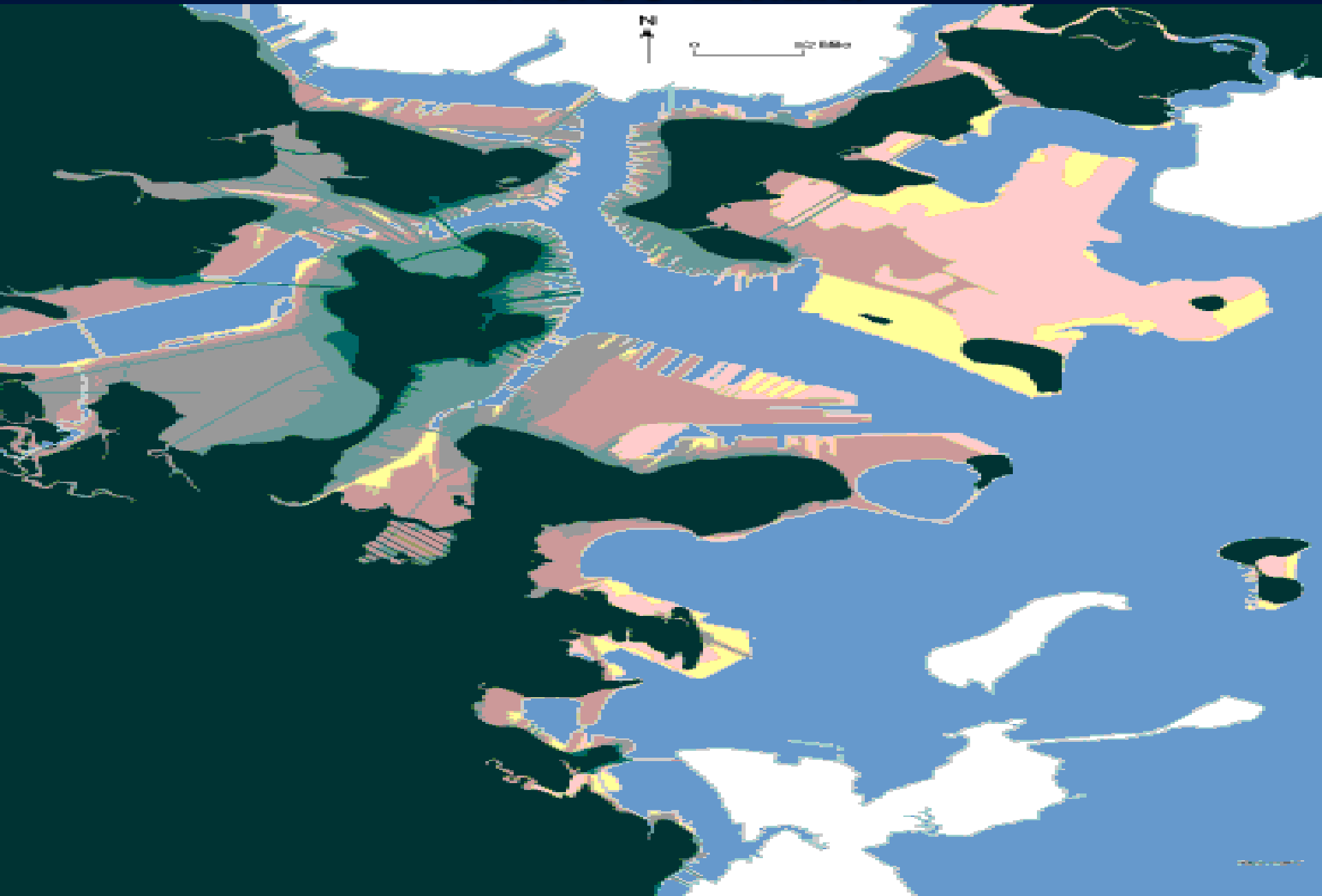
Long-Range Planning and System Improvements at BWSC

April 11, 2013

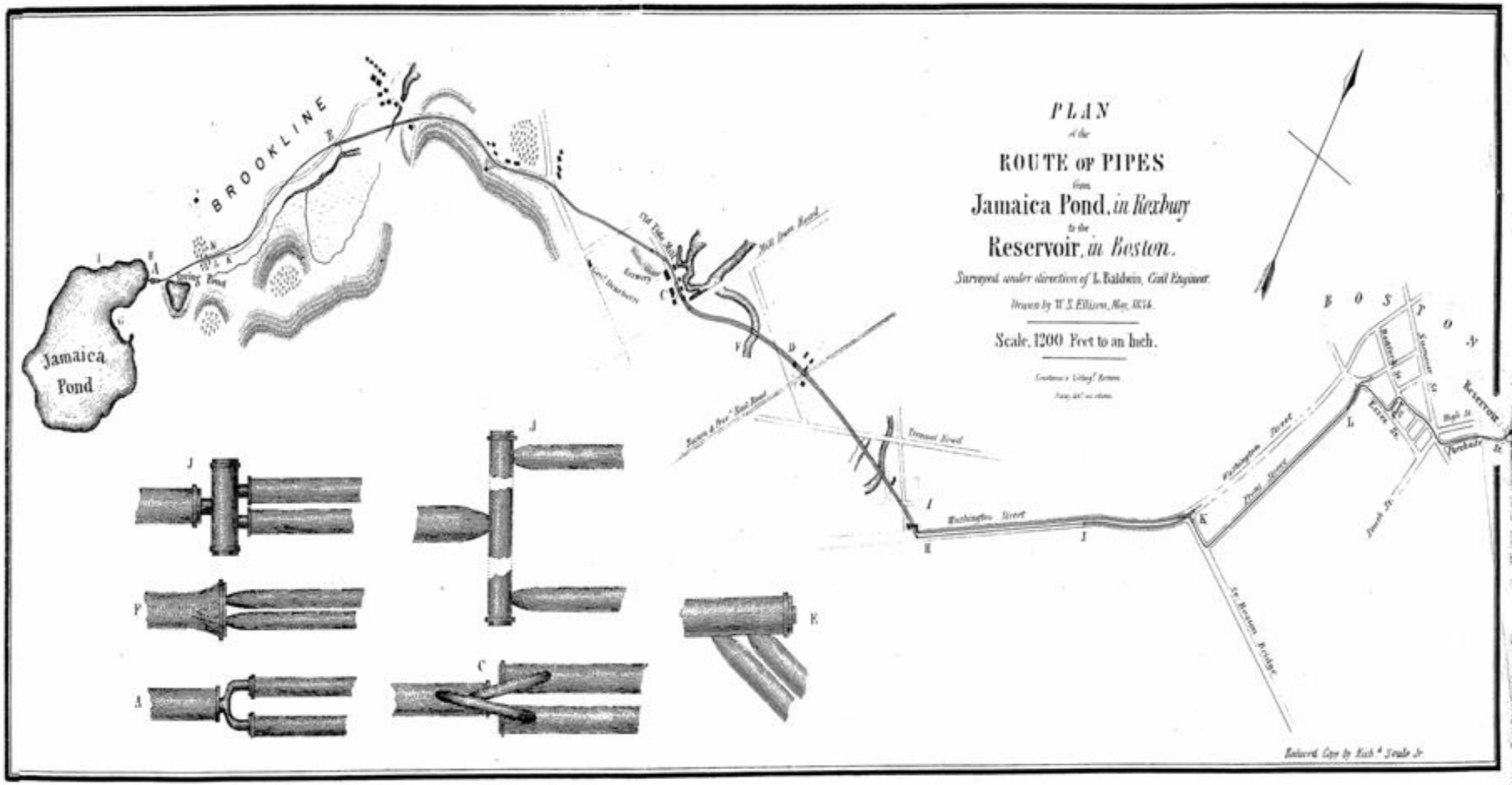
Agenda

- Background
- Water Distribution Study
- Leak Detection/ System Maintenance
- Metering Efforts
- Future Direction and Challenges

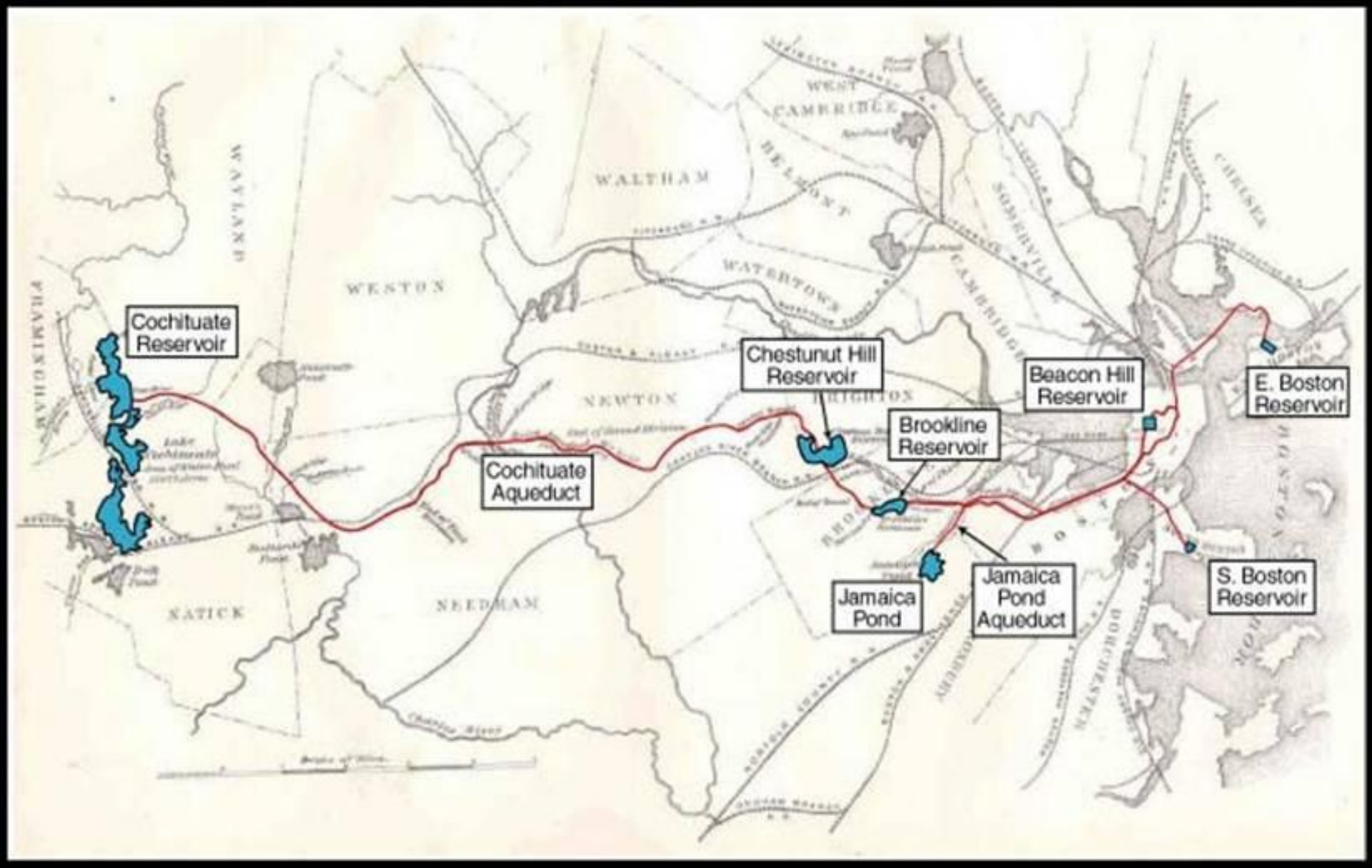
Made Land



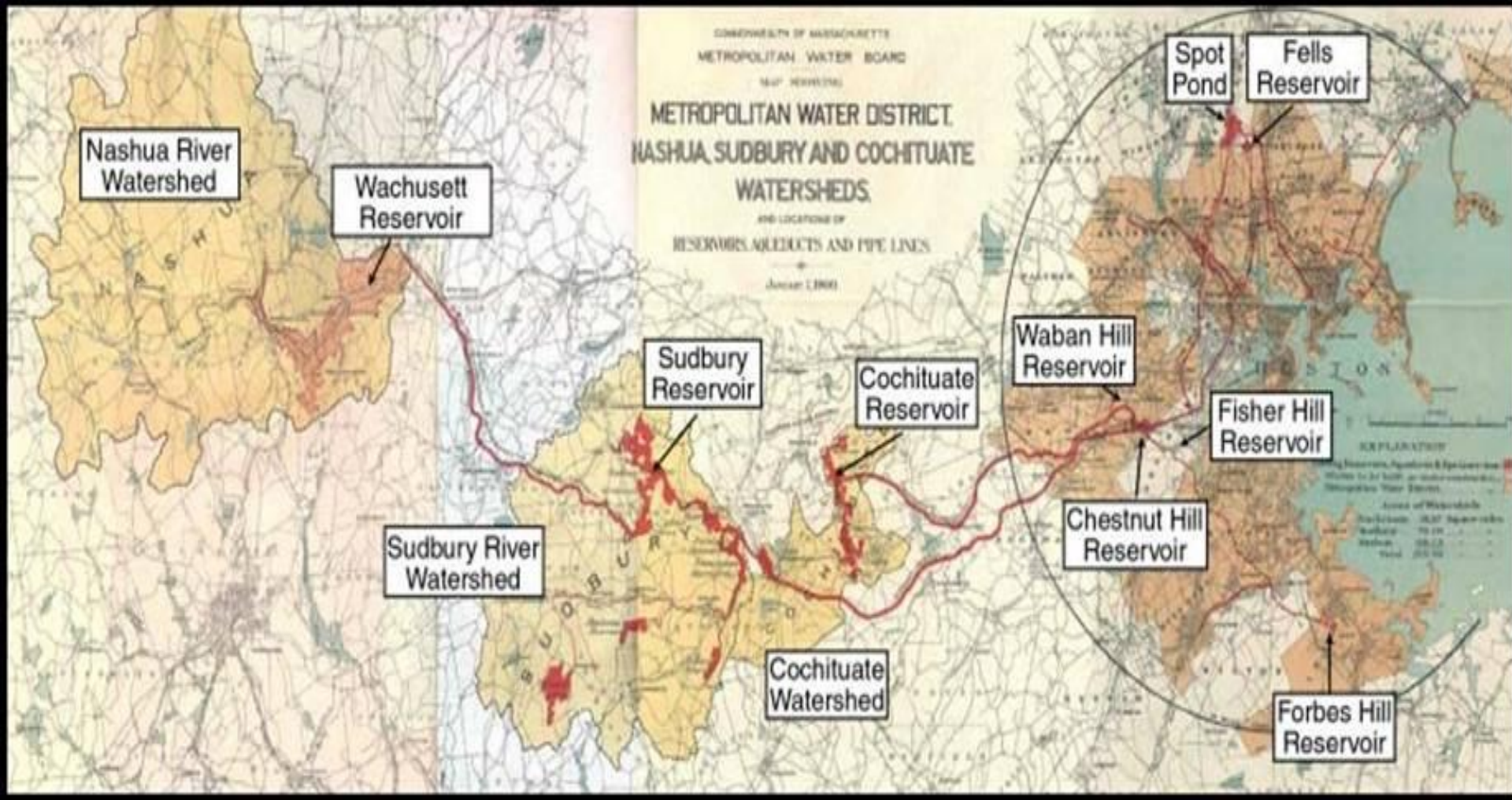
Original Plan for Jamaica Pond Aqueduct Company 1795



