Posted 03/21/2019

Meeting Materials

Annual Update on Infiltration/Inflow Financial Assistance Program

March 20, 2019

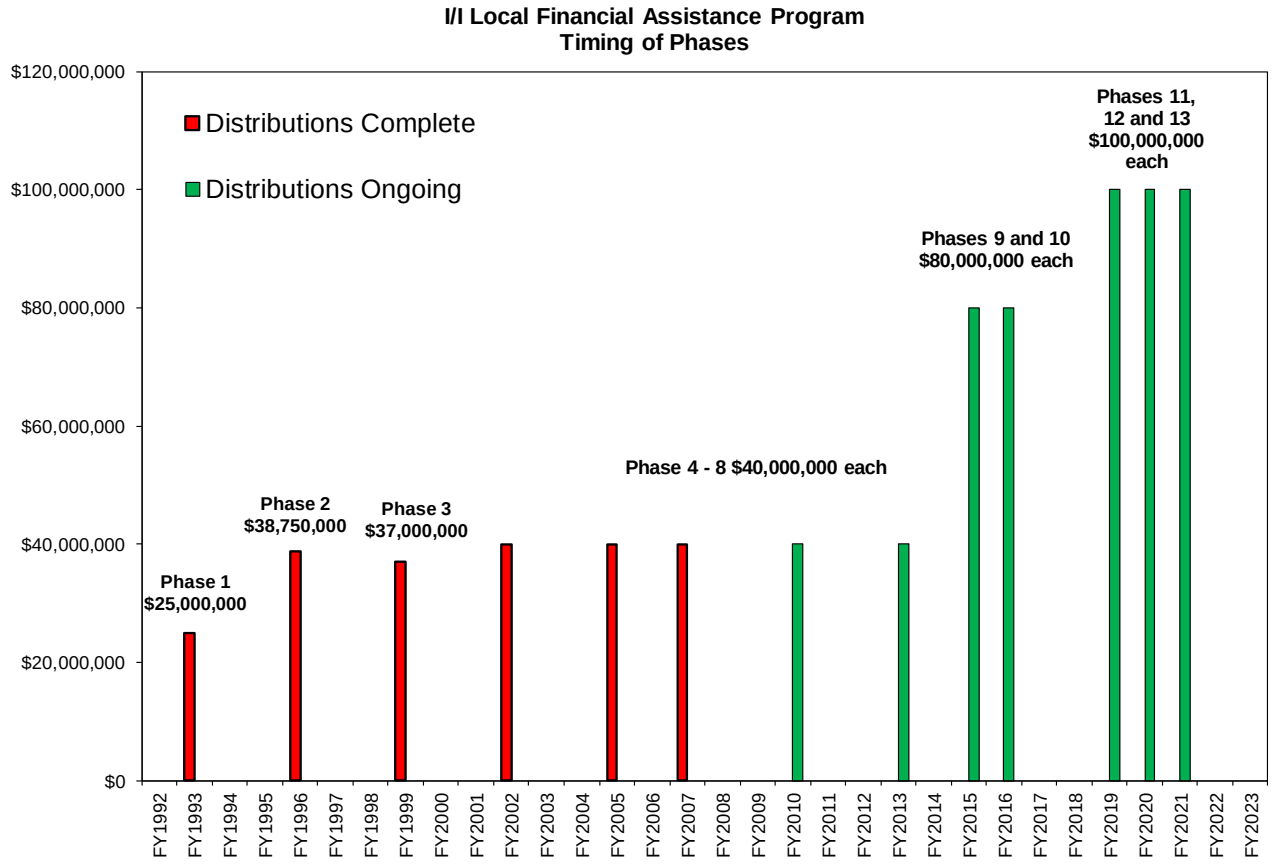
MWRA I/I Local Financial Assistance Program

Infiltration
(Groundwater via physical defects)

Inflow
(Stormwater via direct connections)

Goal: Rehabilitation of Local Sewer Systems and Long-Term Reduction of Infiltration and Inflow

