Massachusetts Water Resources Authority

ASSOCIATION OF METROPOLITAN WATER AGENCIES

MWRA Response to Pipe Break on May 1, 2010

An AWMA Case Study

Frederick A. Laskey
Executive Director

October 18, 2011

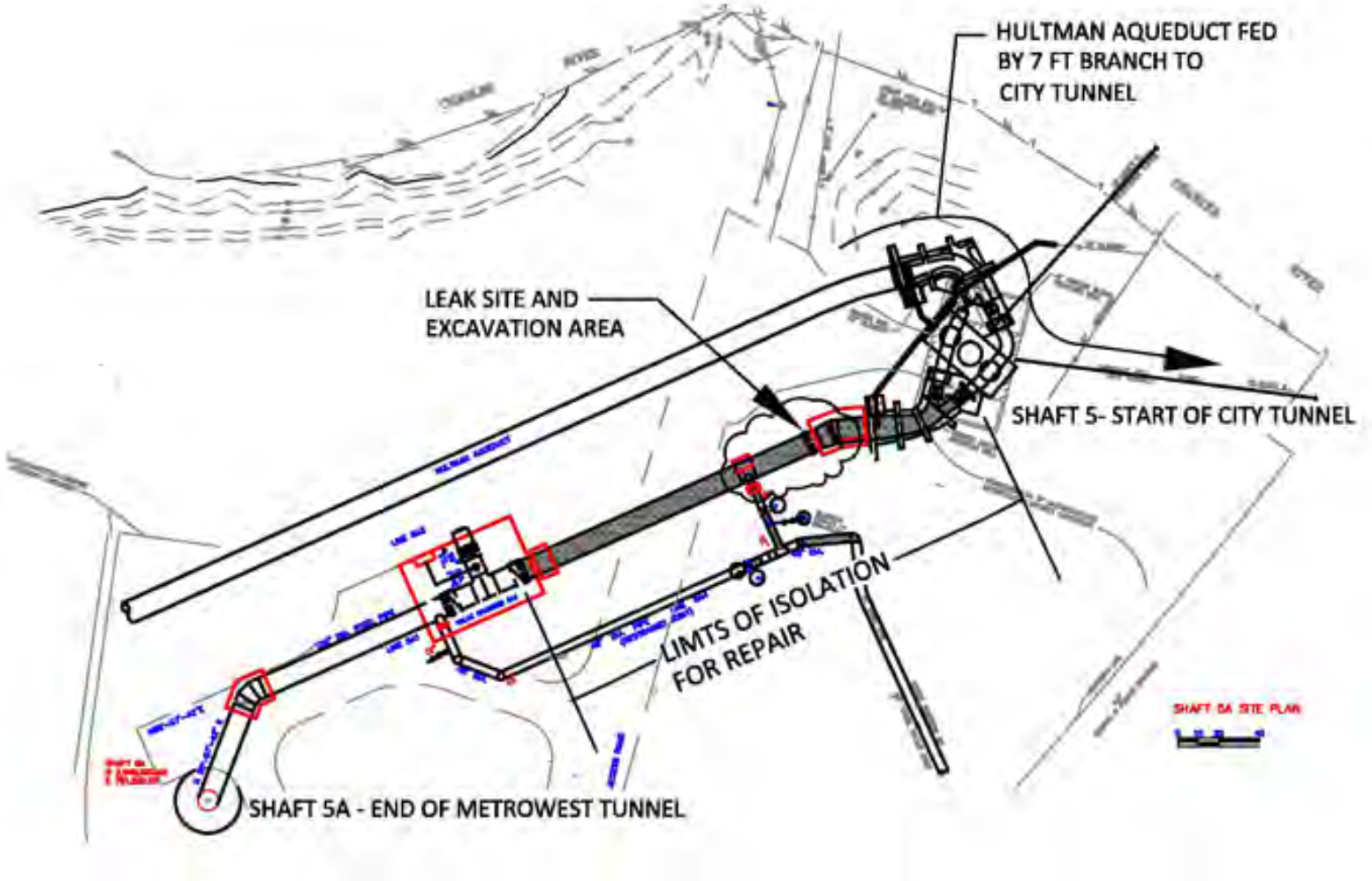
MWRA Service Area

- MWRA provides wholesale water and wastewater services to over 2.5 million customers in 61 communities
- On average, MWRA delivers 200 million gallons per day to its water customers
- MWRA collects and treats an average of 350 million gallons of wastewater per day, with a peak capacity of 1.2 billion gallons