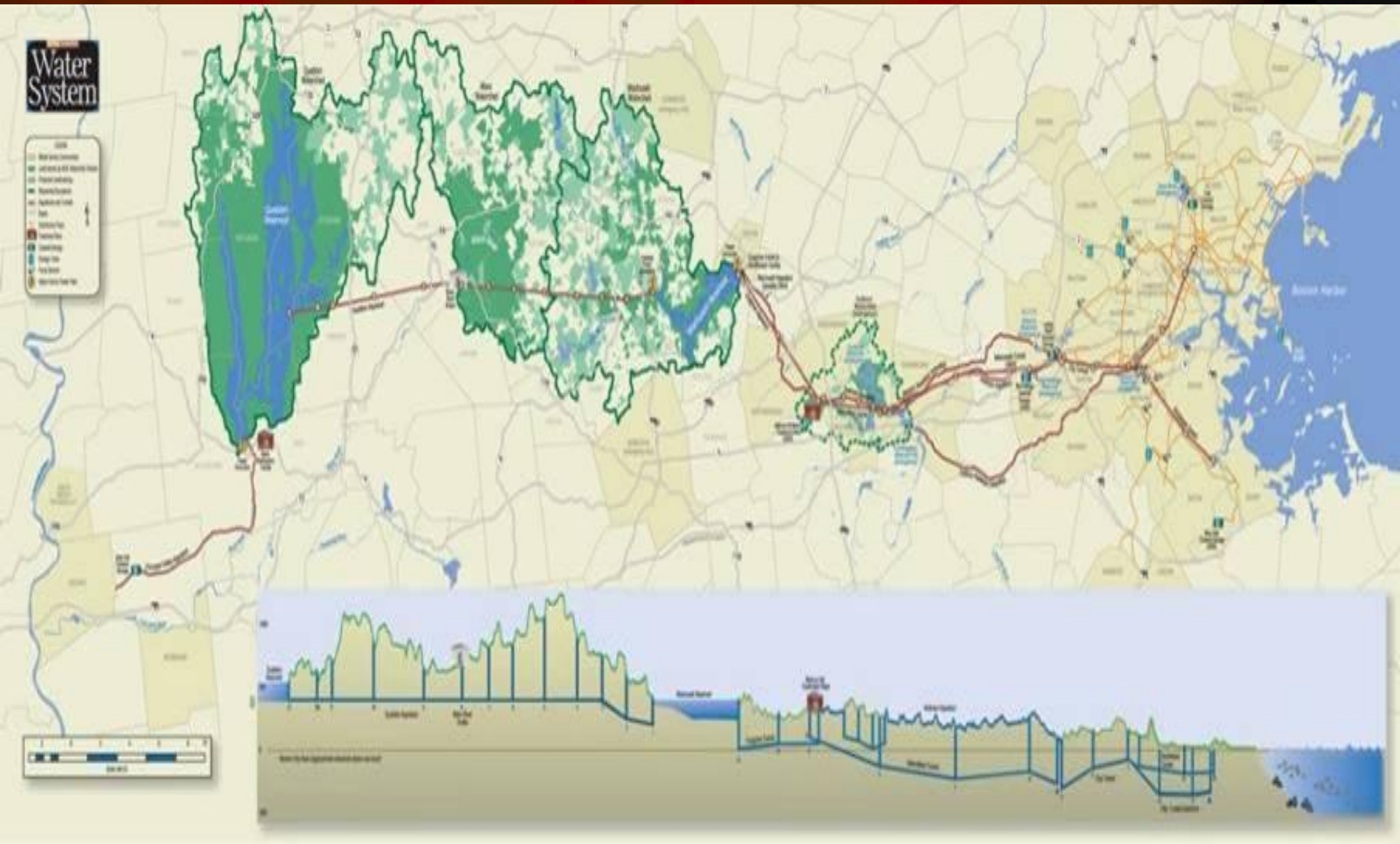
Boston Water System: 1845-1870
Cochituate System



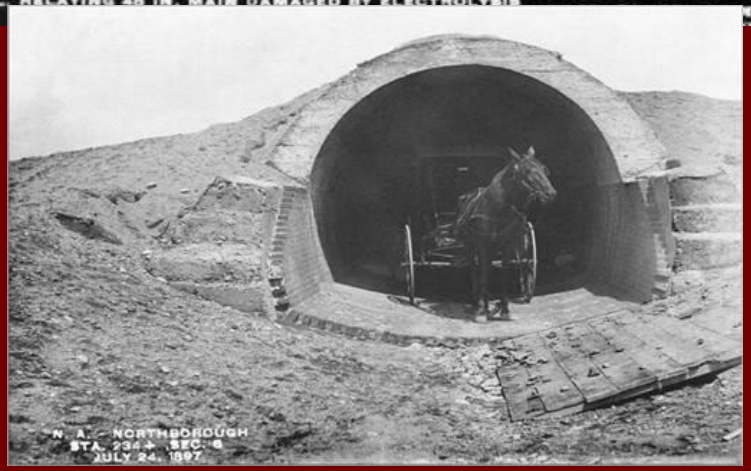
Boston Water System:
1900
Nashua River



Current Water Supply to Boston



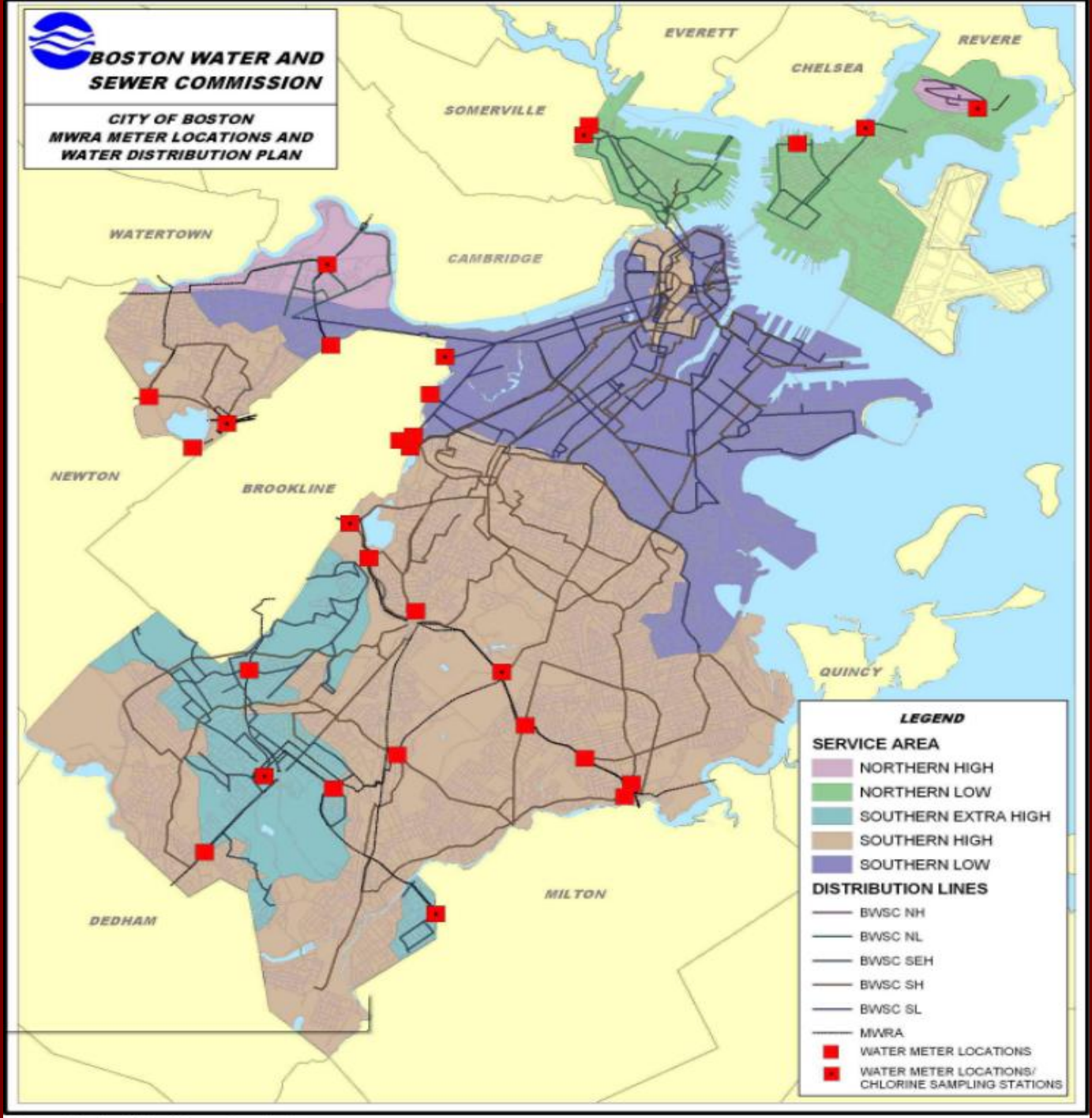
Water Main Construction



Water Distribution System

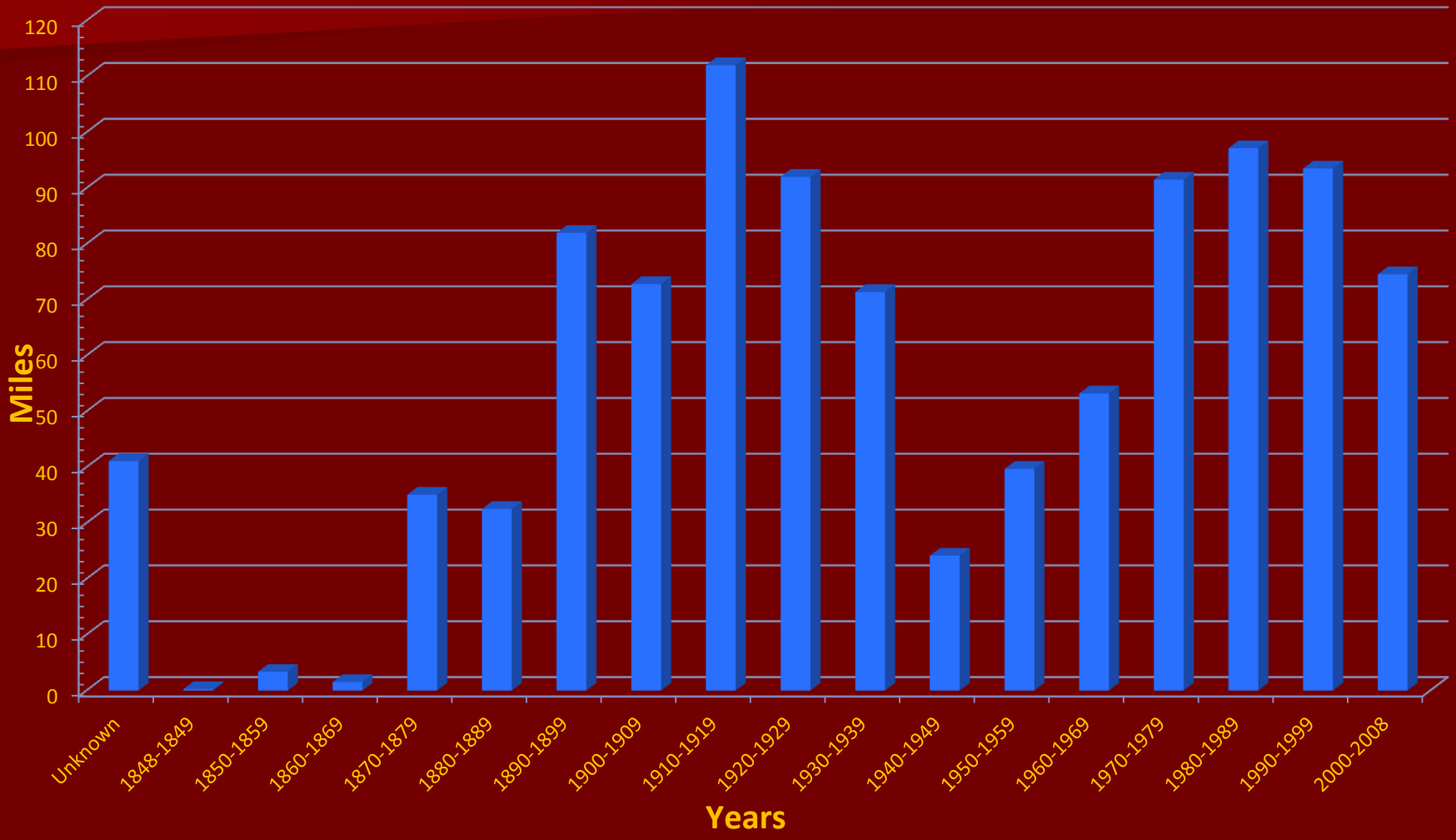
- Five pressure zones 60 psi -112 psi
- Supplied from 29 metered locations
- 1011 miles of pipe from 4 inch to 48 inch
- Approximately 18214 valves
- 13,618 hydrants
- 90,000 Accounts

