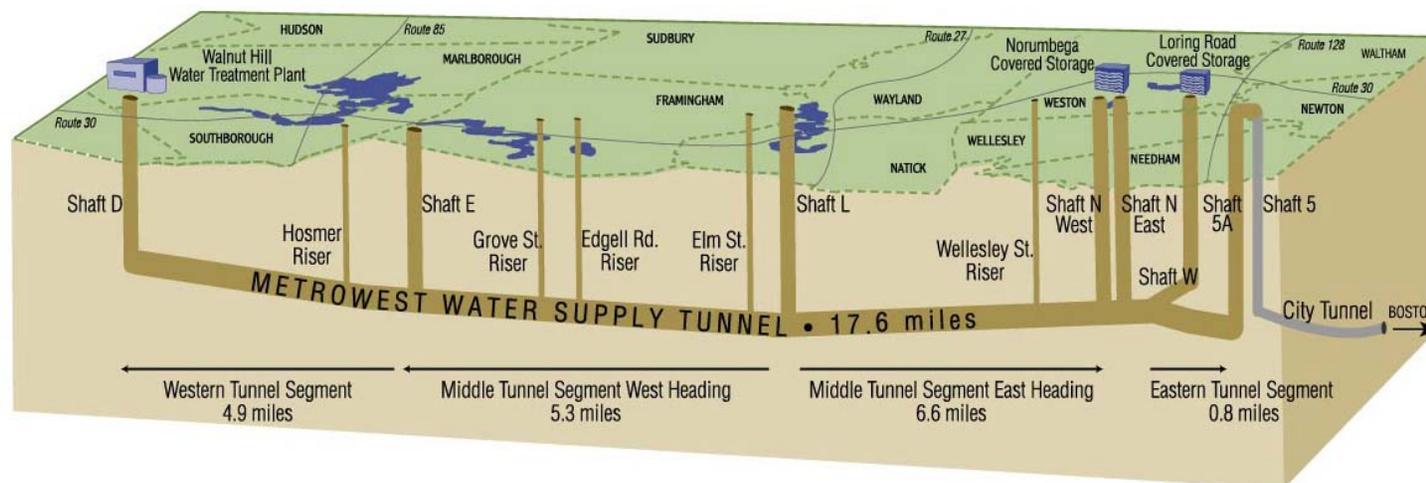
- Detailed Response Plans Developed
- Drills Conducted - Table Top and Full Field Exercises
- Closure Pieces and Enough Pipe to Start Repairs Pre-Purchased
- Still Not Nearly Enough for Peace of Mind





MetroWest Water Supply Tunnel

- 17.3 miles long
- Constructed 1995 to 2003
- Cost \$680 million
- Connects new WTP and new covered storage





Connection Planning Critical

- Connecting New to Old Was a Major Effort
- Significant Investment in Temporary Facilities
 - Interconnects
 - Disinfection
 - Disposal of Water
- Capacity Analysis Forced Work During Winter Months
- Detailed Contingency Planning
- Missing Drop Dead Date for Start Would Have Caused a Full Year Delay in Start-Up