INCIDENT OVERVIEW

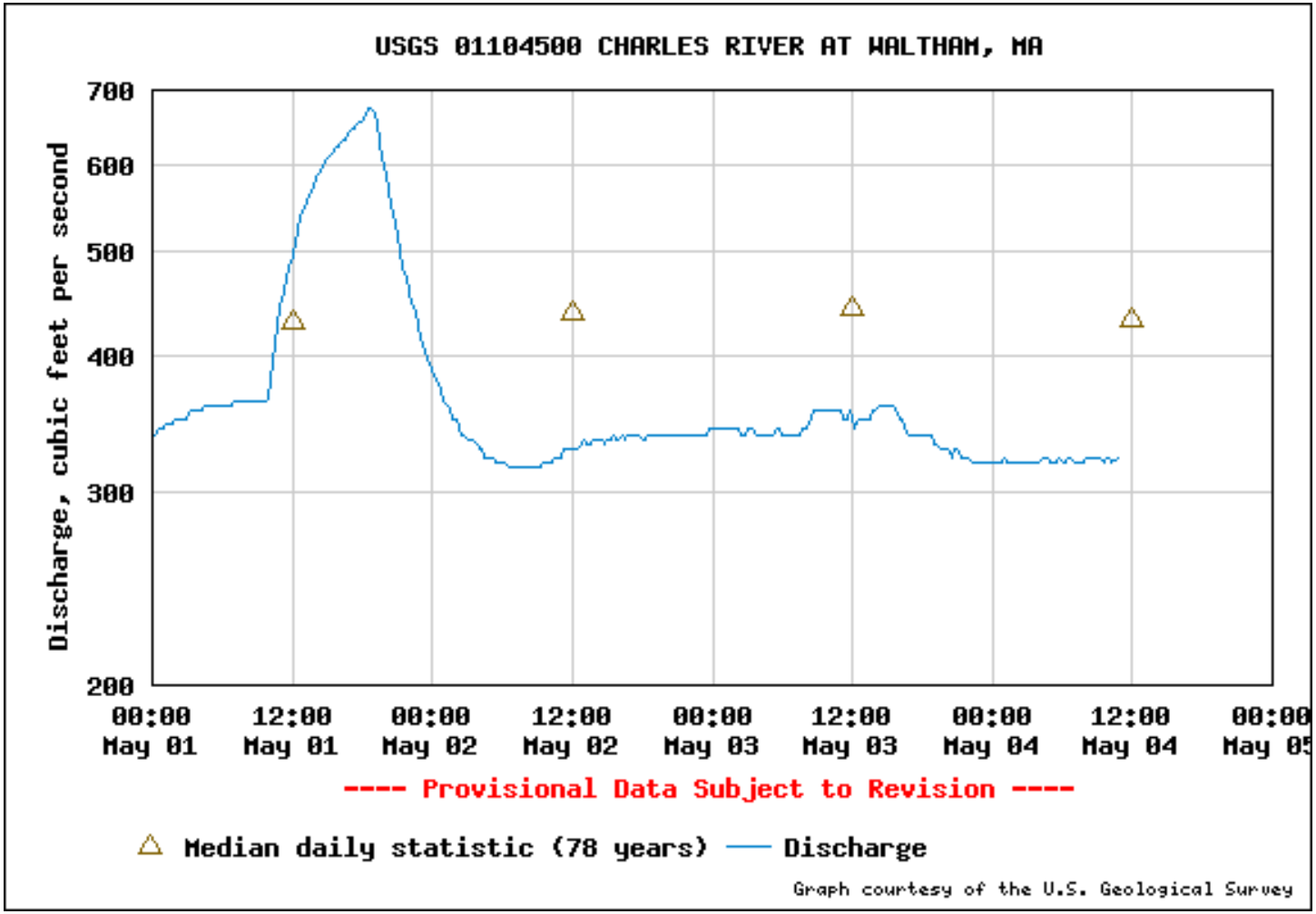
Surveillance Camera Captures Leak

Shaft 5 Break Site



Changes in Flow

Charles River Flow Impacts



Charles River Flow Impacts

Immediate Operational Response

- Increase plant flows (match flow to demand) to mitigate loss of storage in the Norumbega Reservoir
- Shut down Cosgrove Turbine to avoid potential impacts
- Metropolitan system operation stable and decision to continue flow through the break site
- Began contacting local water officials including partial user communities and request use of local sources (Bedford, Woburn, Wakefield, Wellesley, Needham, Peabody, Wilmington, Stoughton)
- Coordinate/control tank fillings to regulate flow (Blue Hills, Loring Road, etc.)

Communications

- Parties were quickly notified by phone or e-mail with a preliminary assessment of the incident and the potential impacts:
  - MWRA Staff
  - Board of Directors
  - Governor's Office
  - Department of Public Health
  - Department of Environmental Protection
  - Fire Marshall
  - MEMA

Member Community Notifications

- Water officials were kept up-to-date with:
  - Emails
  - Phone calls
  - MWRA's Reverse 911 system
  - Web updates
- State and local elected officials were also updated regularly

Full Force of the State Ensured Immediate and Accurate Messaging

- Governor and Mayor convened a meeting at the MEMA bunker that afternoon with
  - Secretary of Energy and Environmental Affairs
  - Secretary of Public Safety
  - MEMA and MWRA staff
- Governor's communications staff coordinated an interagency communications plan which quickly mobilized a massive outreach effort
- MEMA, DEP and DPH sent representatives to MWRA's Emergency Operations Center (EOC) for the duration of the incident
- DEP Commission and staff worked closely with MWRA staff on water quality sampling

Extensive Media Coverage

Extensive Media Coverage

- All local media outlets remained at the site throughout the event and provided up-to-the-minute reports
- TV stations scrolled alerts 24/7
- Radio and print provided detailed information

MEMA Activated HHAN Alert System

- MEMA utilized the Health & Homeland Alert Network (HHAN) and coordinated with MassDOT to place signs along highways

- MBTA made announcements in subway stations

- MEMA coordinated bottled water distribution within communities

City of Boston Quickly Mobilized

- City of Boston opened its emergency centers and utilized police cars with megaphones to alert residents