Pressure Zone	Feet	Miles
High Pressure Fire System	87,870	17
Northern High	25,478	5
Northern Low	470,427	89
Southern Extra High	425,248	81
Southern High	2,956,110	560
Southern Low	1,371,429	260



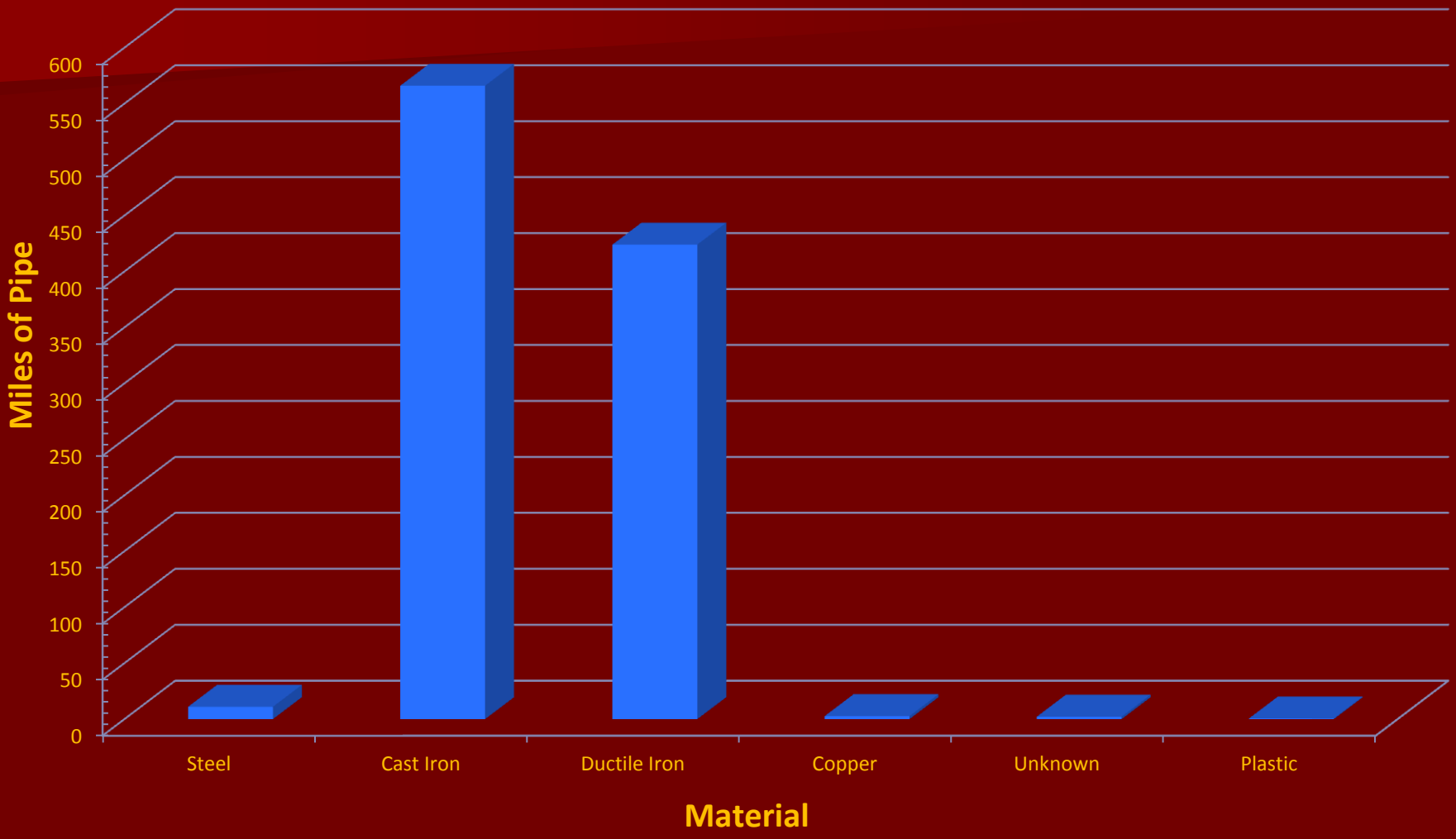
Source: Boston Water & Sewer Commission

Pipe Installation Time Periods



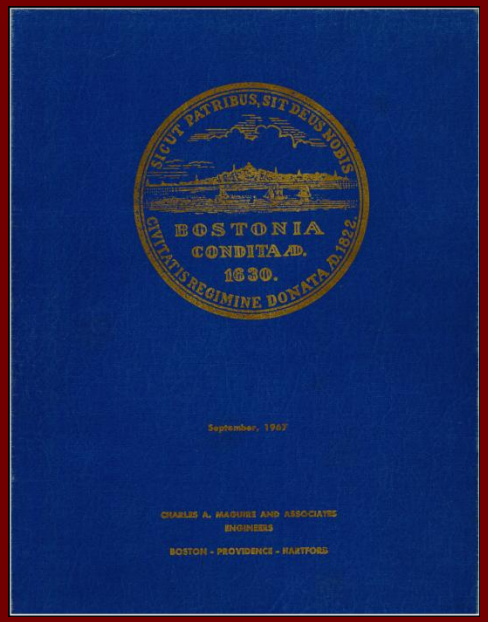
Approximately 87.4% of the system is cement lined

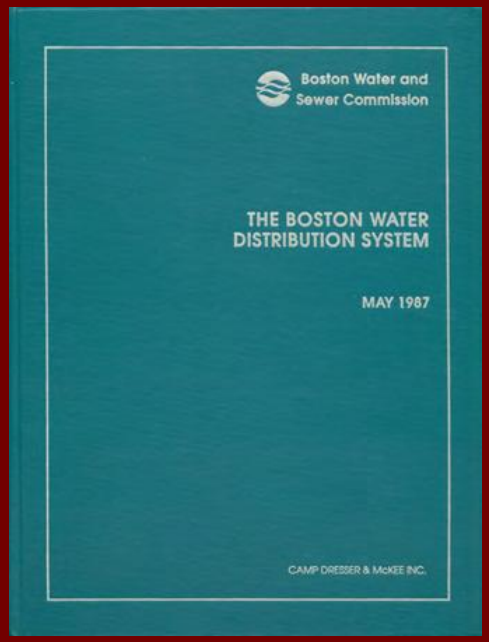
Miles of Pipe by Material



Water Distribution Study

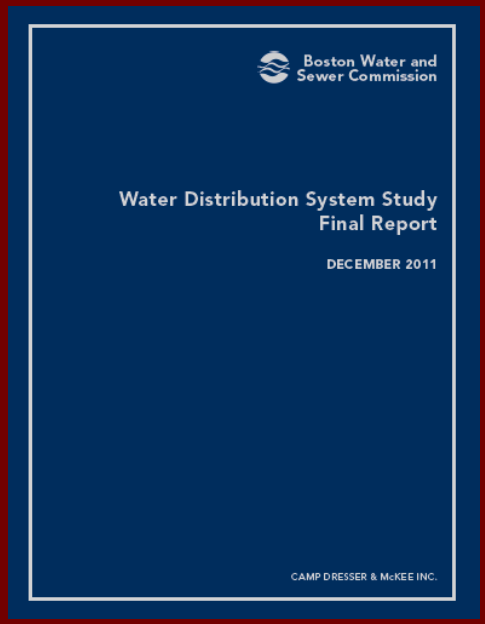
- 1967 – Transmission System
- 1986 – New Design Criteria
- Line or Replace 17 Miles per Year





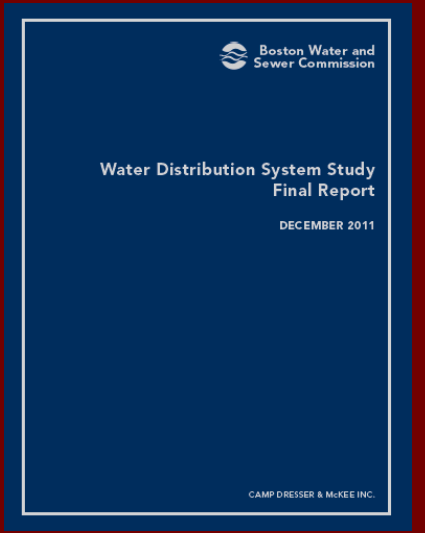
2011 Water Distribution Study

- System Description and History
- MWRA Meter Assessment
- Unaccounted-for –Water
- Hydraulic Conditions
- Water Quality
- External Corrosion
- Facilities Information



Water Study Topics

- Facilities Assessment
- Operational Practices
- Design Criteria
- Software and Technology Tools
- Financial Assessment
- Final Report with Recommendations



Boston Water Pipe

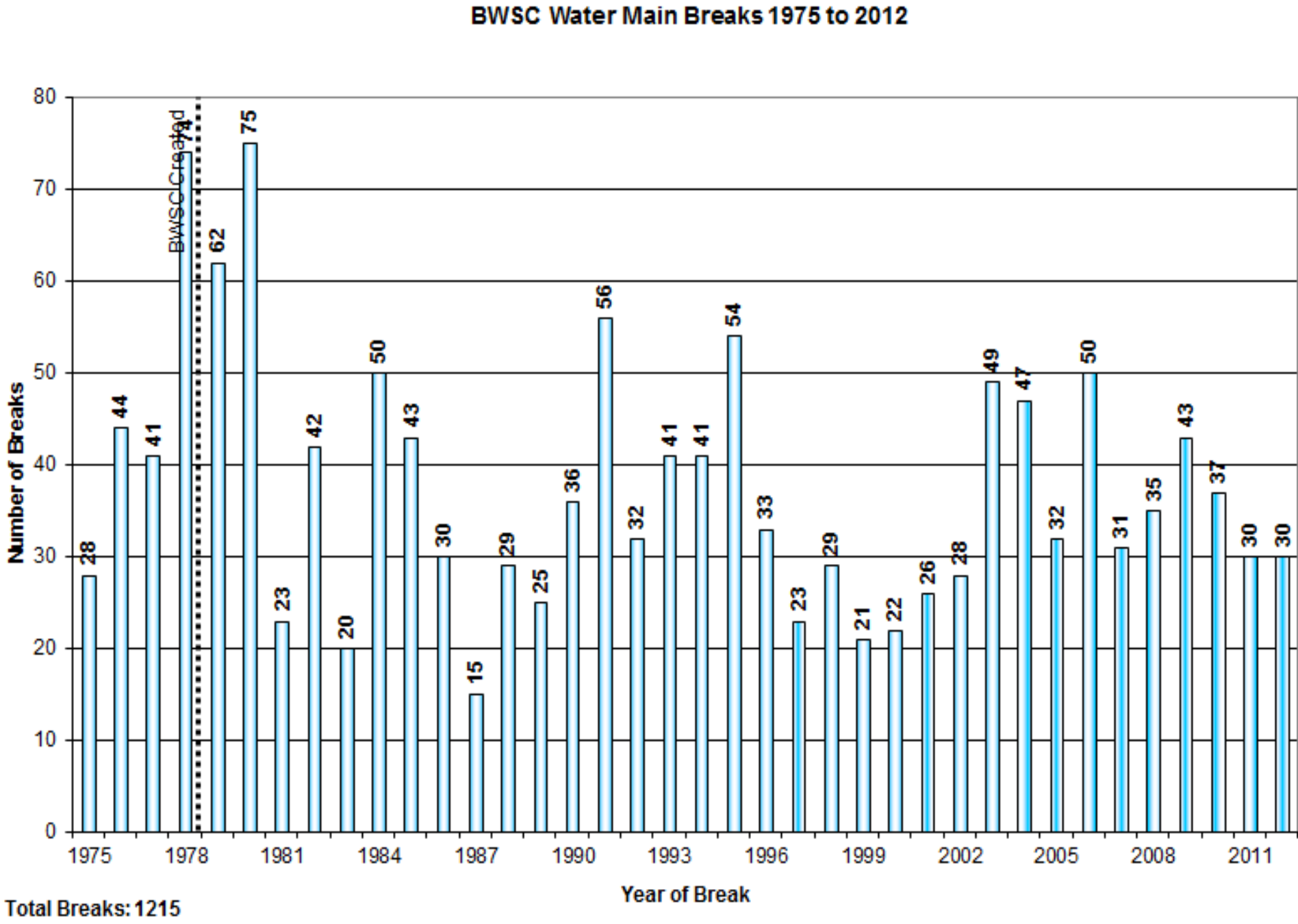
- Early Thick-Walled Cast Iron/Earliest Pipe in 1848
- Thinner Walled Pipe - 1950's
- Ductile Iron pipe - 1970