MWRA's Long-Term Commitment to Fund I/I Reduction



MWRA I/I Local Financial Assistance Program Funding Summary

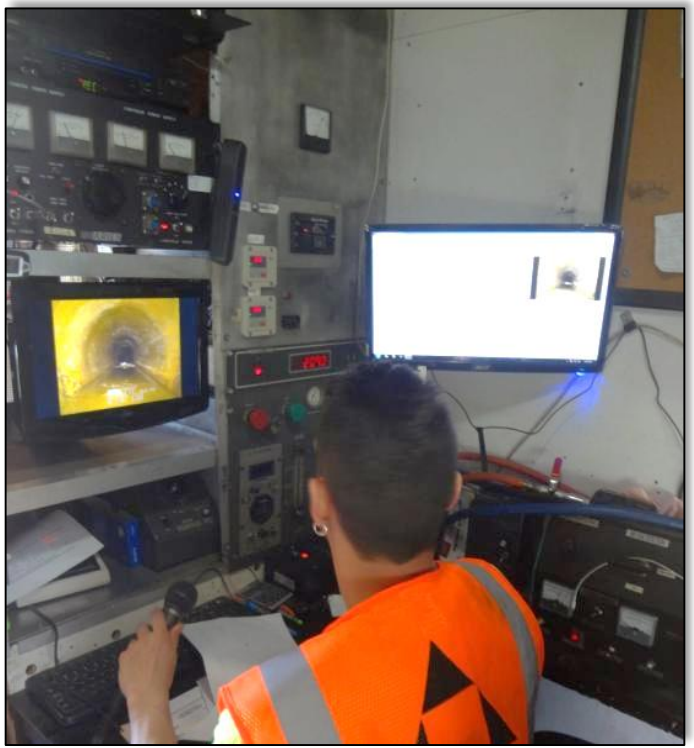
MWRA I/I LOCAL FINANCIAL ASSISTANCE PROGRAM
FUNDING SUMMARY AS OF FEBRUARY 2019

Community	Total Allocations (Phases 1 - 13)	Total Distributions (Phases 1 - 13)	Percent Distributed	Funds Remaining
Arlington	$13,703,000	$8,423,000	61%	$5,280,000
Ashland	$3,818,500	$1,742,450	46%	$2,076,050
Bedford	$5,654,600	$1,999,600	35%	$3,655,000
Belmont	$8,255,100	$2,992,100	36%	$5,263,000
Boston	$218,001,200	$94,112,776	43%	$123,888,424
Braintree	$14,419,000	$8,359,000	58%	$6,060,000
Brookline	$21,355,200	$7,666,200	36%	$13,689,000
Burlington	$8,432,800	$5,102,800	61%	$3,330,000
Cambridge	$39,250,100	$28,830,100	73%	$10,420,000
Canton	$6,635,900	$2,675,900	40%	$3,960,000
Chelsea	$11,760,100	$5,551,100	47%	$6,209,000
Dedham	$9,220,000	$5,740,000	62%	$3,480,000
Everett	$13,381,500	$6,650,500	50%	$6,731,000
Framingham	$20,375,000	$8,803,910	43%	$11,571,090
Hingham	$2,802,500	$2,022,500	72%	$780,000
Holbrook	$2,779,600	$896,562	32%	$1,883,038
Lexington	$12,125,300	$9,005,300	74%	$3,120,000
Malden	$20,683,900	$5,641,900	27%	$15,042,000
Medford	$19,637,600	$7,961,600	41%	$11,676,000
Melrose	$10,126,300	$7,157,300	71%	$2,969,000
Milton	$9,014,500	$5,564,500	62%	$3,450,000
Natick	$9,332,600	$5,582,600	60%	$3,750,000
Needham	$9,977,600	$3,218,600	32%	$6,759,000
Newton	$34,937,400	$25,777,400	74%	$9,160,000
Norwood	$11,589,400	$6,879,400	59%	$4,710,000
Quincy	$32,780,000	$23,302,039	71%	$9,477,961
Randolph	$10,070,800	$3,894,800	39%	$6,176,000
Reading	$7,749,100	$4,629,100	60%	$3,120,000
Revere	$16,940,900	$5,502,900	32%	$11,438,000
Somerville	$25,955,800	$10,117,800	39%	$15,838,000
Stoneham	$7,829,900	$5,889,900	75%	$1,940,000
Stoughton	$7,902,900	$5,122,900	65%	$2,780,000
Wakefield	$9,806,900	$6,493,310	66%	$3,313,590
Walpole	$6,110,000	$3,042,000	50%	$3,068,000
Waltham	$22,282,400	$11,377,400	51%	$10,905,000
Watertown	$10,155,800	$5,235,800	52%	$4,920,000
Wellesley	$9,249,700	$3,582,504	39%	$5,667,196
Westwood	$4,302,300	$2,091,300	49%	$2,211,000
Weymouth	$19,100,900	$9,425,900	49%	$9,675,000
Wilmington	$4,232,000	$1,606,000	38%	$2,626,000
Winchester	$6,793,000	$4,183,000	62%	$2,610,000
Winthrop	$5,553,400	$3,066,900	55%	$2,486,500
Woburn	$16,665,500	$12,685,500	76%	$3,980,000
Totals	$760,750,000	$389,606,151	51%	$371,143,849

- $760.75 million approved (13 Phases)
- $390 million distributed (FY93 – February 2019)
- $169 million loans repaid to MWRA
- All 43 communities participating
- 565 local projects funded
- 504 projects complete, 61 ongoing
- Community allocation based on % share sewer charge