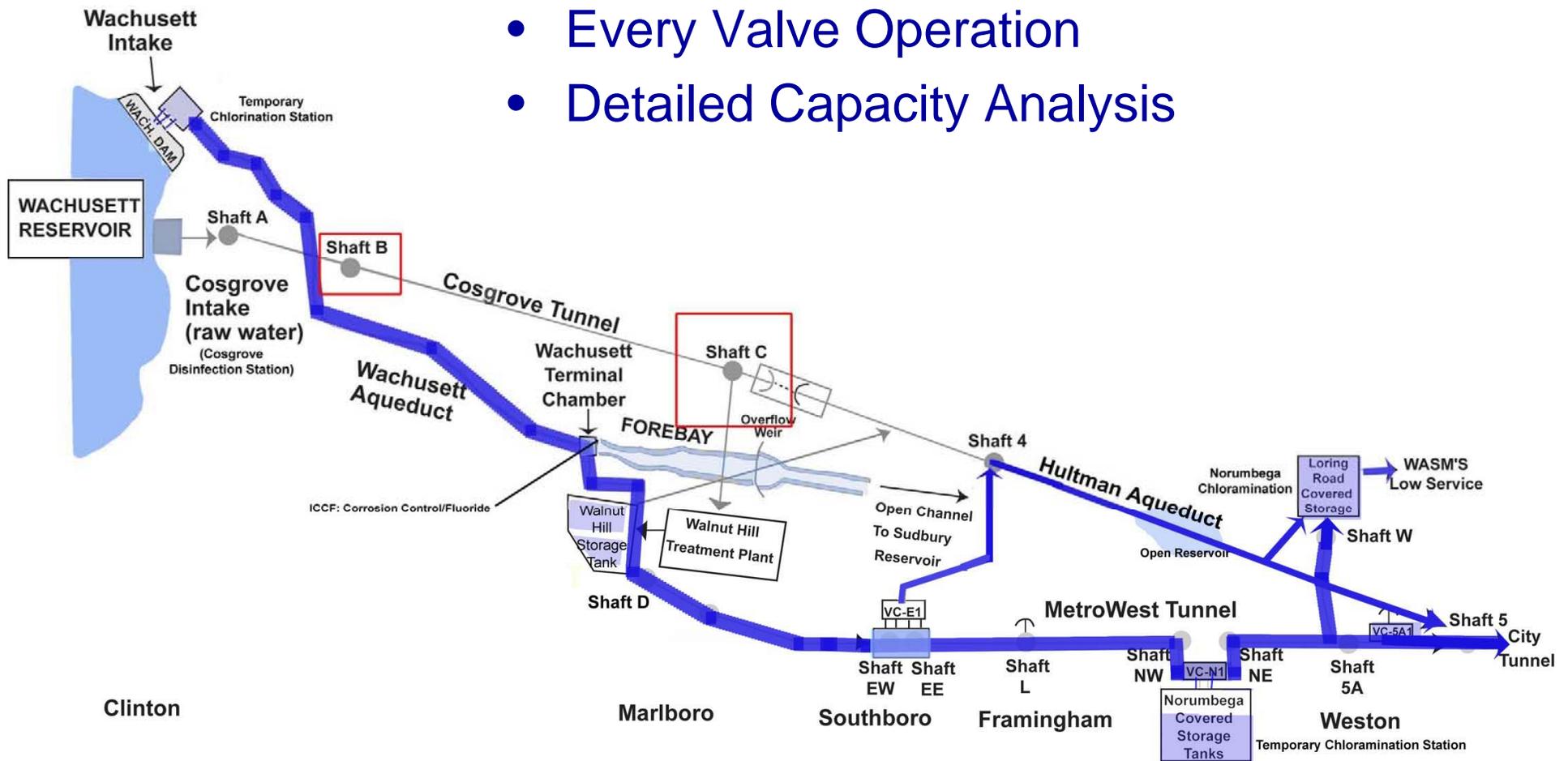




Phase 2

Detailed Planning For Connections and Transitions

- Hour by Hour Analysis
- Every Valve Operation
- Detailed Capacity Analysis





Rehab Hultman and Interconnect

- Don't Make Same Mistake Again
- Full Inspection and Rehab of Old Conduit
- Several Interconnection Points
- Ability to Do Partial Shut Downs of Both New Tunnel and Old Aqueduct
- Run Both in Parallel