1915 Pit Cast Pipe –1" Wall

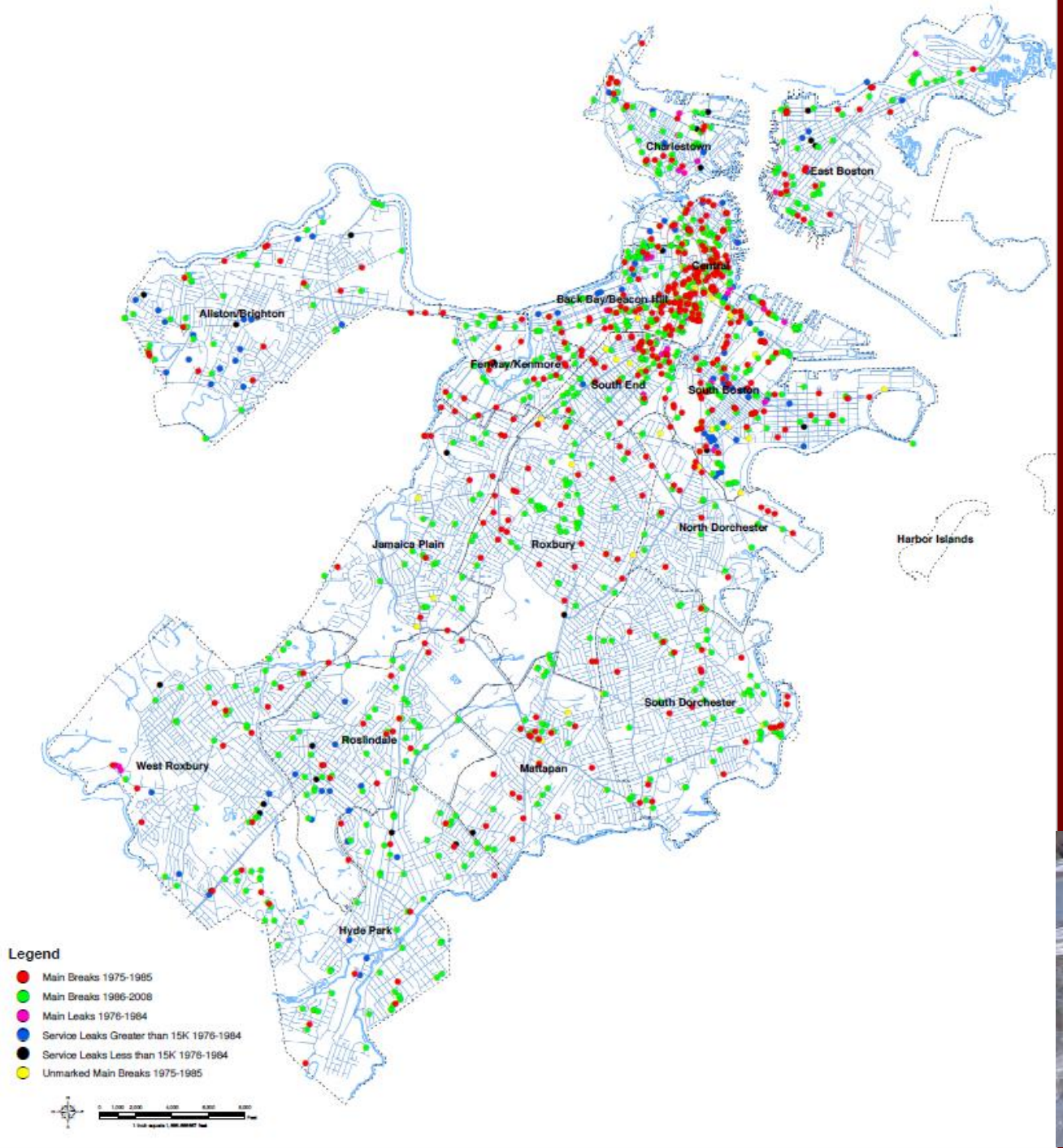
1980 Ductile Iron Pipe – ½" Wall

Cement Lined & Unlined Pipe Samples

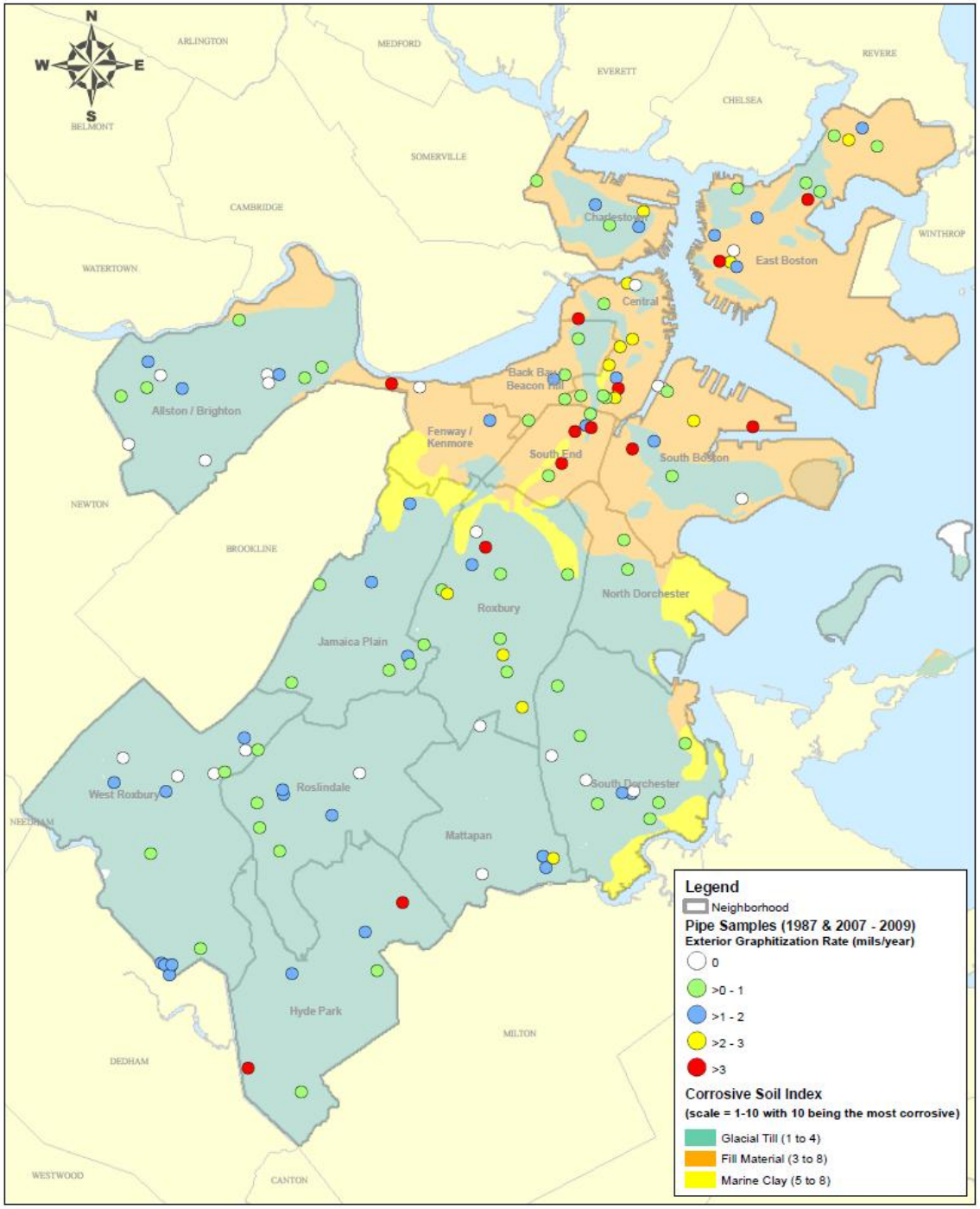
Removal of Pipe Samples

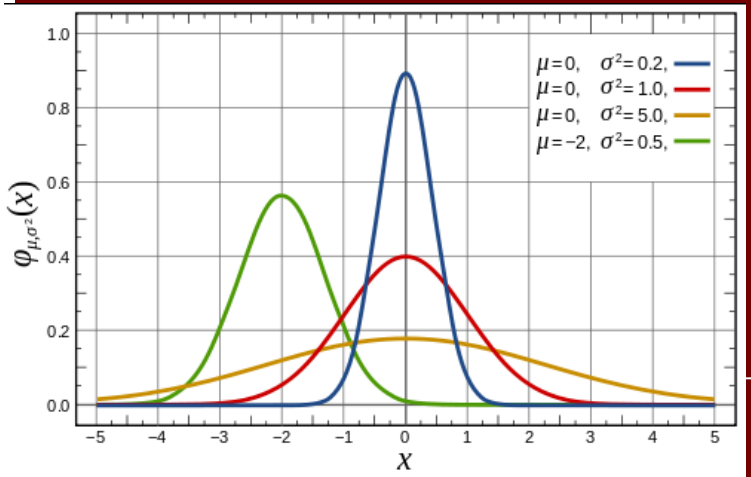

BWSC Water Main Breaks 1975 to 2012
Number of Breaks
Year of Break
BWSC Created
0
10
20
30
40
50
60
70
80
1975
1978
1981
1984
1987
1990
1993
1996
1999
2002
2005
2008
2011
28
44
41
74
62
75
23
42
20
50
43
30
15
29
25
36
56
32
41
41
54
33
23
29
21
22
26
28
49
47
32
50
31
35
43
37
30
30
Total Breaks: 1215

Pipe Break Locations



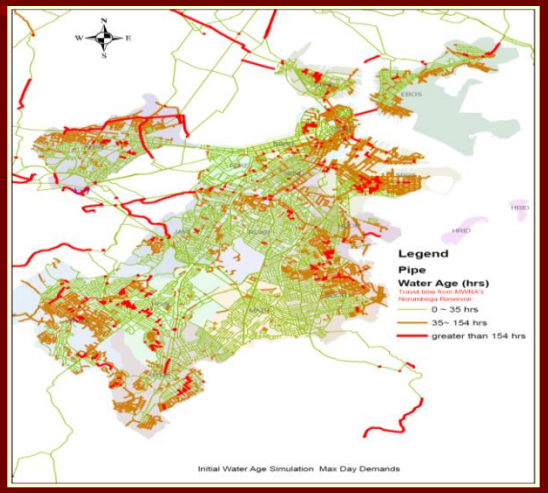
Corrosion Rates and Soil Types – Likelihood of Failure