I/I Funding Results of Local Projects

- TV Inspection of Sewers – 2,074 miles



TV Inspection Location of Infiltration into Sewer Pipelines

I/I Funding for Rehabilitation of Local Sewers

- 219 Miles of Sewer Cured-In-Place Pipe (CIPP) Liner Installed

I/I Funding for Rehabilitation of Local Sewers

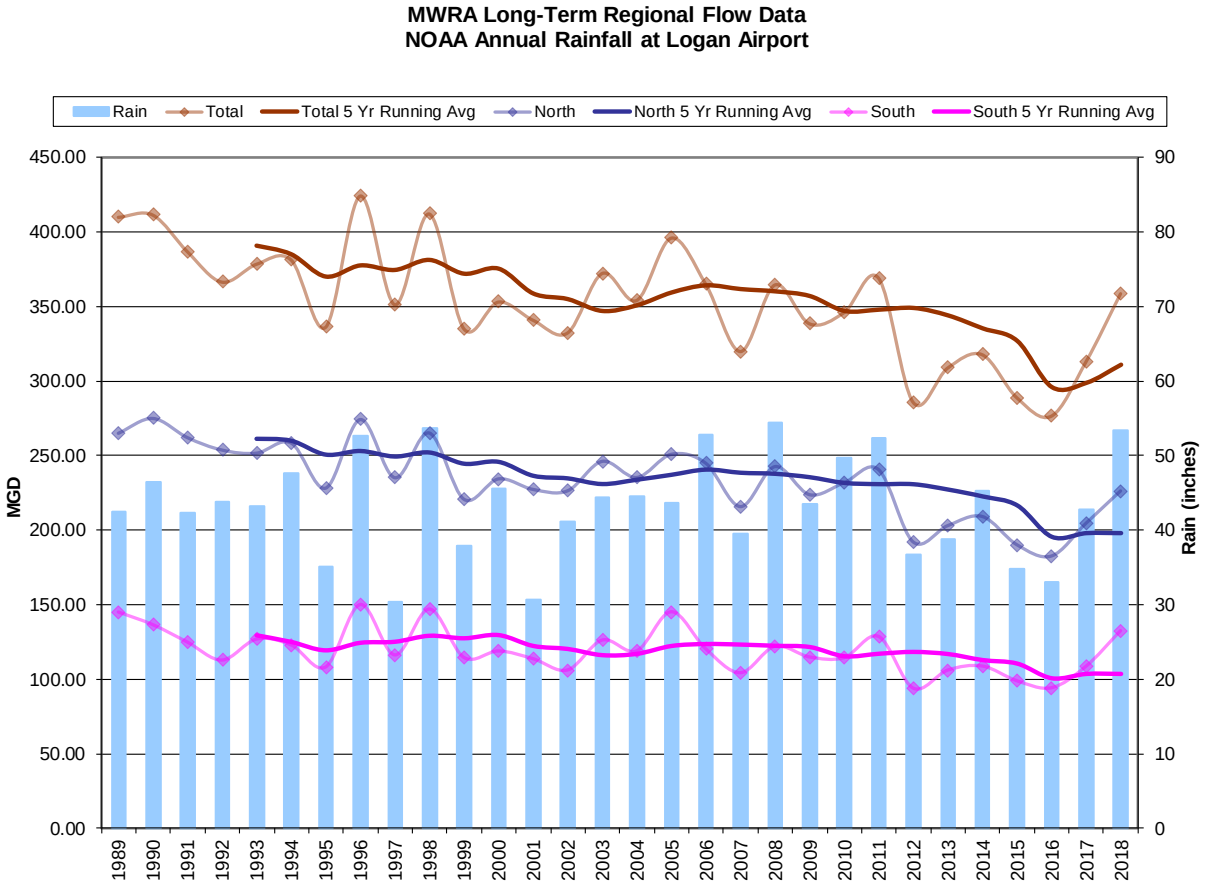
- 18,187 Manholes Rehabilitated/Sealed

Inflow into Manholes