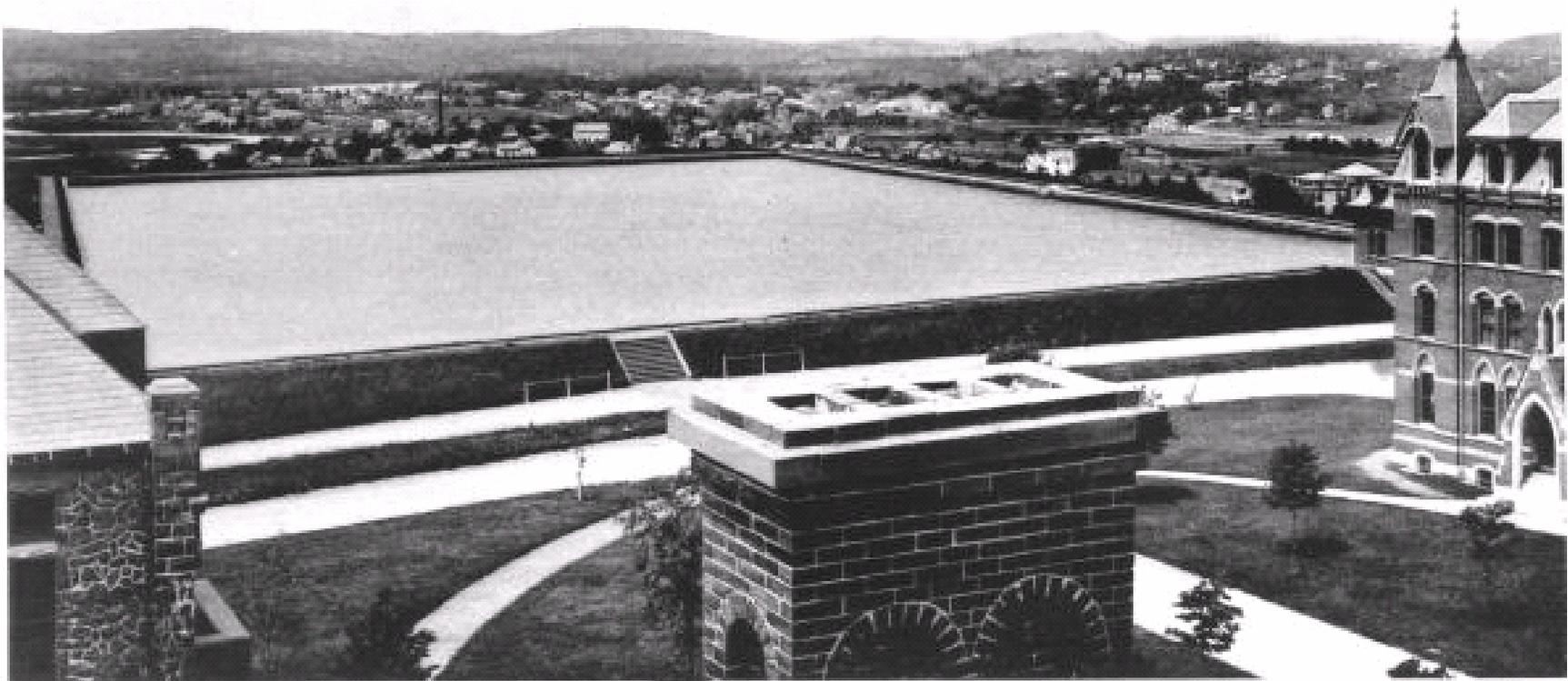
Open Reservoirs Offer Opportunities for Degradation

- Classic Unfiltered System Design
- Modern Water Quality and Security Concerns
- People, Animals, Pathogens and Chemicals
- Just Plain Changed Chemistry





Same As It Always Was





New Covered Storage

- From 10 Days Open Storage to 1 Day Covered Storage
- 6 Major Tanks from 20 to 115 million gallon capacity
- More Stable Water Quality
- Reduced Use of Chlorine
- Better Total Coliform Results





Buried Tanks Become Meadows





Pipes Are a Weak Link

- In 1993, Median Age of MWRA pipes was 85 years
- Over 80 Percent Unlined
- Half of valves were suspect
- More than half of community pipes were unlined
- Rehab of 2.5% per year on MWRA
- \$250 Million Zero-Interest loan program for community pipes





A Few Other Important Topics

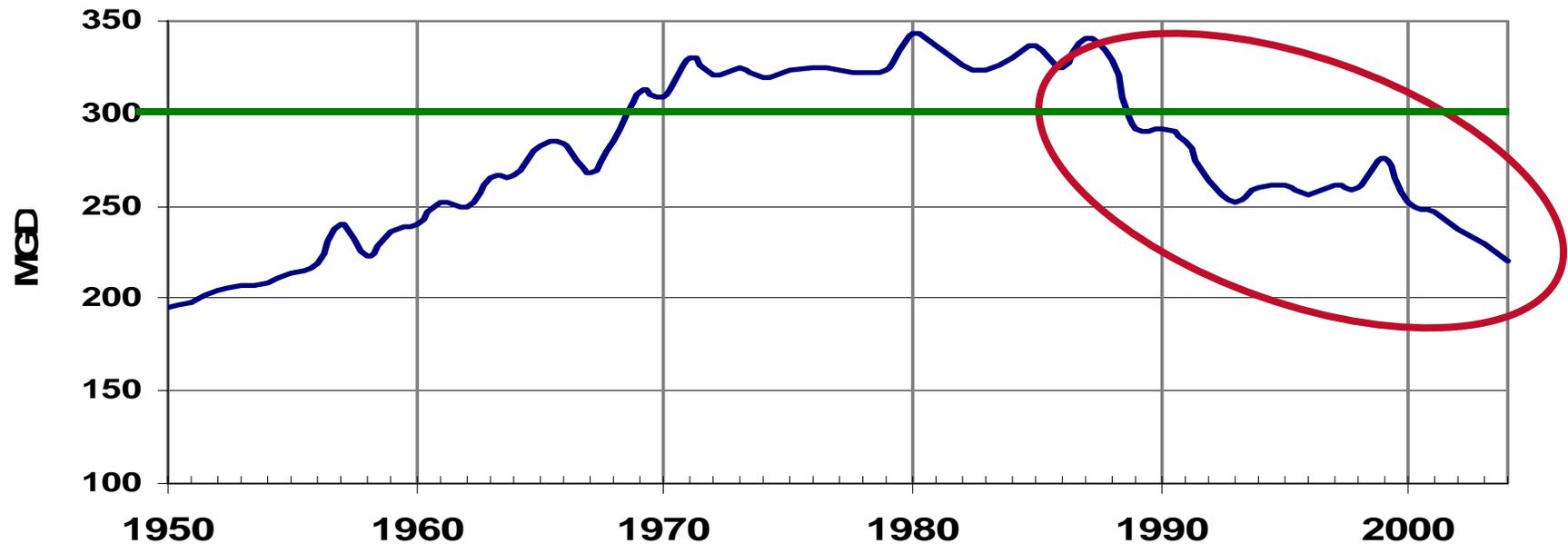
- Monitoring and Communicating Changes in Water Quality and Health Outcomes
- Demand Management Controls Future Costs and Adds Flexibility
- Transition From Capital Project Delivery Focus To a Well Functioning Maintenance Oriented Agency