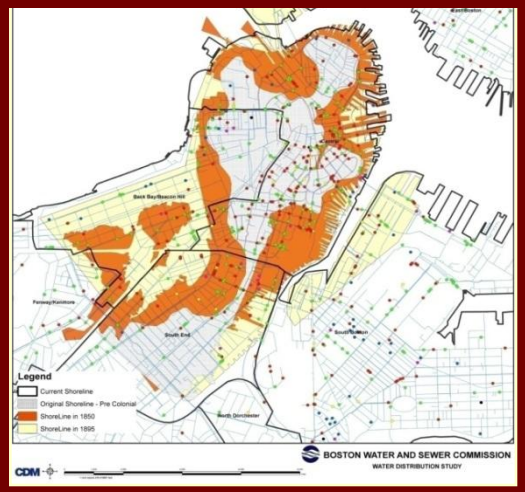


Consequences of Failure - Leverage GIS and Hydraulic Model

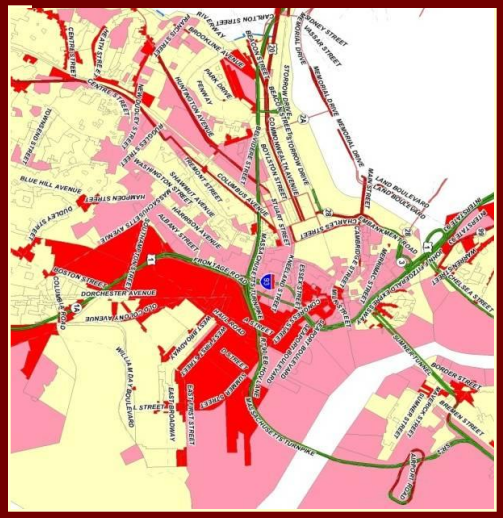
Water Age/Chemistry

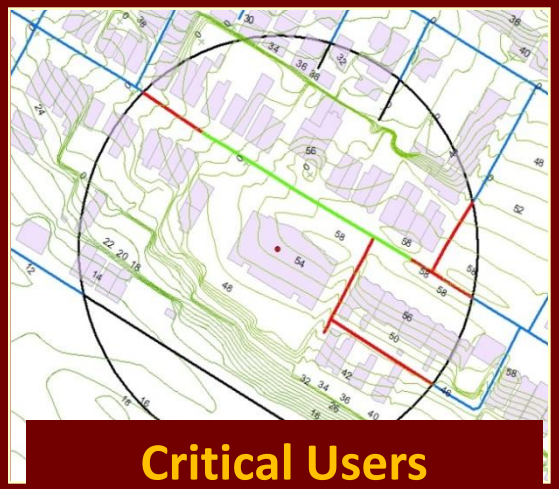


Historic Shorelines

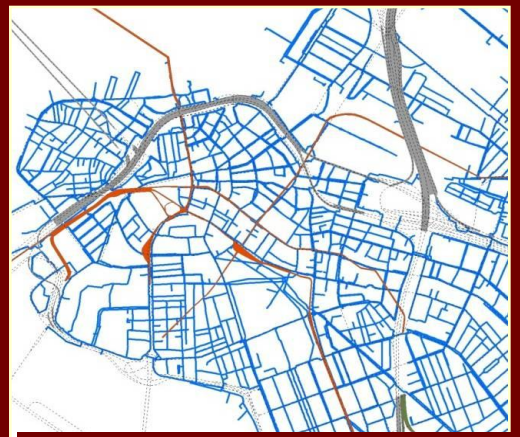


Economic Zones

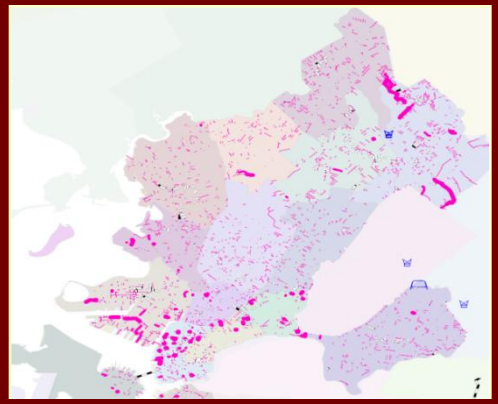




Critical Users

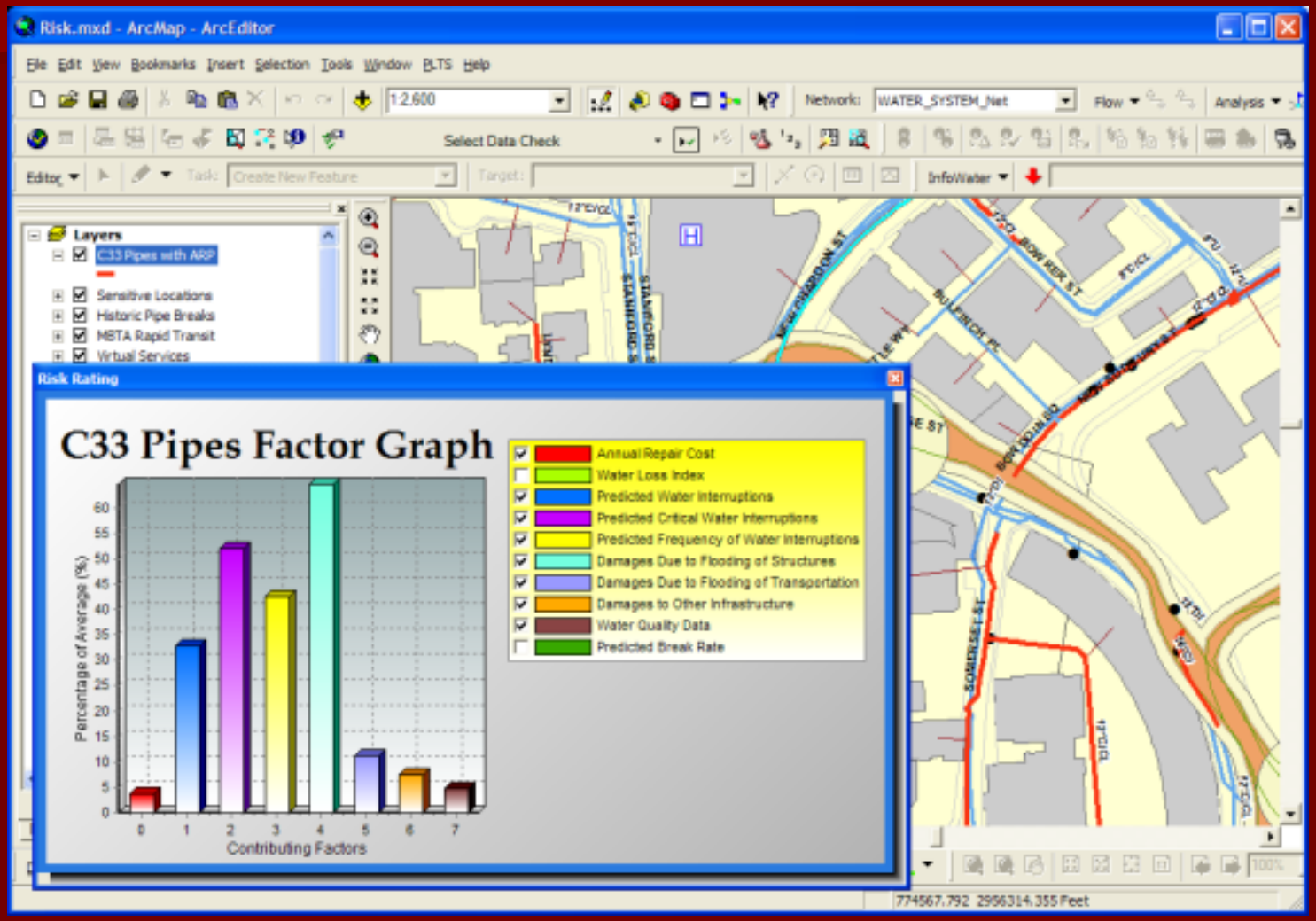


Roads and Tunnels

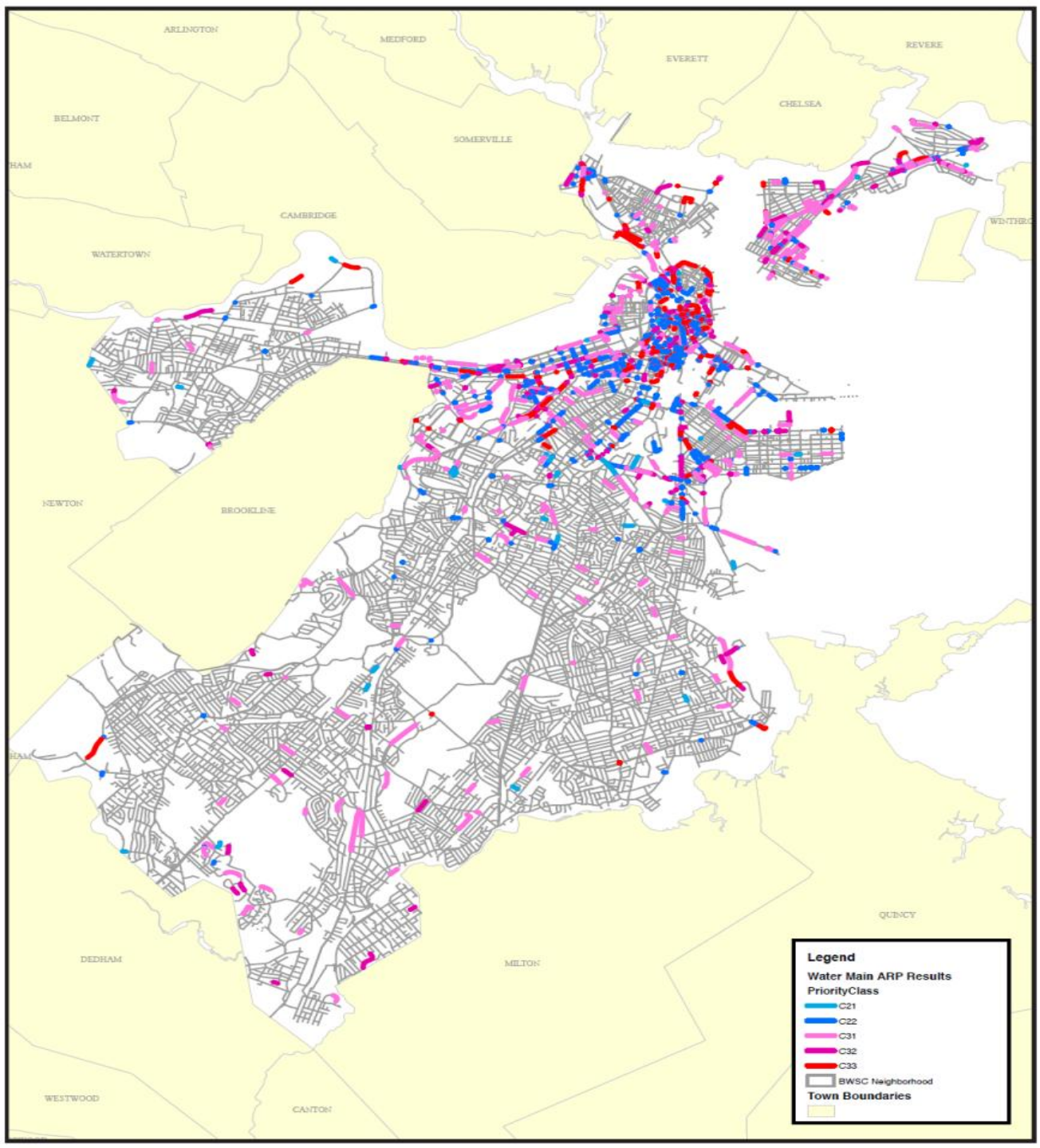


Hydraulic Criticality

Annual Rehabilitation Planning (ARP) Model

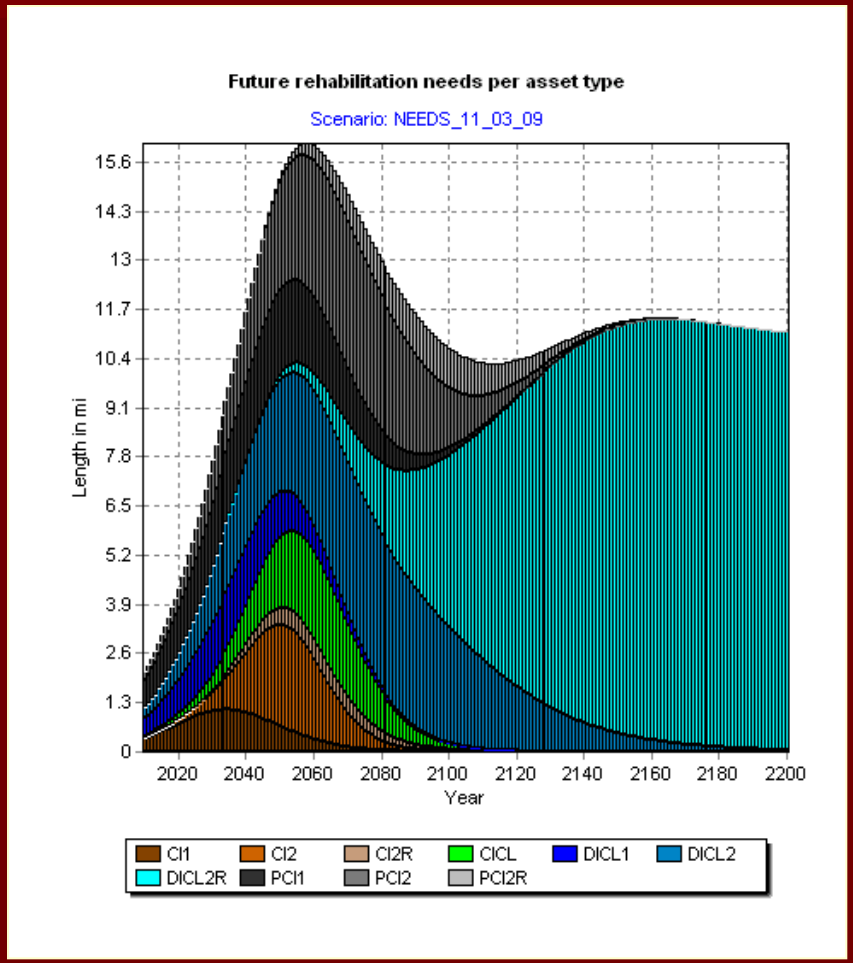


Highest Priority Pipe Renewal – ARP Output

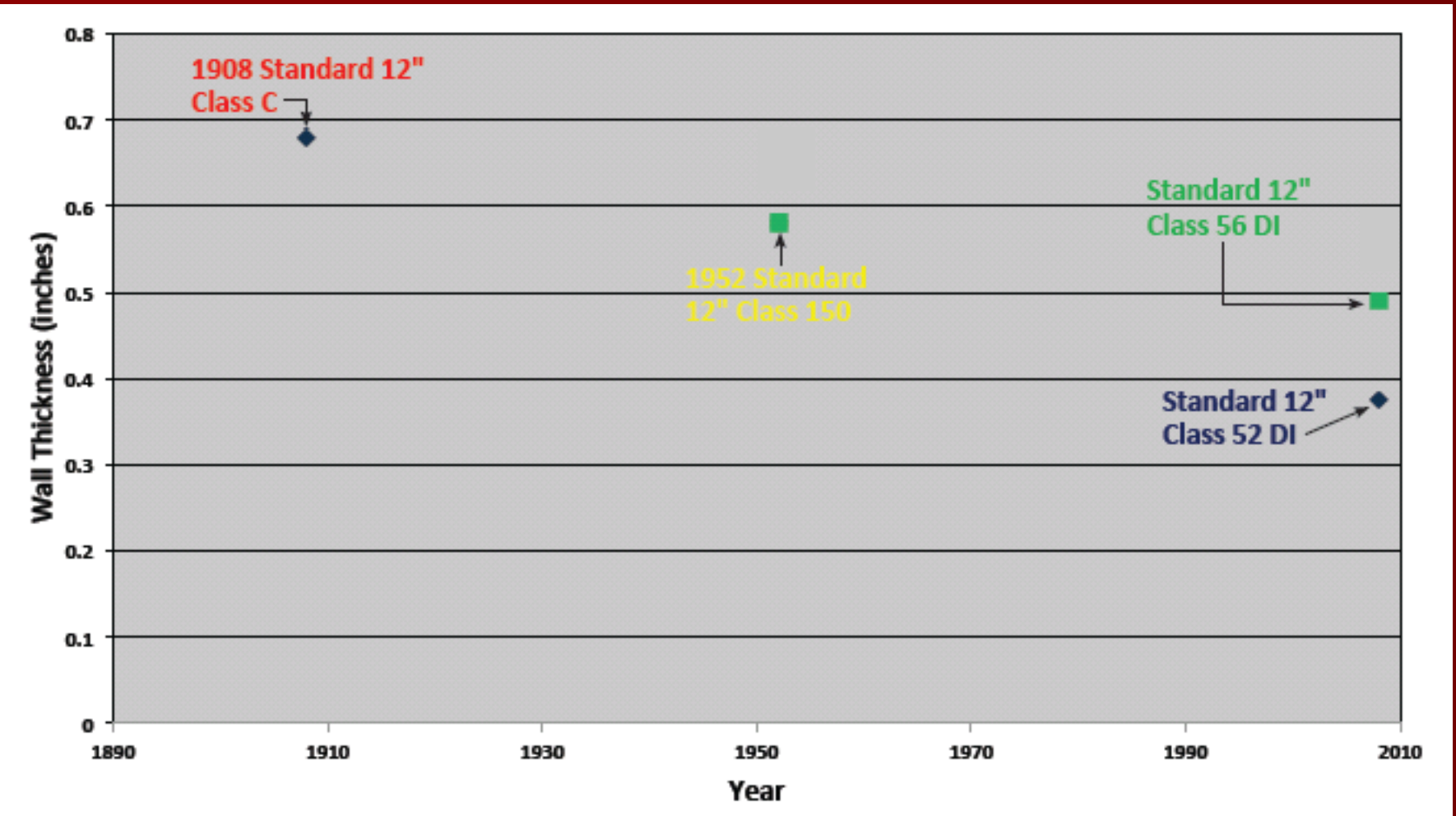


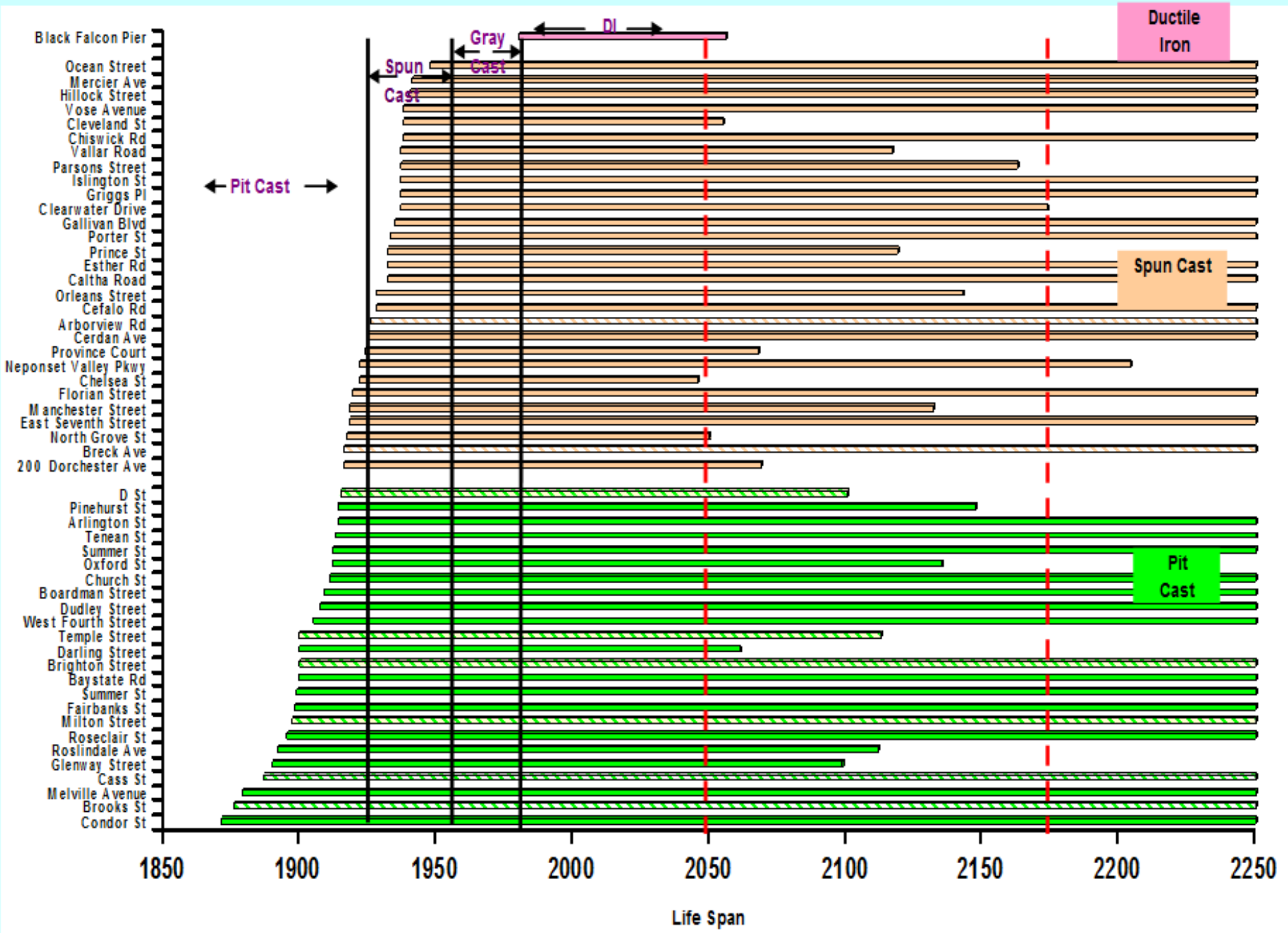
KANEW: Convergence of Renewal Requirements

- Old 1800's and Early 1900's Cast Iron Pipe and Spun Cast Pipe with long lives are due for replacement mid- century
- Mid 1900s Cast Iron Pipe and Newer Ductile Iron Pipe from 1960s and 1970s also coming due mid-century



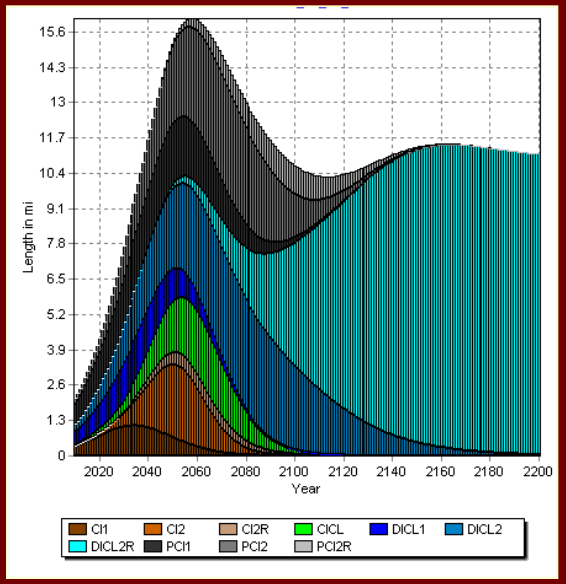
Trend in Pipe Wall Thickness

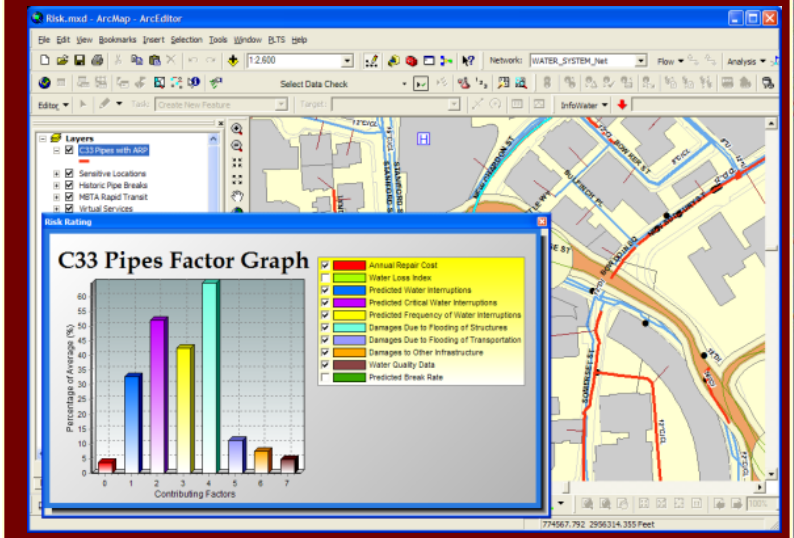


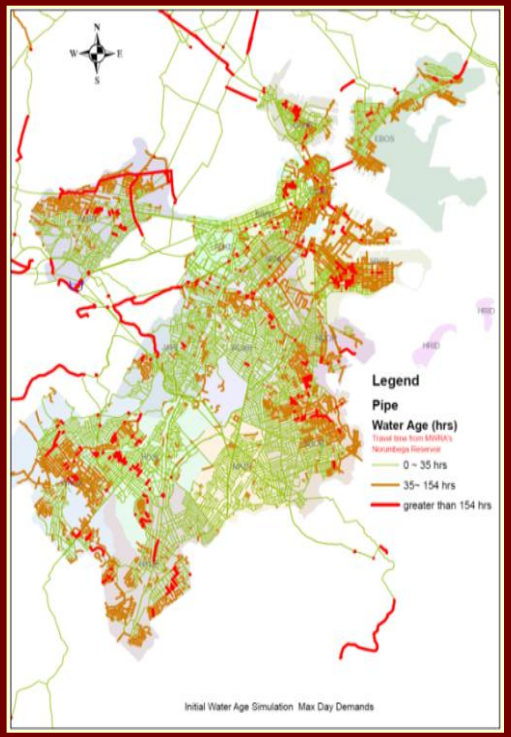

Black Falcon Pier
Ocean Street
Mercier Ave
Hillock Street
Vose Avenue
Cleveland St
Chiswick Rd
Vallar Road
Parsons Street