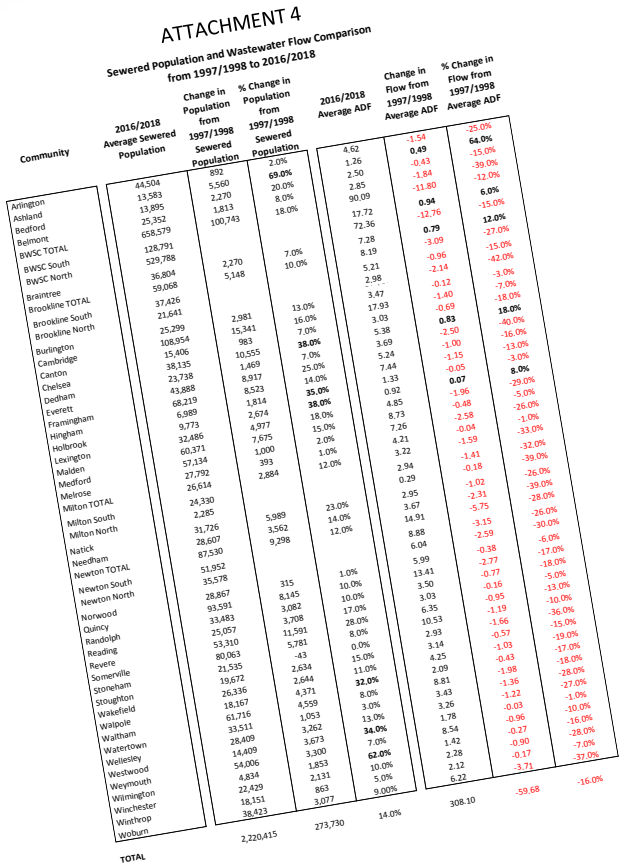
I/I Funding for Rehabilitation of Local Sewers

- 1,331 Miles of Sewer Smoke Tested
- 1,060 Catch Basins Disconnected from Sewer

MWRA Long-Term Regional Flow Data – Gradual Decrease in Flow



Percent Change in Wastewater Flow – 20 Year Snapshot



ATTACHMENT 4

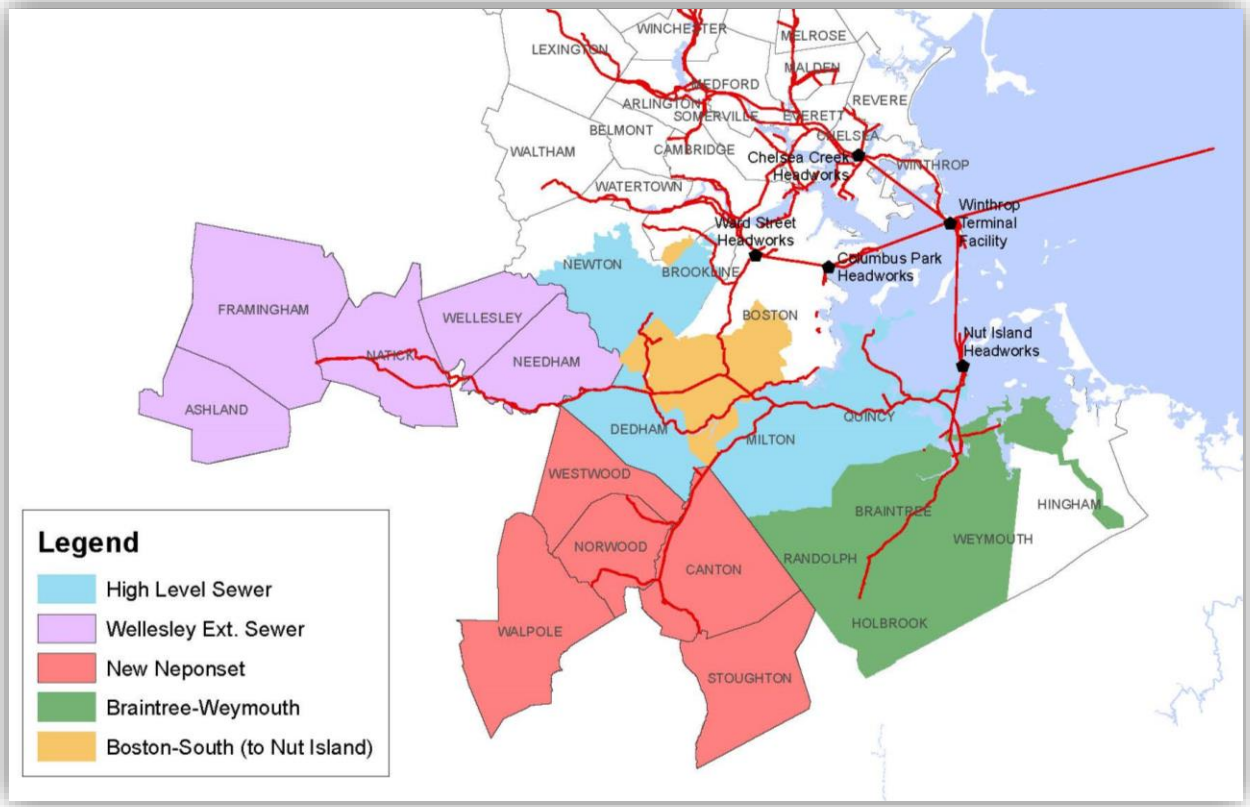
Sewered Population and Wastewater Flow Comparison from 1997/1998 to 2016/2018