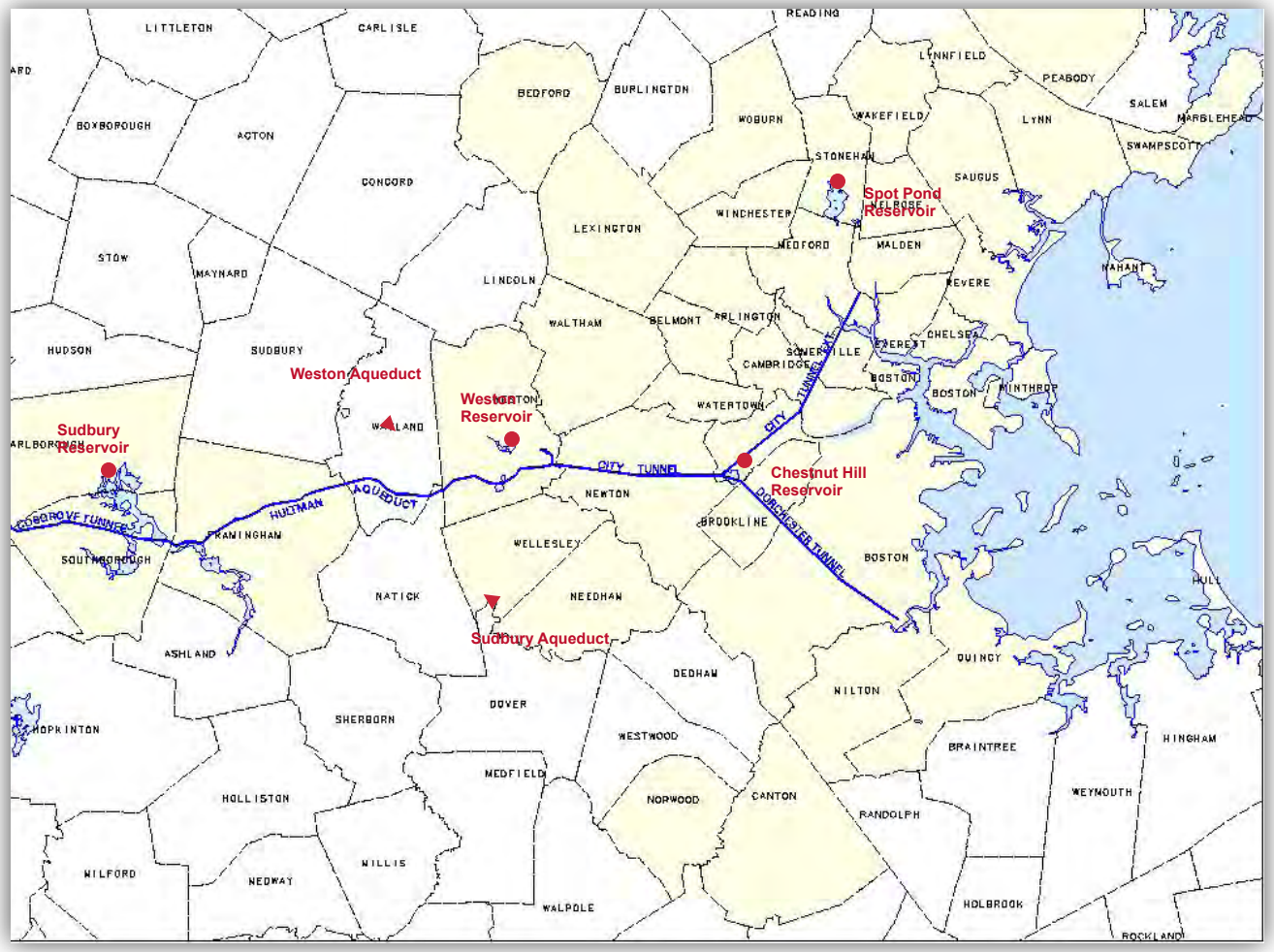
MWRA Member Communities' Response

- 20 of the affected communities utilized their Reverse 911 systems during the incident

- Community water samplers were reached and dispatched to take multiple samples on Sunday

EMERGENCY BACK-UP SUPPLY

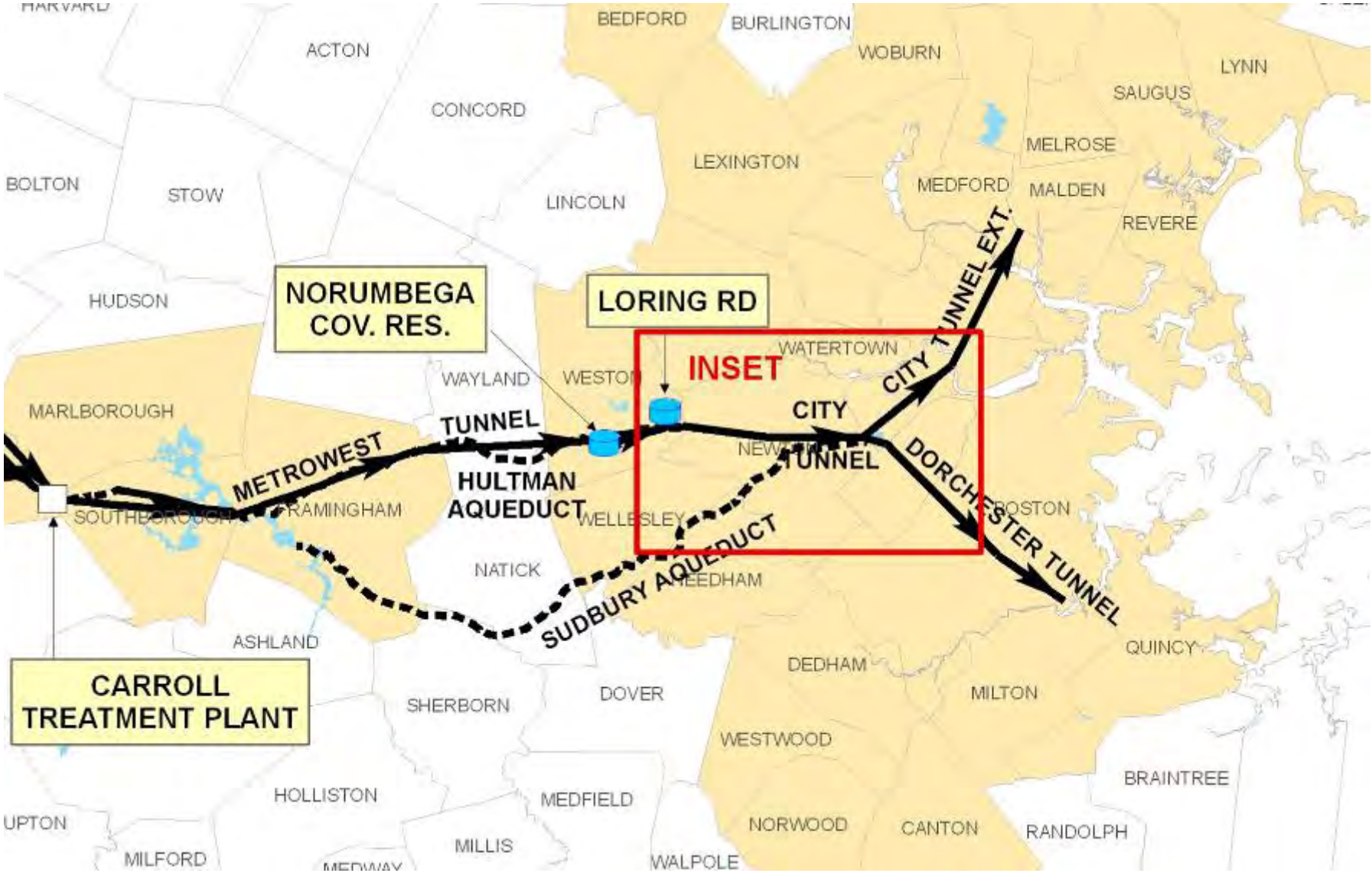
Back-up Facilities



Normal Flow


BEDFORD
BURLINGTON
WOBURN
LYNN
SAUGUS
ACTON
CONCORD
MELROSE
LEXINGTON
BOLTON
STOW
MEDFORD
MALDEN
LINCOLN
REVERE
CITY TUNNEL EXT.
HUDSON
NORUMBEGA COV. RES.
LORING RD
WATERTOWN
WAYLAND
WESTON
MARLBOROUGH
TUNNEL
CITY
METROWEST
TUNNEL
DORCHESTER TUNNEL
HULTMAN AQUEDUCT
SOUTHBOROUGH
FRAMINGHAM
WELLESLEY
BOSTON
NATICK
NEEDHAM
SUDBURY AQUEDUCT
ASHLAND
QUINCY
CARROLL TREATMENT PLANT
DEDHAM
DOVER
MILTON
SHERBORN
WESTWOOD
BRAINTREE
HOLLISTON
MEDFIELD
UPTON
NORWOOD
CANTON
RANDOLPH
MILLIS
MILFORD
WALPOLE