Islington St
Griggs Pl
Clearwater Drive
Gallivan Blvd
Porter St
Prince St
Esther Rd
Caltha Road
Orleans Street
Cefalo Rd
Arborview Rd
Cerdan Ave
Province Court
Neponset Valley Pkwy
Chelsea St
Florian Street
Manchester Street
East Seventh Street
North Grove St
Breck Ave
200 Dorchester Ave
D St
Pinehurst St
Arlington St
Tenean St
Summer St
Oxford St
Church St
Boardman Street
Dudley Street
West Fourth Street
Temple Street
Darling Street
Brighton Street
Baystate Rd
Summer St
Fairbanks St
Milton Street
Roseclair St
Roslindale Ave
Glenway Street
Cass St
Melville Avenue
Brooks St
Condor St
Pit Cast
Spun Cast
Gray Cast
DI
Ductile Iron
Spun Cast
Pit Cast
1850
1900
1950
2000
2050
2100
2150
2200
2250
Life Span

Conclusions

- New Understanding of Boston's Water System
- No longer Rely on Old Rules
- Long Range Plan







Leak Detection Efforts

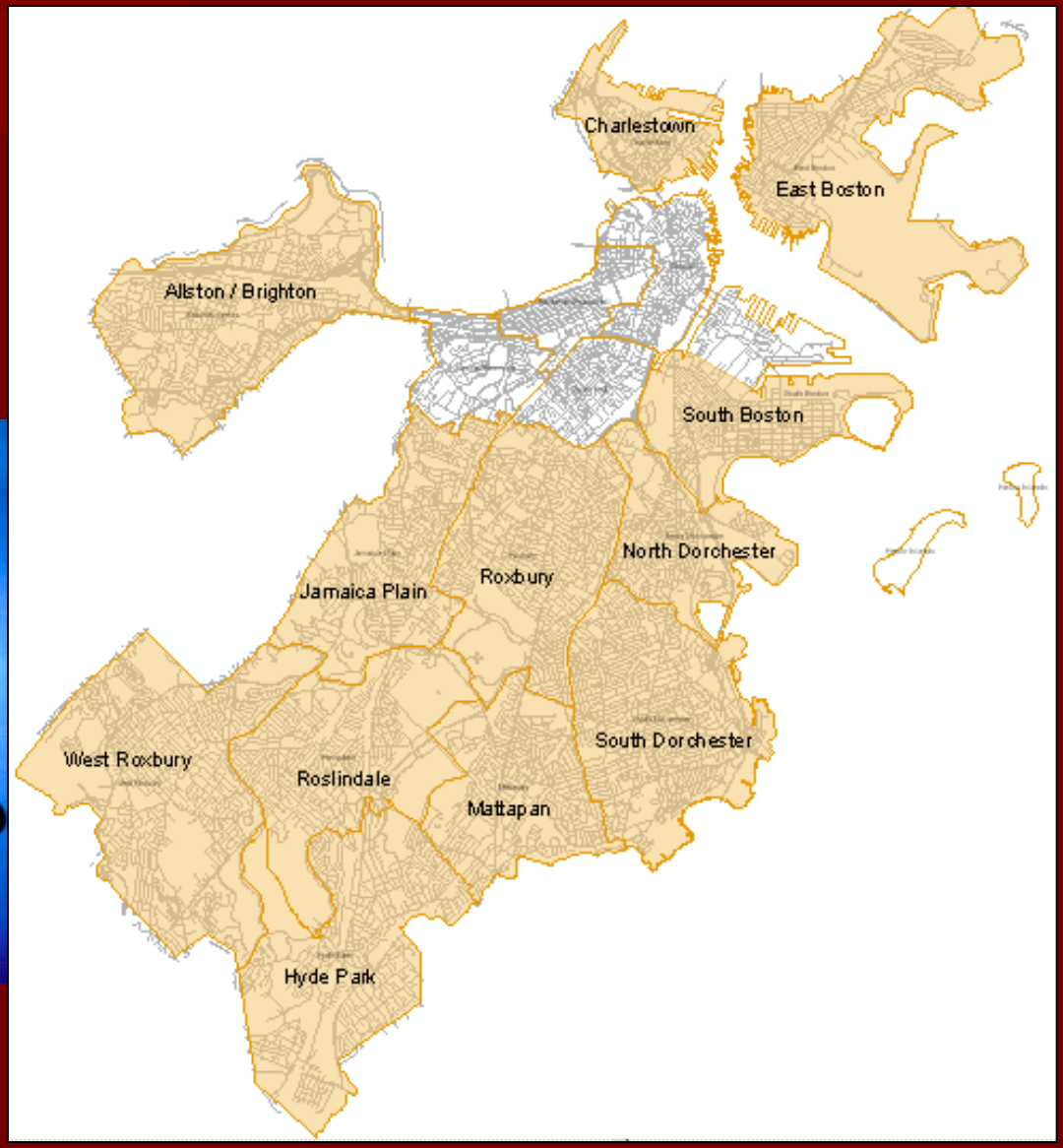
- 6 full time personnel
- 3 additional as needed
- Required to survey entire system every 2 years

BWSC Engineering Services Leak Detection Totals By Year		
YEAR	Number of Leaks Detected	Miles of Main Surveyed
2004	273	683
2005	180	815
2006	197	985
2007	194	809
2008	167	672
2009	231	841
2010	252	994
2011	187	776
2012	274	753
Total:	1,955	7,328