Community	2016/2018 Average Sewered Population	Change in Population from 1997/1998 Sewered Population	% Change in Population from 1997/1998 Sewered Population	2016/2018 Average ADF	Change in Flow from 1997/1998 Average ADF	% Change in Flow from 1997/1998 Average ADF
Arlington	44,504	892	2.0%	4.62	-1.54	-25.0%
Ashland	13,583	5,560	**69.0%**	1.26	**0.49**	**64.0%**
Bedford	13,895	2,270	20.0%	2.50	-0.43	-15.0%
Belmont	25,352	1,813	8.0%	2.85	-1.84	-39.0%
BWSC TOTAL	658,579	100,743	18.0%	90.09	-11.80	-12.0%
BWSC South	128,791			17.72	**0.94**	**6.0%**
BWSC North	529,788	2,270	7.0%	72.36	-12.76	-15.0%
Braintree	36,804	5,148	10.0%	7.28	**0.79**	**12.0%**
Brookline TOTAL	59,068			8.19	-3.09	-27.0%
Brookline South	37,426			5.21	-0.96	-15.0%
Brookline North	21,641	2,981	13.0%	2.98	-2.14	-42.0%
Burlington	25,299	15,341	16.0%	3.47	-0.12	-3.0%
Cambridge	108,954	983	7.0%	17.93	-1.40	-7.0%
Canton	15,406	10,555	**38.0%**	3.03	-0.69	-18.0%
Chelsea	38,135	1,469	7.0%	5.38	**0.83**	**18.0%**
Dedham	23,738	8,917	25.0%	3.69	-2.50	-40.0%
Everett	43,888	8,523	14.0%	5.24	-1.00	-16.0%
Framingham	68,219	1,814	**35.0%**	7.44	-1.15	-13.0%
Hingham	6,989	2,674	**38.0%**	1.33	-0.05	-3.0%
Holbrook	9,773	4,977	18.0%	0.92	**0.07**	**8.0%**
Lexington	32,486	7,675	15.0%	4.85	-1.96	-29.0%
Malden	60,371	1,000	2.0%	8.73	-0.48	-5.0%
Medford	57,134	393	1.0%	7.26	-2.58	-26.0%
Melrose	27,792	2,884	12.0%	4.21	-0.04	-1.0%
Milton TOTAL	26,614			3.22	-1.59	-33.0%
Milton South	24,330			2.94	-1.41	-32.0%
Milton North	2,285	5,989	23.0%	0.29	-0.18	-39.0%
Natick	31,726	3,562	14.0%	2.95	-1.02	-26.0%
Needham	28,607	9,298	12.0%	3.67	-2.31	-39.0%
Newton TOTAL	87,530			14.91	-5.75	-28.0%
Newton South	51,952			8.88	-3.15	-26.0%
Newton North	35,578	315	1.0%	6.04	-2.59	-30.0%
Norwood	28,867	8,145	10.0%	5.99	-0.38	-6.0%
Quincy	93,591	3,082	10.0%	13.41	-2.77	-17.0%
Randolph	33,483	3,708	17.0%	3.50	-0.77	-18.0%
Reading	25,057	11,591	28.0%	3.03	-0.16	-5.0%
Revere	53,310	5,781	8.0%	6.35	-0.95	-13.0%
Somerville	80,063	-43	0.0%	10.53	-1.19	-10.0%
Stoneham	21,535	2,634	15.0%	2.93	-1.66	-36.0%
Stoughton	19,672	2,644	11.0%	3.14	-0.57	-15.0%
Wakefield	26,336	4,371	**32.0%**	4.25	-1.03	-19.0%
Wakefield	18,167	4,559	8.0%	2.09	-0.43	-17.0%
Walpole	61,716	1,053	3.0%	8.81	-1.98	-18.0%
Waltham	33,511	3,262	13.0%	3.43	-1.36	-28.0%
Watertown	28,409	3,673	**34.0%**	3.26	-1.22	-27.0%
Wellesley	14,409	3,300	7.0%	1.78	-0.03	-1.0%
Westwood	54,006	1,853	**62.0%**	8.54	-0.96	-10.0%
Weymouth	4,834	2,131	10.0%	1.42	-0.27	-16.0%
Wilmington	22,429	863	5.0%	2.28	-0.90	-28.0%
Winchester	18,151	3,077	9.00%	2.12	-0.17	-7.0%
Winthrop	38,423			6.22	-3.71	-37.0%
Woburn						
TOTAL	2,220,415	273,730	14.0%	308.10	-59.68	-16.0%

Largest Flow % Decrease

Dedham	**40%**
Belmont	**37%**
Needham	**39%**
Woburn	**37%**
Stoneham	**36%**
Milton	**33%**
Nine Communities	**25-30%**