Normal Flow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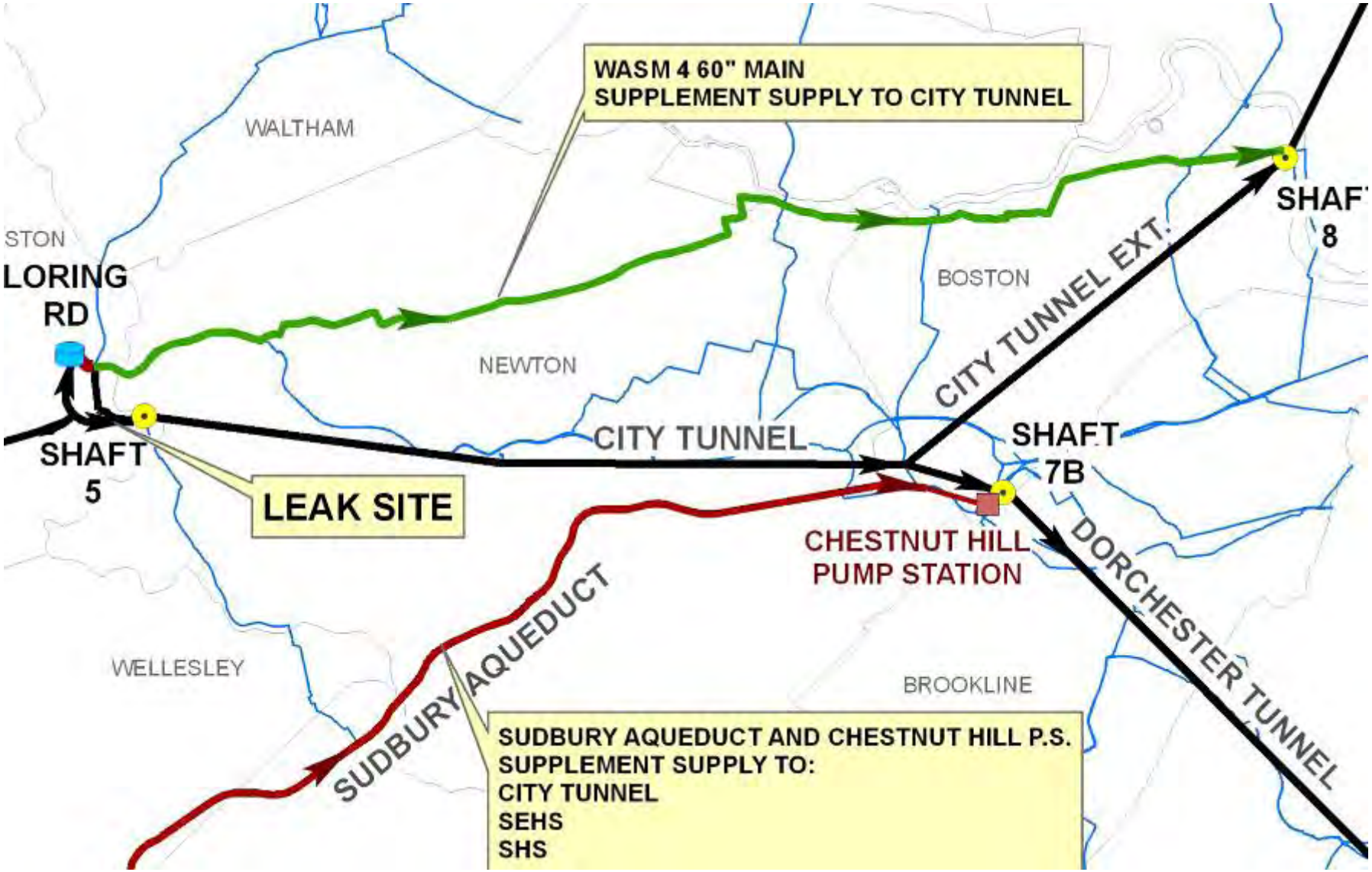
Diverted Flow After Leak



Sudbury System/Chestnut Hill Emergency Pump Station

- Hydraulic grade lines below targets – fire protection
- Fear of catastrophic failure at break site
- Fear of loss of backpressure necessary to start Chestnut Hill Pumps Station and air intrusion in system
- Imminent loss of power at Shaft 5 resulting in significant delay if shut down

Sudbury System/Chestnut Hill Emergency Pump Station

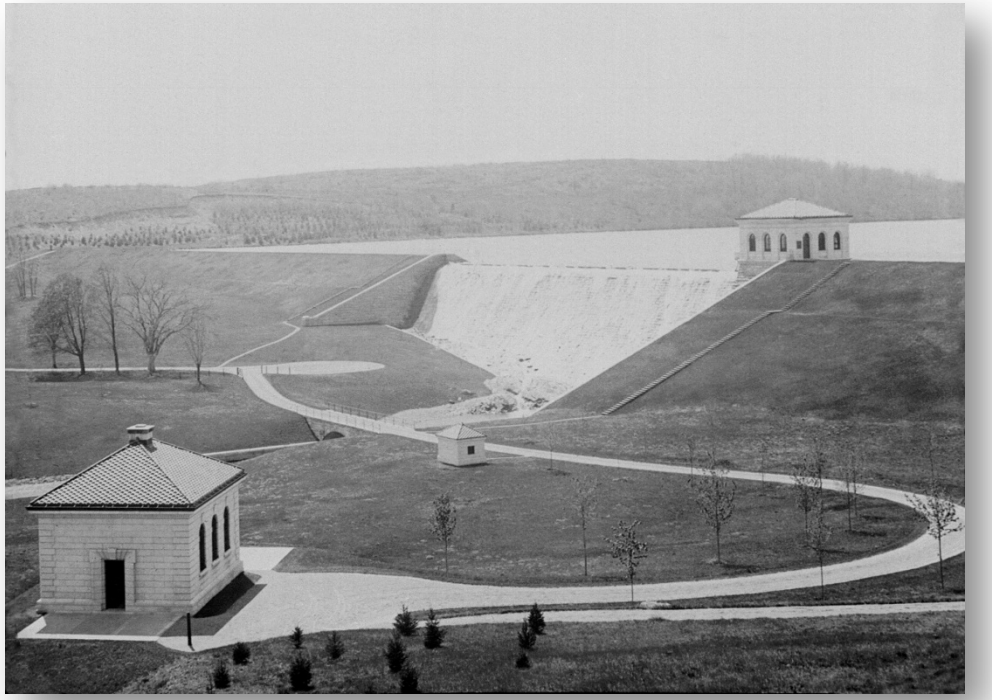
- May 1
  - Operated for 7 hours
- May 2
  - Operated for 8 hours
- Sudbury Aqueduct
  - Activated May 1, shut down May 4, 9:30 AM
  - Transferred approximately 90 million gallons