Previous Leak Detection Methods

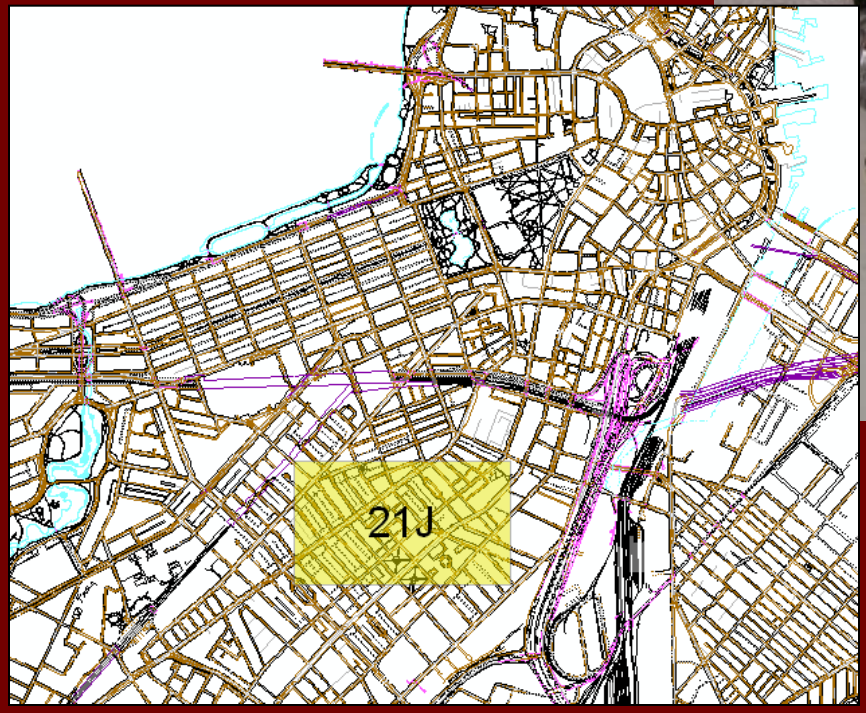
Newer Leak Detection Methods

- Permaloggers



Newer Leak Detection Methods

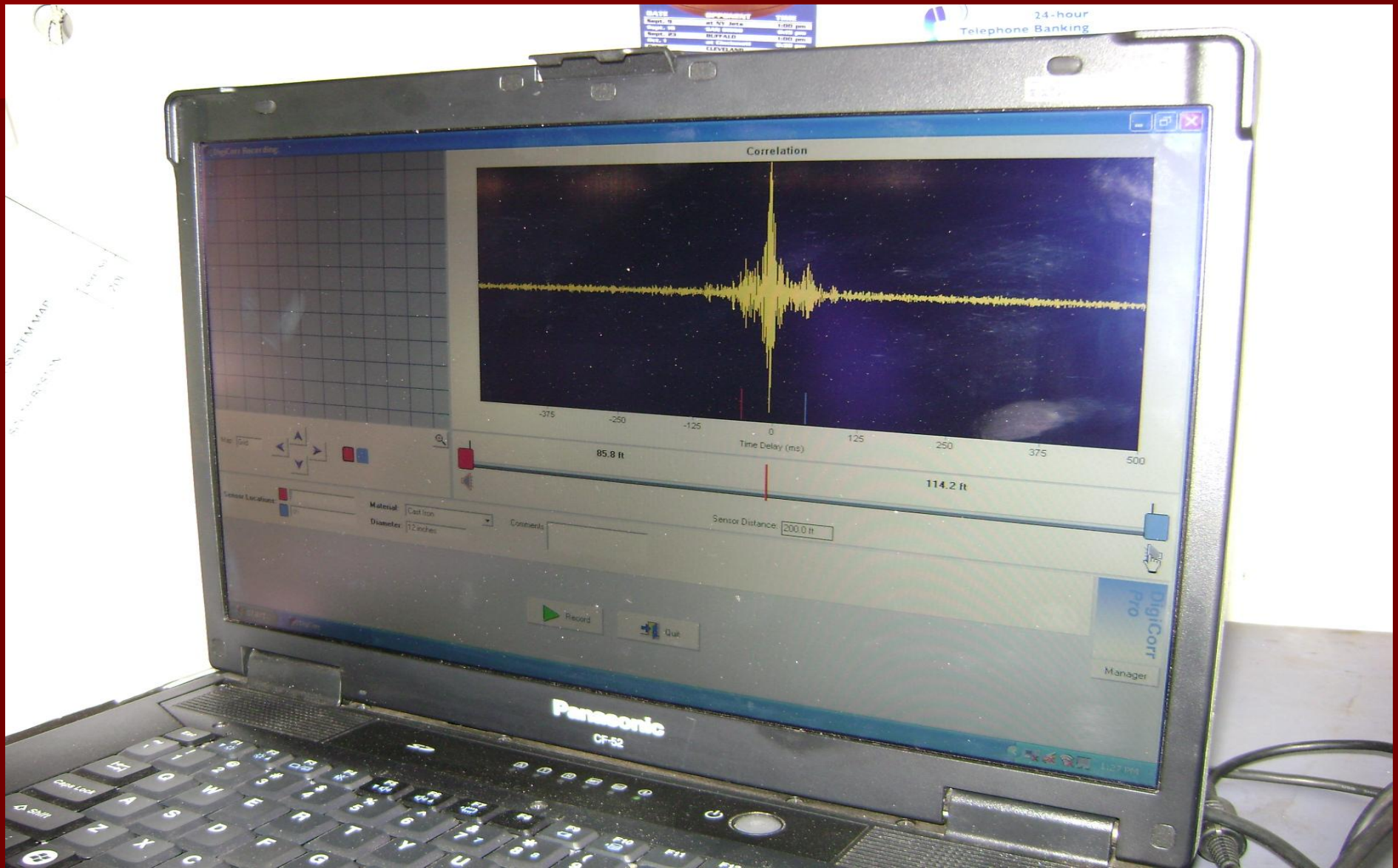
- Zcorr



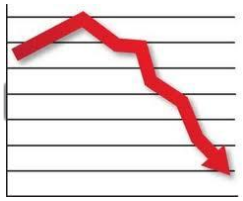
NEWER LEAK DETECTION METHODS

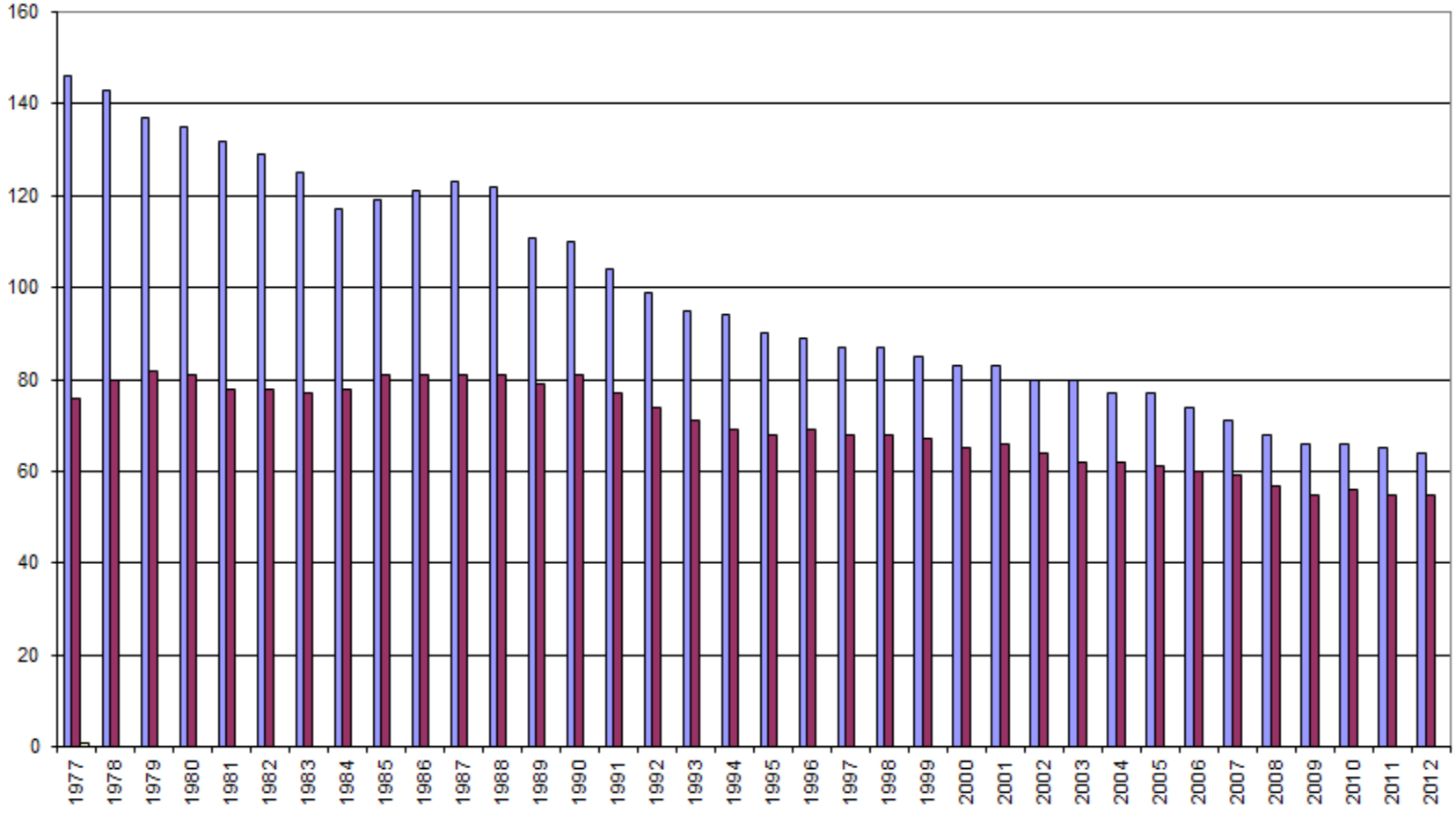
- CORRELATORS

Leak Location Pinpointed



Boston's Water Consumption Trend
1977 - 2012

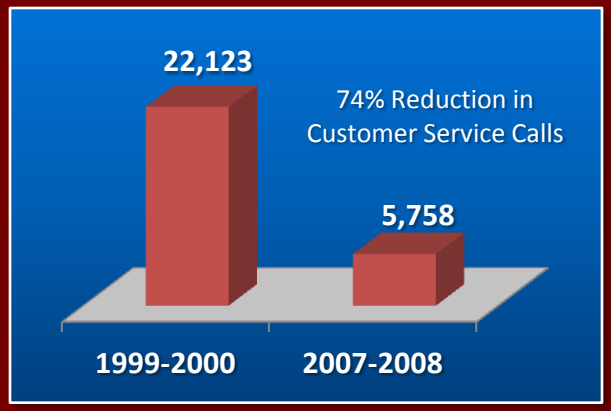




Metering Efforts

Automated Metering Reading System

- System operating successfully for over 10 years
- 90,000 residential/commercial meters
- Four reads per day for each meter – 99% accuracy
- Transmits over a secured FCC licensed frequency
- Reduced calls to Customer Service



What is AMR and how does it work?

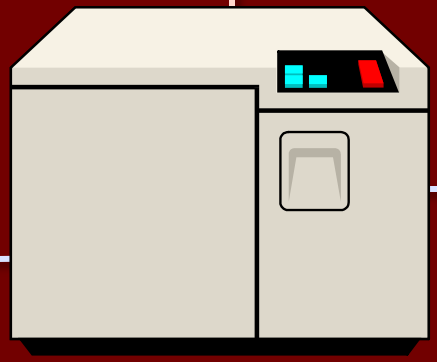
Meter Transmitter Unit

RF Transmission

Data Collection Unit

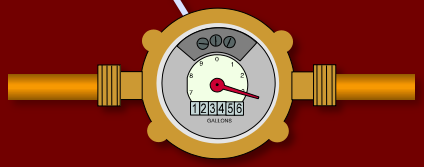
Cellular Telephone

BWSC AMR Control Computer



BWSC Billing System

Web

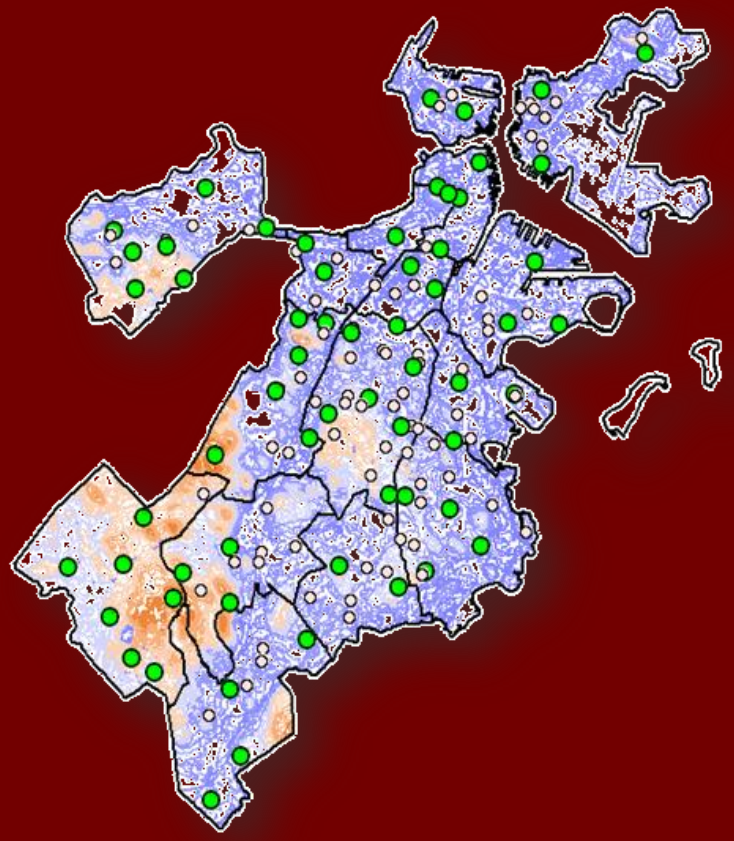


Encoder-Register Water Meter

Monthly Bill

Data Collection Units (DCU) Locations

- 62 DCUs
- Boston School Department
- Non-School Locations
  - EDIC
  - 1 Ashburton Place
  - Boston University



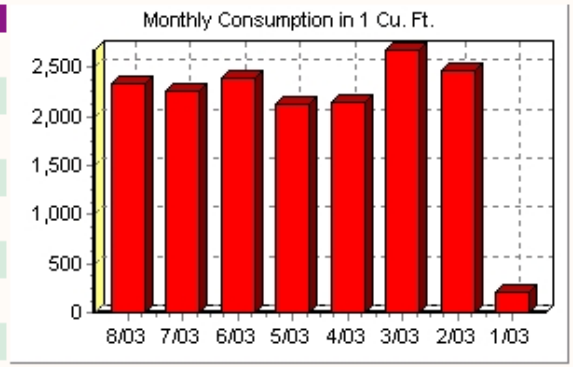
What do we get?

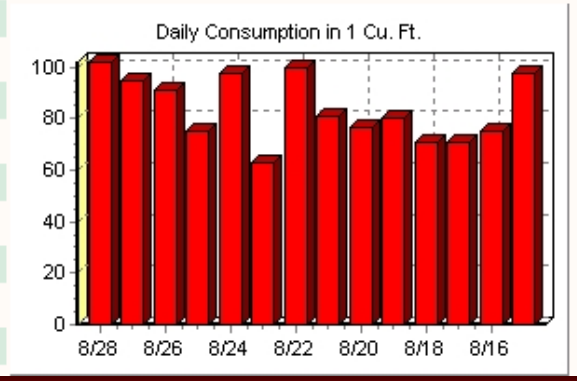
Star
Every Meter. Every Day.