South System by Subarea: Percent Change in Wastewater Flow - 20 Year Snapshot



High Level Sewer: - 24%
Newton-South, Brookline-South, Dedham, Milton, Quincy

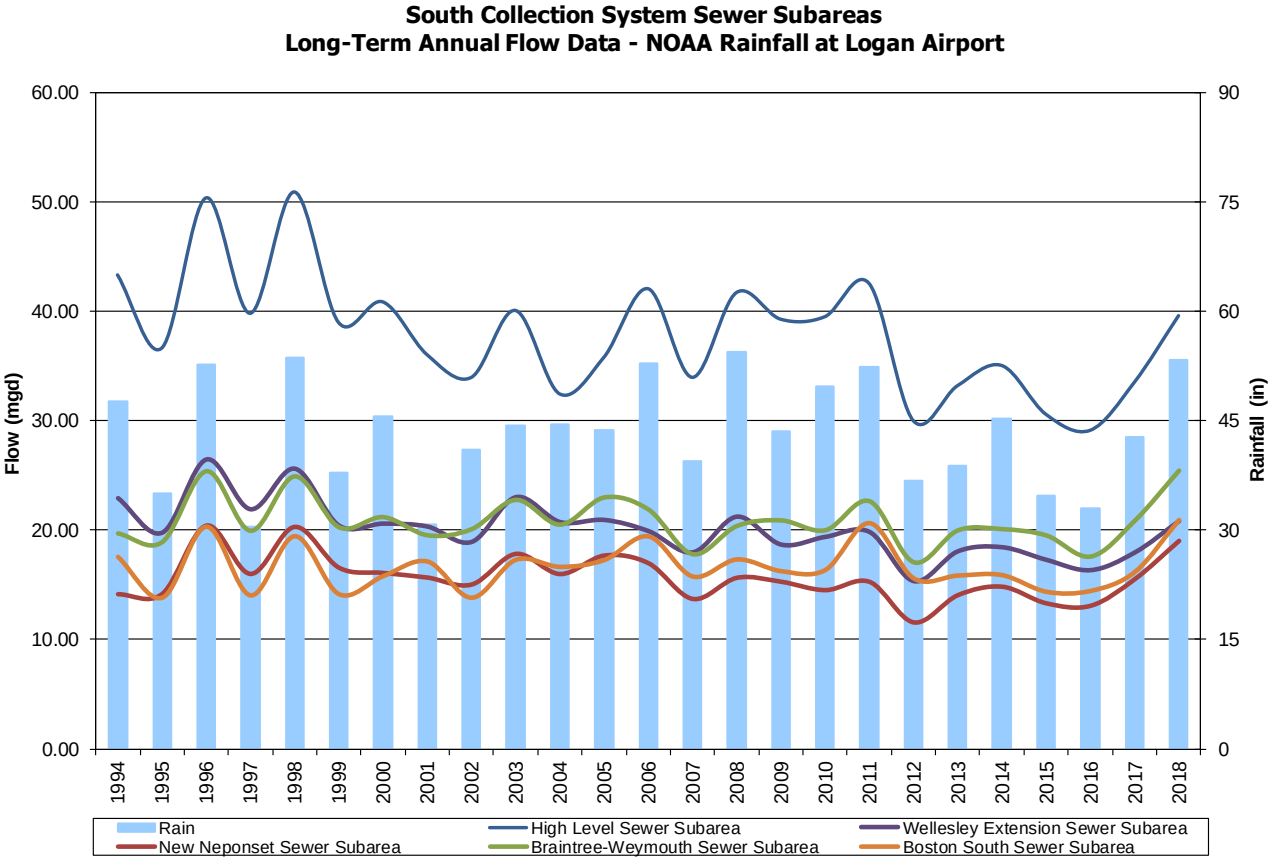
Wellesley Extension Sewer: - 22%
Ashland, Framingham, Natick, Needham, Wellesley