The Sudbury System

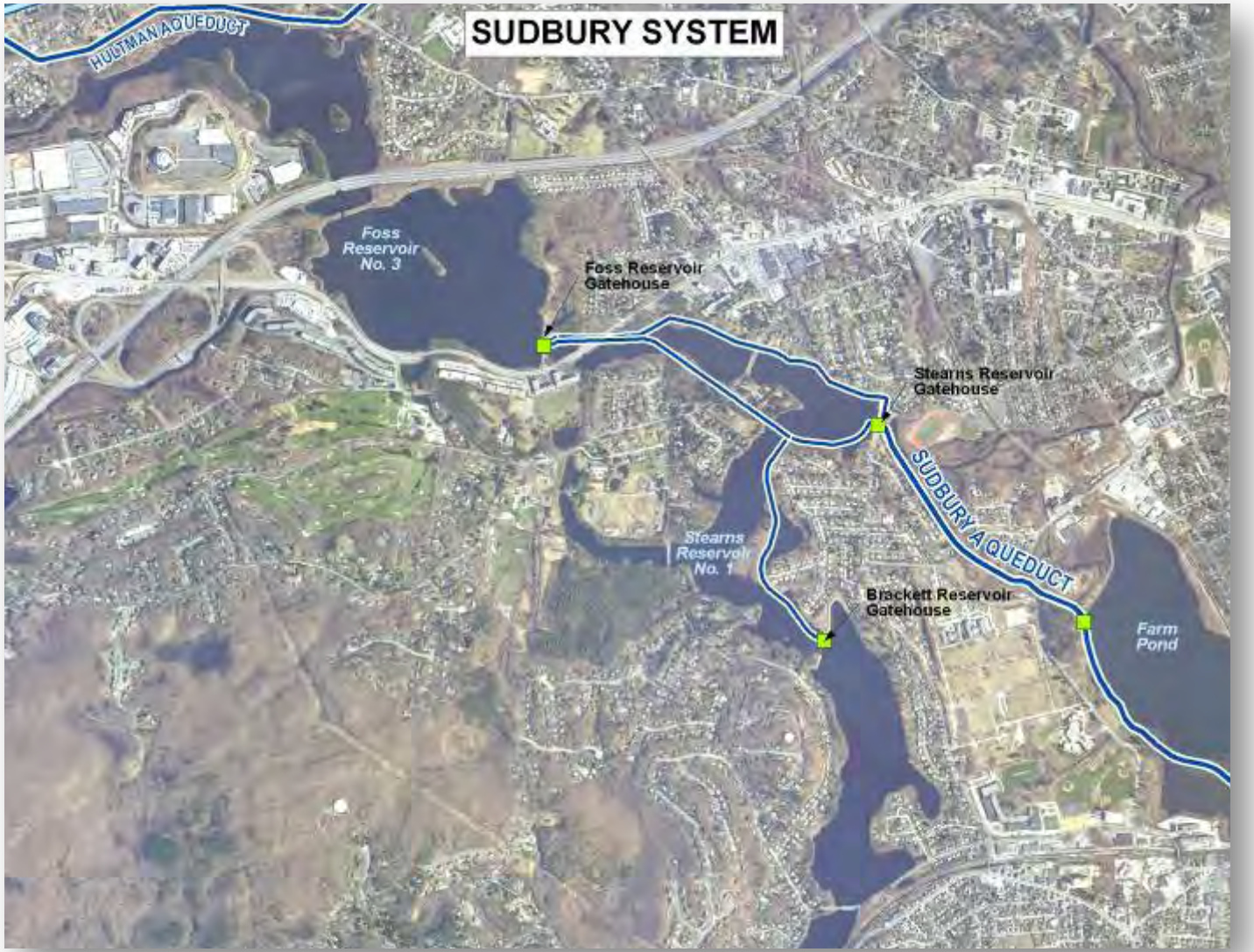
- In 1878, the Sudbury River, 18 miles from Boston, was diverted through the Sudbury Aqueduct to the Chestnut Hill Reservoir

- By 1898, the Fayville Dam and the Sudbury Reservoir were completed

- The Sudbury system was used until 1980, when the Dorchester Tunnel was completed



Sudbury System



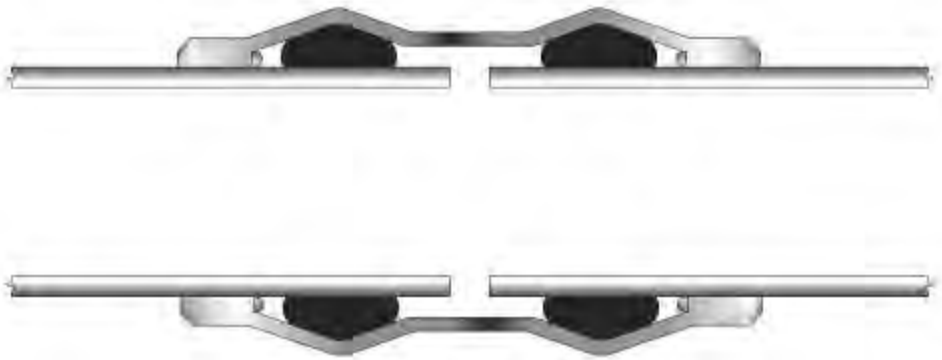
Chestnut Hill Reservoir

Spot Pond Reservoir Was Also Made Ready

- Staffed, all valving reset and chlorine delivered May 1
- Could have provided another 30-40 million gallons per day