Readings | Management Reports | Tamper Reports | DCU |

Readings

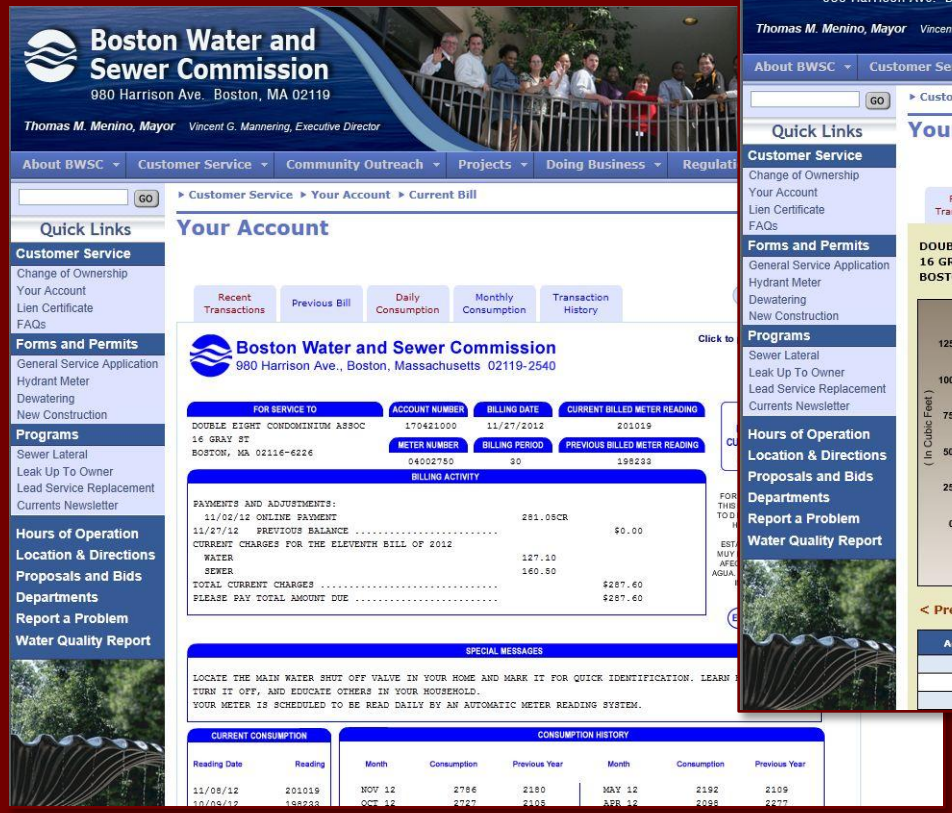
Date	Reading	Comments
8/28/2003 7:58:41 PM	16,622	
8/28/2003 1:56:45 PM	16,611	
8/28/2003 7:52:34 AM	16,562	
8/28/2003 1:49:41 AM	16,542	
8/27/2003 7:48:27 PM	16,520	
8/27/2003 1:45:30 PM	16,501	
8/27/2003 7:44:14 AM	16,488	
8/27/2003 1:44:28 AM	16,465	
8/26/2003 7:42:19 PM	16,425	
8/26/2003 1:39:53 PM	16,391	
8/26/2003 7:34:37 AM	16,378	
8/26/2003 1:29:37 AM	16,361	
8/25/2003 7:27:26 PM	16,334	
8/25/2003 1:25:27 PM	16,307	
8/25/2003 7:22:05 AM	16,286	
8/25/2003 1:20:40 AM	16,275	
8/24/2003 7:19:27 PM	16,259	
8/24/2003 1:16:35 PM	16,237	

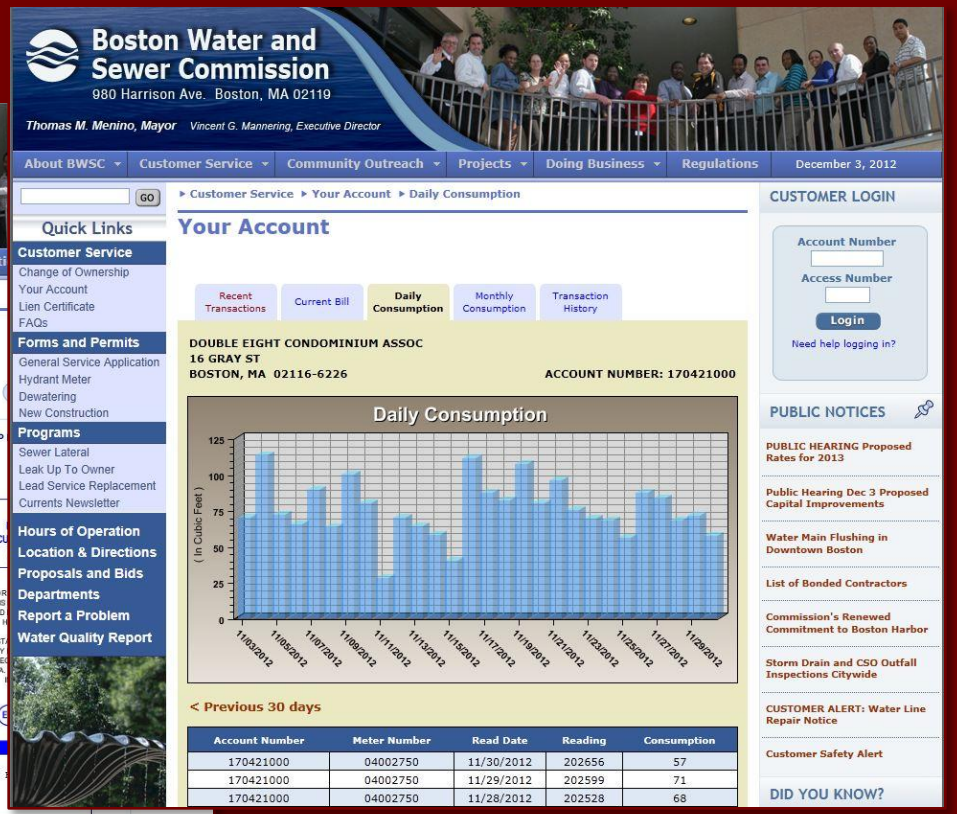




Account Information on Web

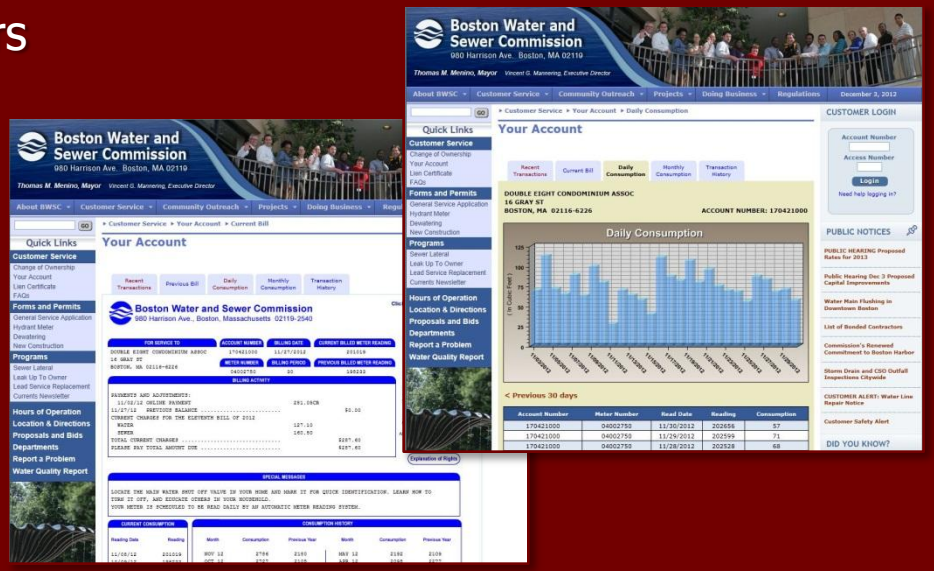
- On-line bill payment
- Consumption





Proactive Customer Service

- Collected data used to support analyses for:
  - Daily Consumption Review – High/Low usage
  - Consumption Analysis – Trends/Patterns – Failing Meters
  - Anomalies – Theft/Broken Meters
  - Leak Detection
  - Customer Service - Web



Strategy

- Upgrade the AMR system – install new software, DCUs, MTUs and meters
- Replacement process proposed in 2 phases:

Phase I

- Concentrate on replacing all MTUs on all accounts >1.5” meters
- Large meters are retrofitted and not “changed out”
- Largest meters (7000+) account for 55% of BWSC sales

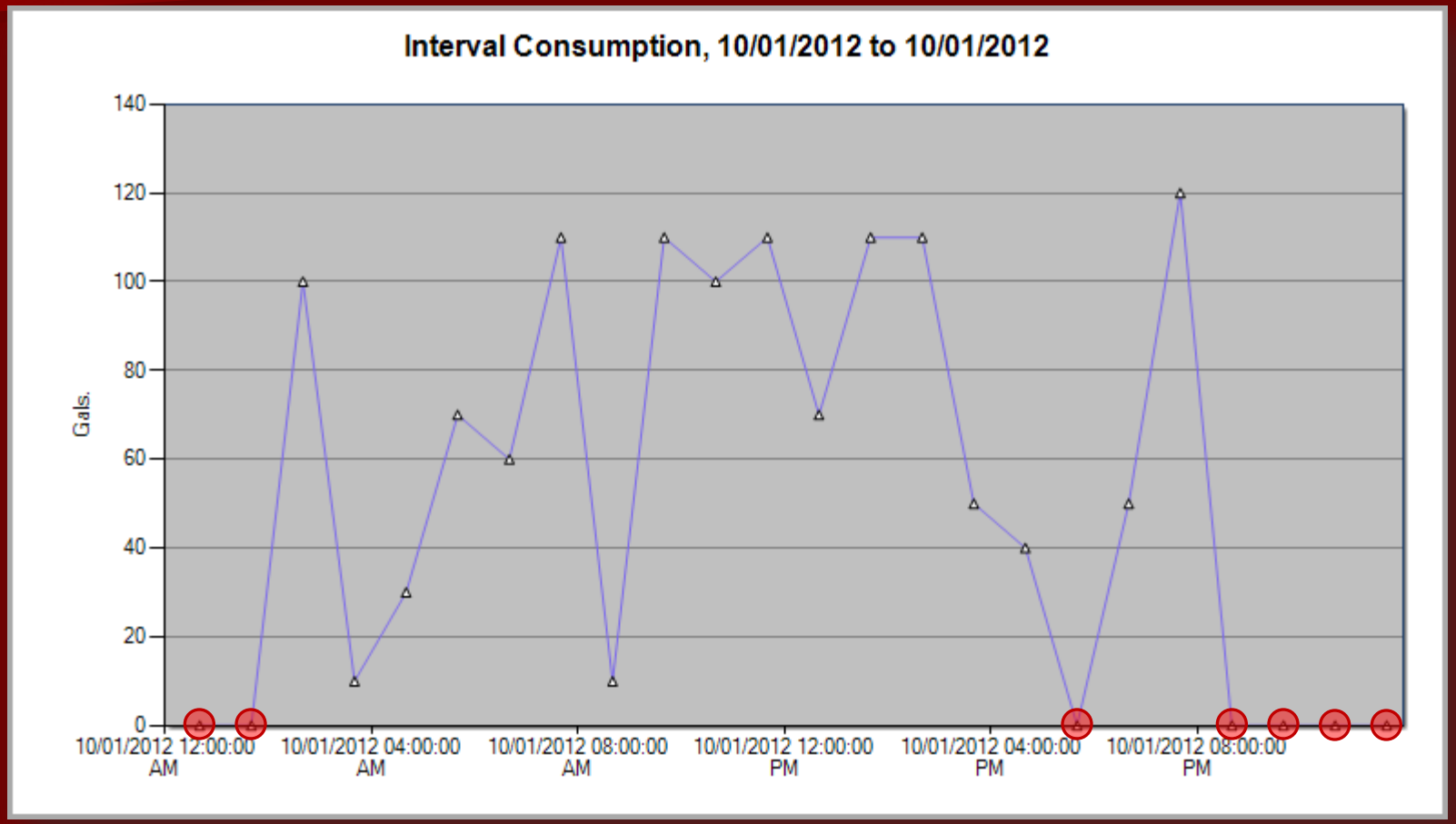
Phase II

- Establish a 3-5 year plan to replace the remaining 82,000 meters and MTUs.

Benefits

- More accurate data - From 4 reads to 24 reads/day
- Two-way communication
- Reduced cost - Switch from cellular to WiFi
- More efficient downloads and data processing
- Improved analysis of data
- More robust reporting - Better customer service

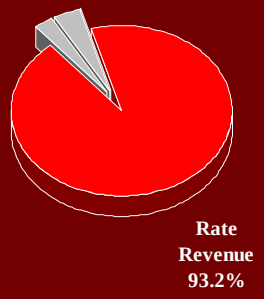
Constant Usage Report



Zero Consumption

Identify Sources of Lost Revenues

- Leaks
- Under-registering meters
- Theft
- Non-metered accounts
- Non-metered construction flushing
- Construction bypass
- Un-permitted street sweepers
- Other unaccounted-for water



Future Direction and Challenges

- In leadership
- Governance
- Employees
- Revenue
- Regulations on top of decaying infrastructure
- Adapting to our changing climate

Major Concerns/Challenges

- **Political Climate**
  - ***"Political Hyper Frenzy over rates– risk averse"***
  - **"Have to justify every cost- much more of bottom line new normal"**
  - **"Culture change has been pretty drastic"**
  - **"The trust is going away"**

Major Concerns/Challenges

- ***Workforce Issues***
  - ***Most have reduced staffing, some drastically***
  - ***Public pension changes & eroding benefits creating mass exodus***
  - ***"Losing critical mass of professional talent"***

Major Concerns/Challenges

- ***Decaying Infrastructure***
  - ***Still trying to address, but struggling with priorities in revised CIP budgets***
  - ***Competing requirements; wastewater, drainage***
  - ***"Are we replacing the right things?"***

Major Concerns/Challenges

- ***Revenues***
  - **Across the nation, utilities are seeing consumption/revenues drop**
  - **Water saving devices have made an impact as well as efforts by consumers**
  - **Seek additional sources of revenue**
  - **Raise rates**
  - **Conflicts with need for Stormwater revenue**

Major Concerns/Challenges

- **Climate Change**
  - **Will sea level rise impact coastal groundwater sources?**
  - **Increase in severe droughts**
  - **More intense rainfall causing water quality problems in surface supplies?**
  - **Intense heat periods causing shortages in summer supply**

Discussion