New Neponset Sewer: - 11%
Canton, Norwood, Stoughton, Walpole, Westwood

Braintree/Weymouth Sewer: - 4%
Braintree, Hingham, Holbrook, Randolph, Weymouth

Boston-South: + 6%

South System Subareas




WATER RESOURCES AUTHORITY
MASSACHUSETTS

Combined Heat and Power Study
Deer Island Treatment Plant
Contract 6963A

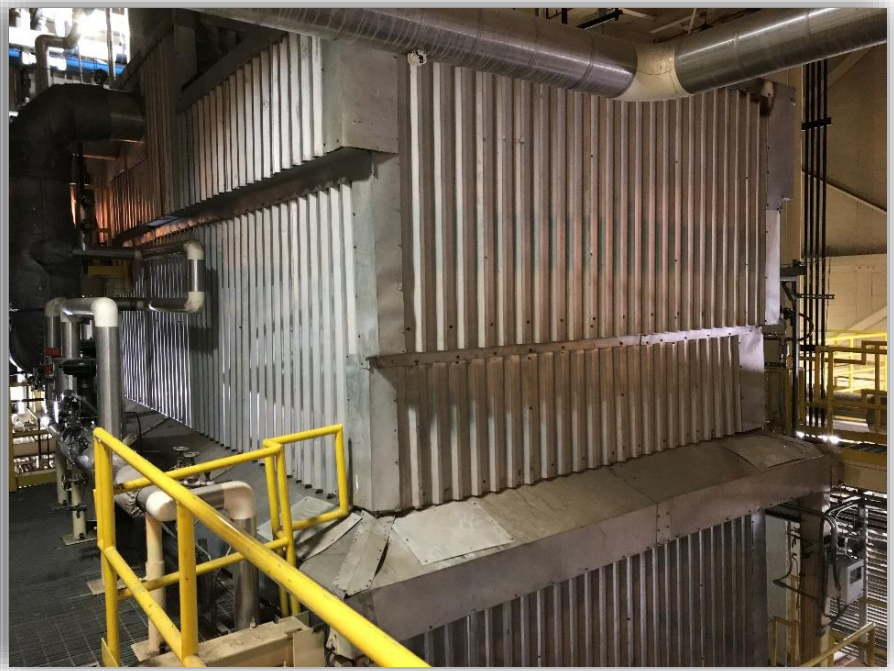
March 20, 2019

Deer Island Energy Supply

- Cross Harbor Electrical Cable (primary power)
- Fuel oil (CTGs as backup power)
- Digester gas from sludge (combined heat and power)
- Hydro
- Wind
- Solar