PIPE BREAK AND REPAIR

Coupling



Dewatering

Top of Pipe

Pipe Joint

Installing New Strap

Welding Strap in Place

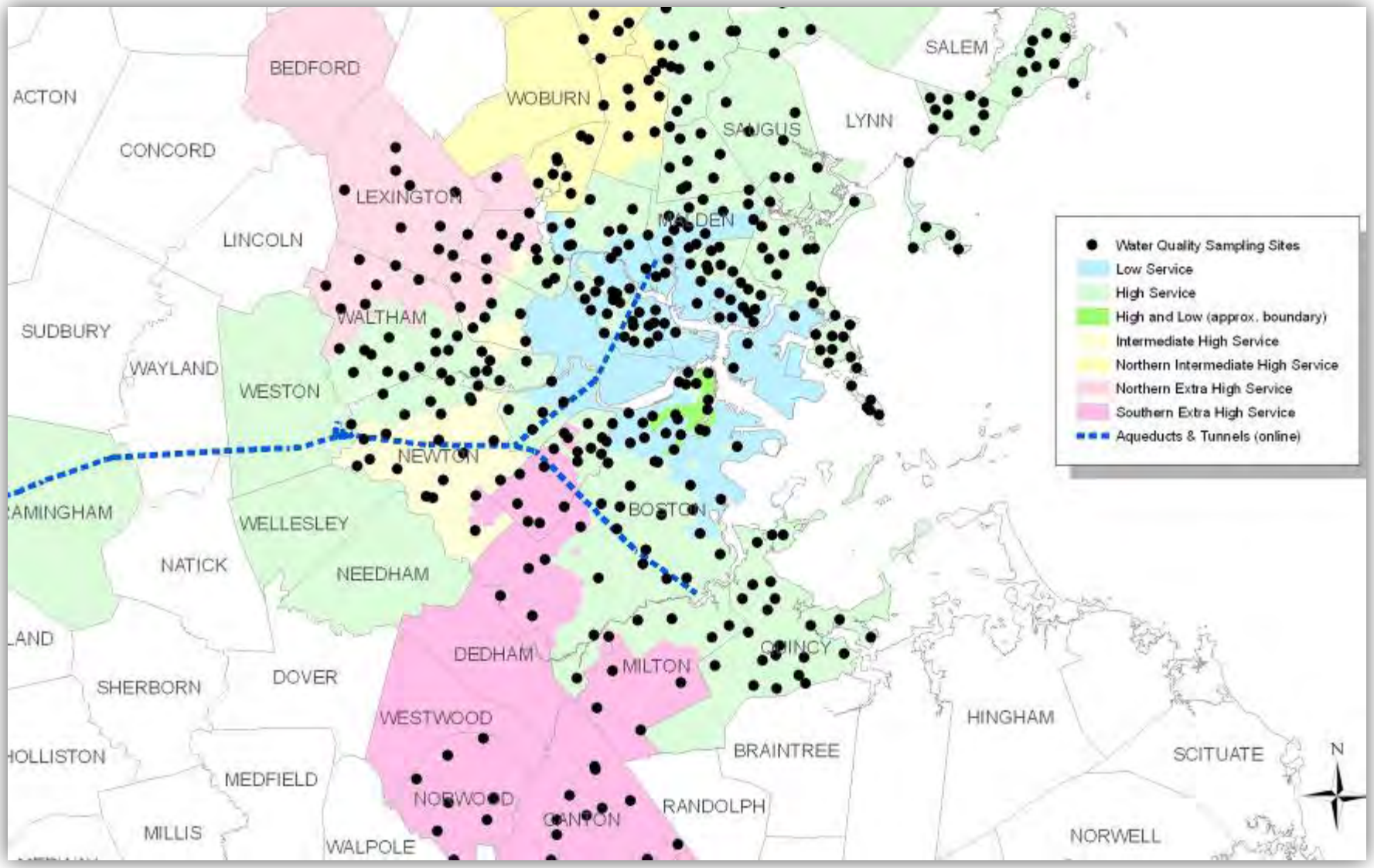
Concrete Cradle Poured

WATER QUALITY

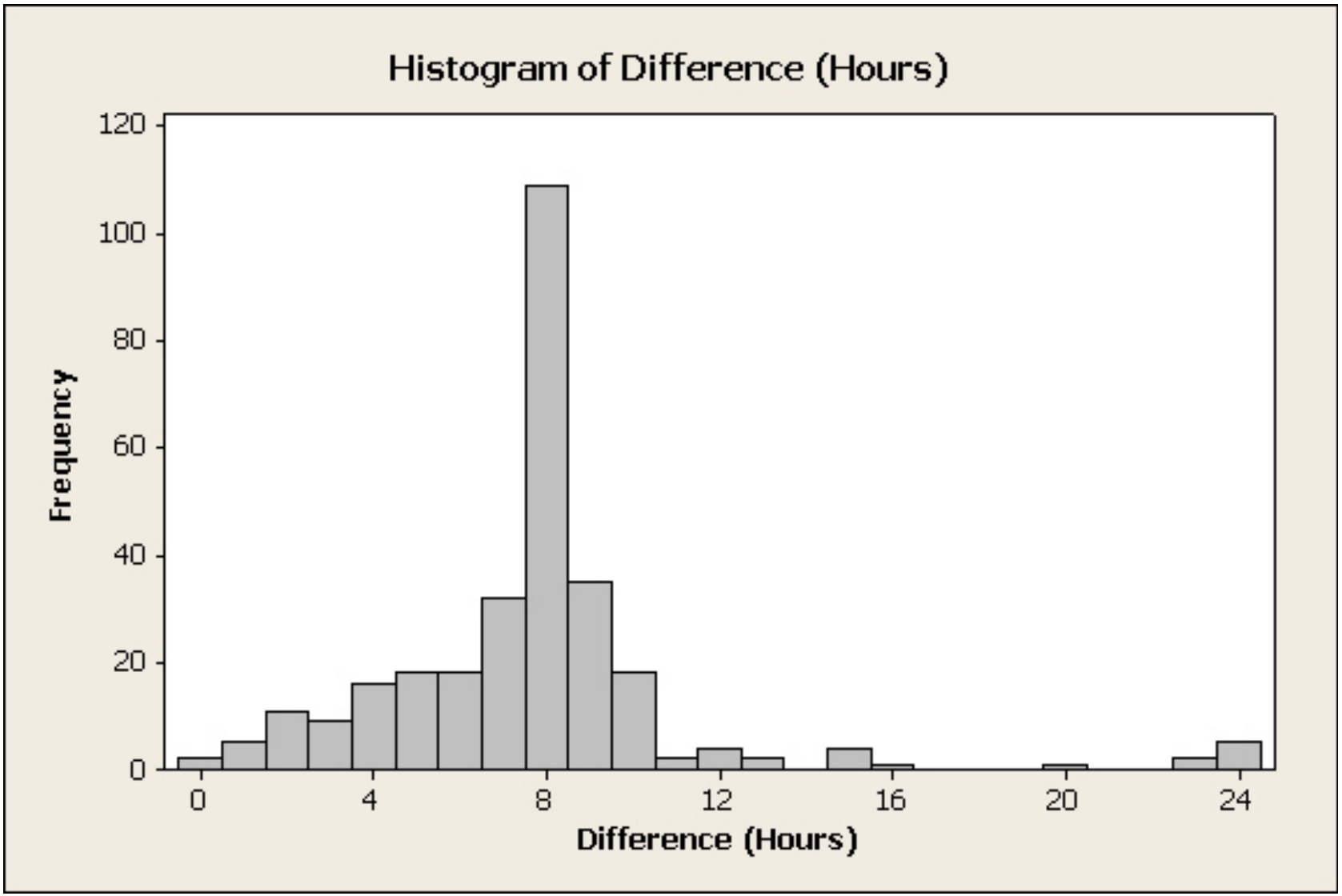
Boil Order

- Worked with DEP to determine criteria for lifting the boil order
  - Agreed to conducting two rounds of coliform sampling each Sunday and Monday (continuing as needed)
  - About 400 samples per round - Each round represents a normal week of sampling
- Test results include total coliform, E. coli, and chlorine residual
- Agreed with DEP that two rounds of samples about 8 hours apart would allow boil order to be lifted
- Communities contacted Sunday morning to collect two rounds of samples

Sampling Locations



Sample Collections Averaged 8 Hours Between First and Second Rounds



Boil Order Lifted

- Last of Sunday sample results were available at approximately 1 am Tuesday
- DEP set up emergency operations at MWRA facility to monitor results
- Boil order for all 30 communities lifted at about 7 am Tuesday

INVESTIGATION AND INDEPENDENT REVIEW PANEL

Components Recovered

- Rubber gasket and insulating pad from coupling

Components Recovered

- One complete bolt and pieces of other

Components Recovered

- Both halves of coupling

Independent Panel Review

- MWRA Board voted at its May 6, 2010 meeting to appoint an independent panel of experts
  - Chair: Zorica Pantić, President of the Wentworth Institute of Technology
  - Ronald Ballinger, Professor of Nuclear Science and Engineering and Materials Science and Engineering at the Massachusetts Institute of Technology and Director of the H. H. Uhlig Corrosion Laboratory