Dramatic Reductions in Demand Reduce Cost and Anxiety

- From 10% over Safe Yield to Almost One Third Under
- Treatment Plant Down-sized
- No Supply Plans On Books, In Fact, Looking For New Communities

MWRA Annual Average System Demand



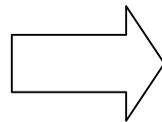


Demand Management Strategy

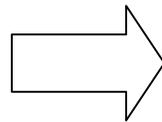
WATER USE

Residential Toilet Shower Laundry Kitchen Tub & Sink Outdoor
Industrial Commercial Institutional Process Cooling Sanitary
Unaccounted For Water Leakage Meter Errors Public Use Other

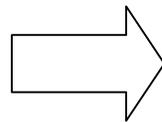
Problem



Inefficient Fixtures
Poor Water Habits

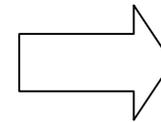


Inefficient Fixtures
Once Through Cooling
Inefficient Process Use

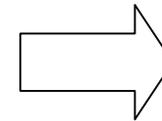


Leakage
Meter Errors

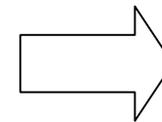
Response



Retrofit Fixtures
Public Education
School Education
Efficient Technology



Technical Assistance
Water Audits
Technology Transfer
Training & Education

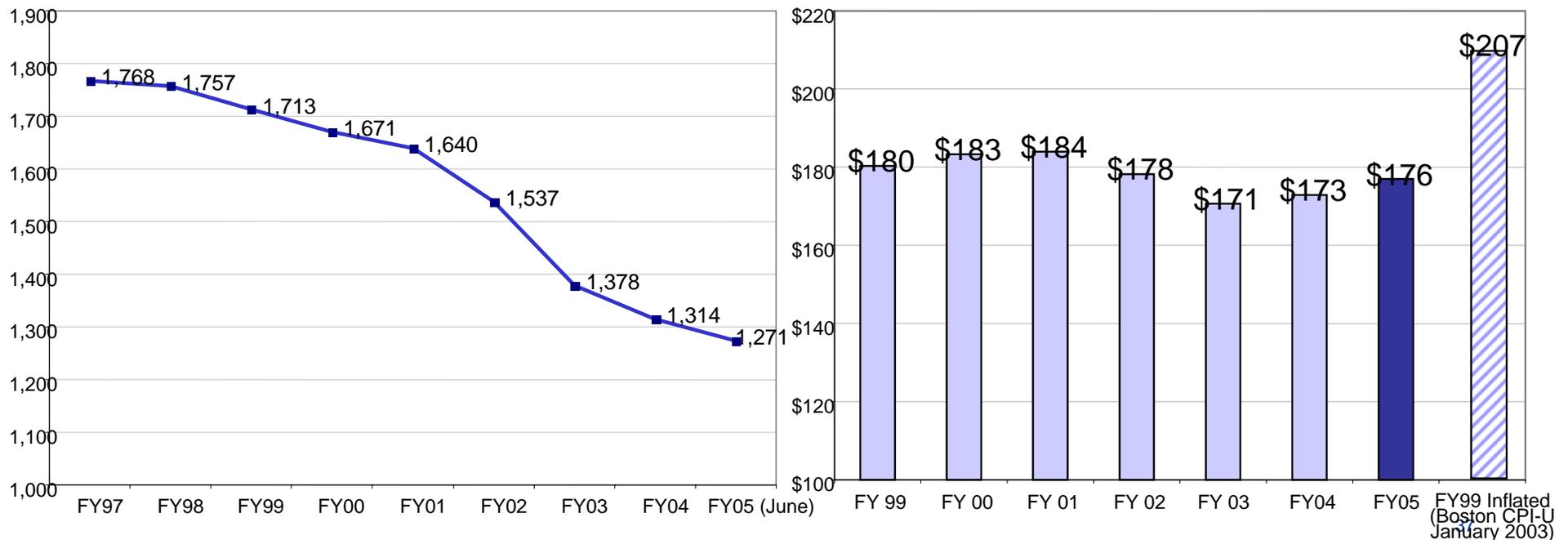


Leak Survey & Repair
Test/Replace Meters



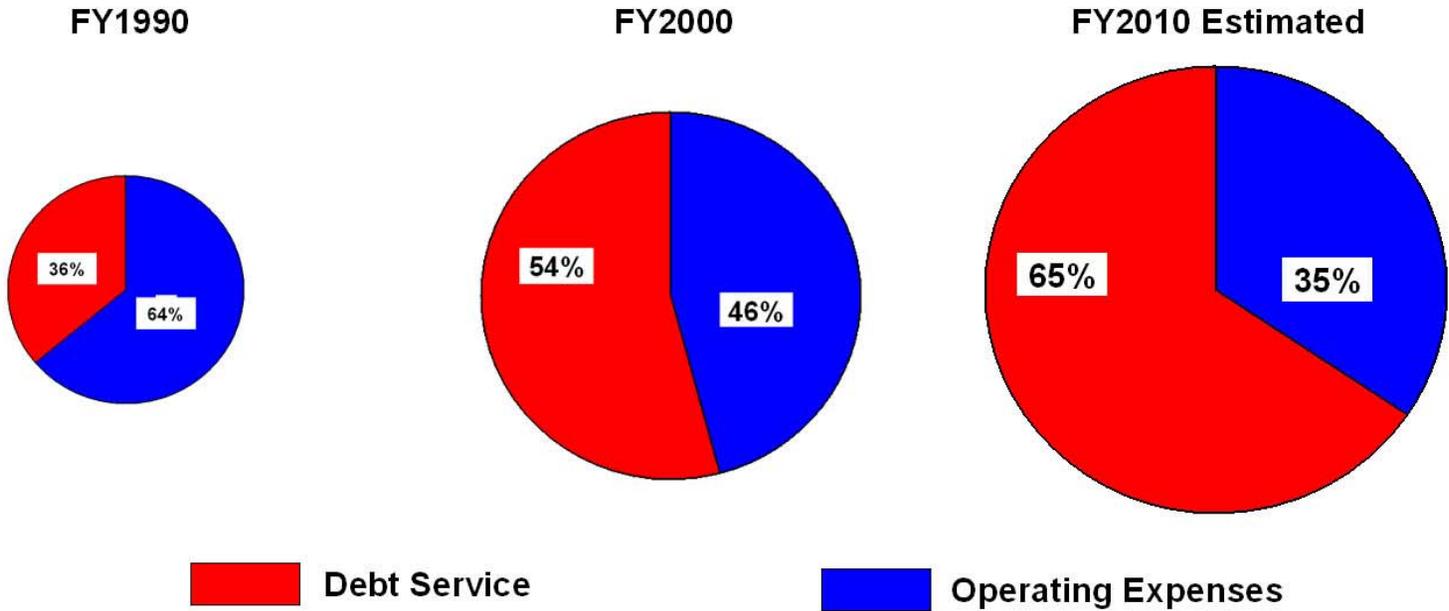
Investment Produces Rates Management Questions

- Staffing Reduced Primarily Through Attrition and Retirement
- Current Expense Budget Holding Steady, But Shrinking in Real Dollars
- Careful Tracking of Hundreds of Measures to Ensure No Loss of Service or Backsliding on Maintenance





Even With Cost Control, Rates Will Rise





Our Bottom Line

- Safe Reliable Water - Today and Tomorrow
- Satisfying our Customers Needs At a Fair Cost
- Decisions Made on Good Science and Sound Public Policy
- Keeping our Priorities Straight

Questions or Comments?

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