  - John H. Bambei, Jr., Chief of Engineering for Denver Water and Chairman of the American Waterworks Associations' Standards Committee on Steel Pipe since 2004

Independent Panel Report

- MWRA received the Panel's report in May 2011
- Panel determined that the cause of the coupling failure was the studs
- Lawsuit has been filed against several parties


MWRA MetroWest Water Supply Tunnel Shaft 5A Pipe Break
Pipe Failure Scenario Report

May 2011

Prepared By:

Zorica Pantić
Wentworth Institute of Technology

Ronald G. Ballinger
Massachusetts Institute of Technology

John H. Bambei, Jr.
Denver Water

EMERGENCY RESPONSE PREPARATION

Emergency Planning

- MWRA has developed and maintains contingency or emergency plans for a wide range of events, including:
  - 140 Individual Emergency Action Plans for each of MWRA's facilities and events
  - Emergency Service Unit plans for responding to water contamination
  - Specific plans for reactivating backup facilities
  - Continuity of Operations Plan
  - Emergency Plans for all MWRA Dams
  - Integrated Contingency Plans for Deer Island and the Carroll Water Treatment Plant
  - Spill Control Plans

Training and Drills

- MWRA staff regularly participate in drills and training exercises
- These have included a 2006 exercise that specifically involved damage to Shaft 5 and the resulting need to activate the Sudbury Aqueduct
- Other training and exercises include:
  - Major yearly exercises
  - Monthly Emergency Service Unit drills
  - Boom Deployment drills using boats and other equipment
  - Mobile Disinfection Unit drills and deployments
  - Notification Drills

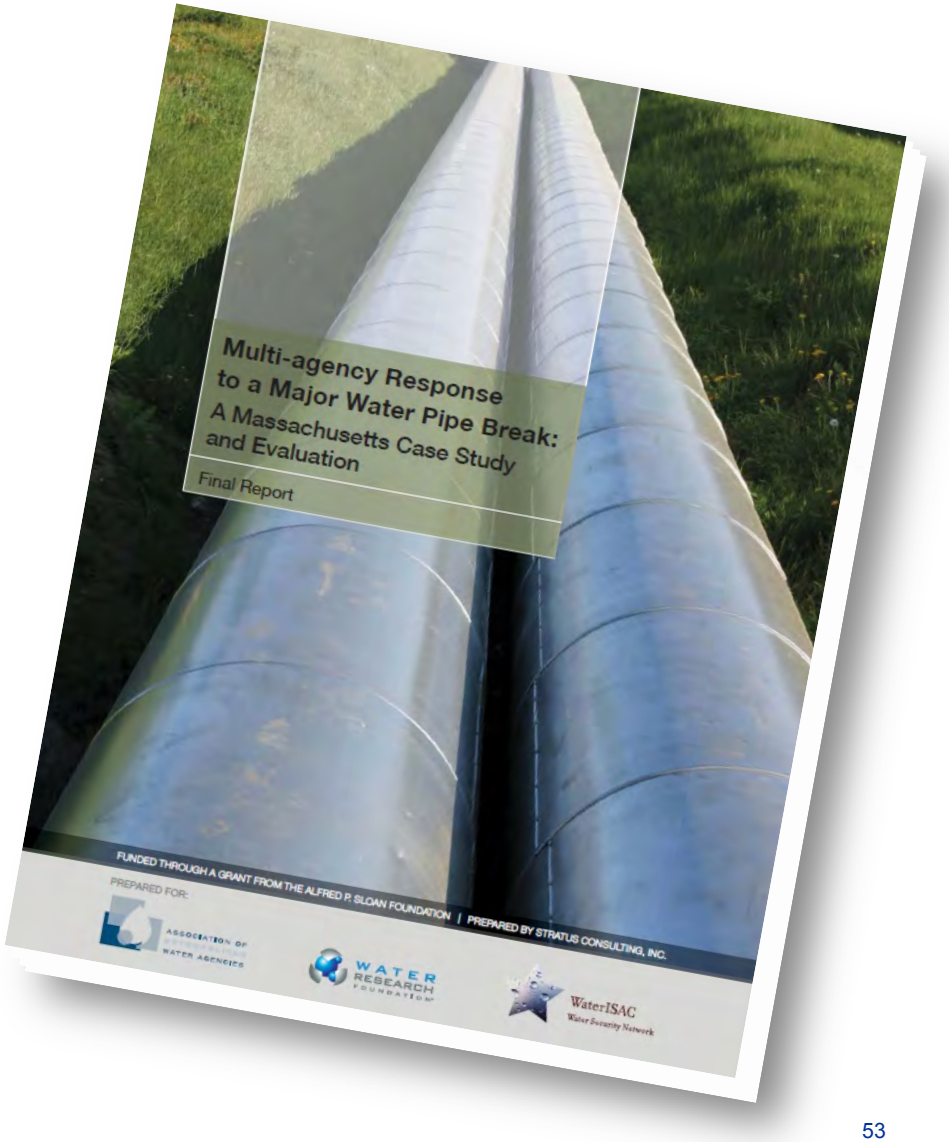
Emergency Equipment

AMWA STUDY

Case Study by AMWA, Water Research Foundation and ISAC

Principle conclusions:

- *Develop a "Security Culture"*
- *Nurture Relationships Before an Event, Not Just During an Event*
- *Develop a Strong Emergency Operations Center/Incident Command*



Principle Conclusions from Case Study Report

- Develop a "Security Culture"

  (1) conduct emergency response planning

  (2) emphasize drills and training

  (3) treat normal incidents as drills

  (4) learn the ERP, but also emphasize the importance of mindful response improvisation

  (5) review and revise the ERP, incident command structure, and associated emergency protocols after every emergency event

Principle Conclusions from Case Study Report

- Nurture relationships before an event, not just during an event
  - *Colleagues in different agencies and departments already knew and trusted each other*
  - *Had participated in drills together, collaborated with each other during other emergency and non-emergency events*
  - *Knew what to expect from one another*

(Mayor of Boston and Massachusetts Governor directly involved)

Principle Conclusions from Case Study Report

- Develop a Strong Emergency Operations Center/Incident Command
  - *implemented a command structure where the Massachusetts Governor was in charge of state operations, the Boston Mayor was in charge of the city's operations, MWRA's Executive Director was in charge of coordinating the Authority's operations with the state, and the MWRA Chief Operating Officer was the Incident Commander for MWRA*
  - *The greater Boston emergency response structure enjoys many positive characteristics, including*
    - *strong security cultures within agencies*
    - *well-trained staff*
    - *excellent interagency relationships*

Bottled Water Distribution

- Immediate promise of bottled water
- Procurement of so much water was problematic
  - 2 million people effected
  - About $500,000
- Handled by MEMA, National Guard, and Towns
- Distribution was difficult even though towns had plans
- Very different distribution models
  - General distribution
  - Targeted to d shut-ins and special populations
  - Consumer perception of bottled vs. boiled
  - Everyone wanted their “free water”

Principle Conclusions from Case Study Report

- Communications Practices
  - *Adopt a philosophy of transparency and frequent and varied communication. In many ways, the high degree of response transparency practiced by MWRA during the Shaft 5A incident enabled the media to become a literal partner in the emergency response.*

Communications Practices

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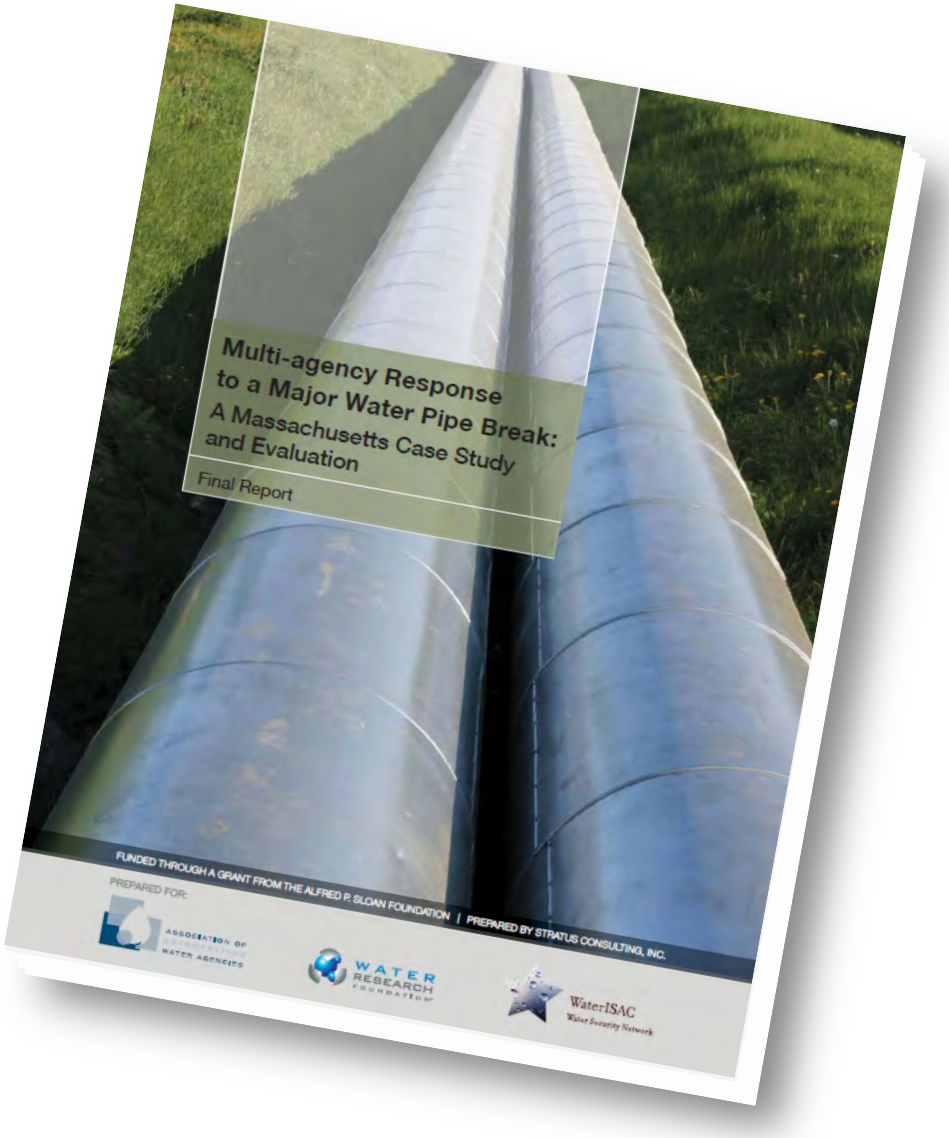
AMWA Case Study

- Full report available at www.amwa.net



CONTINUED WORK ON REDUNDANCY

Hultman Rehabilitation