Energy Generation Equipment

Combustion Turbine Generators



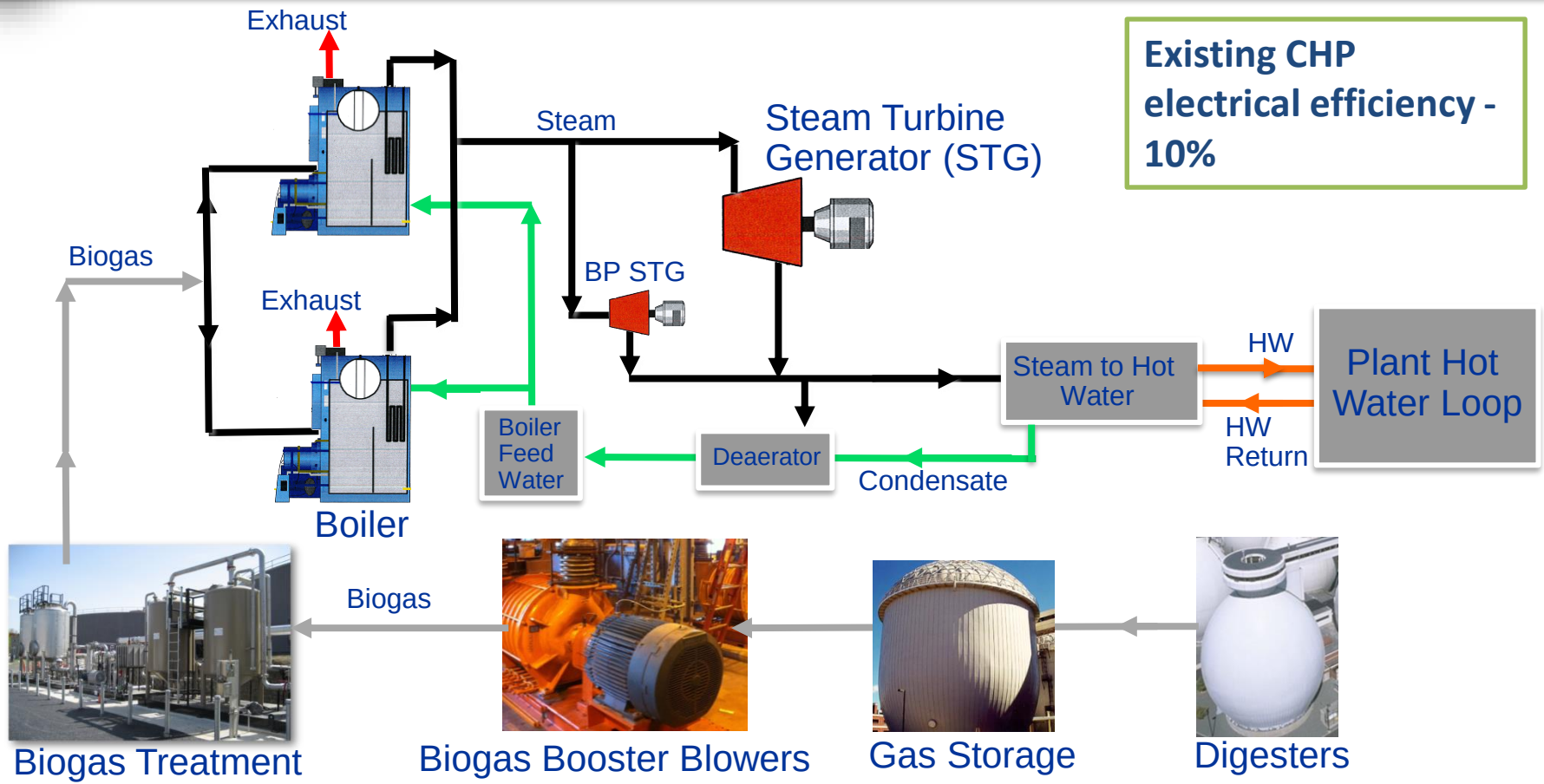
Steam Boilers

Energy Generation Equipment

Back Pressure Steam Turbine Generator

Steam Turbine Generator

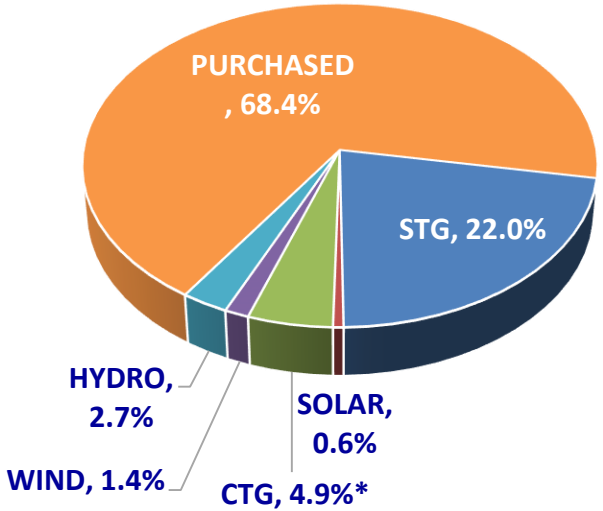
Existing On Site Thermal/Power Plant Schematic



Electrical Supply Breakdown

- Produced 27%* of electricity with renewable energy in FY17 & FY18
- Deer Island electrical demand reduced 14% since FY09

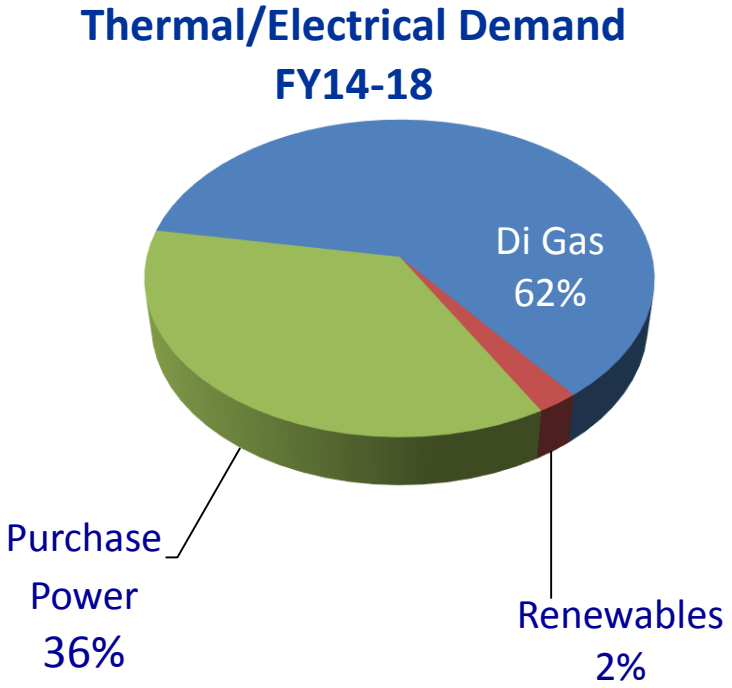
Electrical Supply by Source



** Electricity produced by CTG (4.9%) not considered as renewable energy*

Total Energy Supply Breakdown (Thermal + Electrical)

- Digester gas meets 95% of the plant's thermal demand
- Produced 64% of thermal and electricity demand with renewable energy



Project Justification

- Existing equipment is nearing end of useful life
- Increased energy efficiency (newer technology)
- Potential energy cost savings
- Plan for Deer Island's energy supply future

Consultant Activities

Contract 6963A will:

- Evaluate existing energy infrastructure;
- Evaluate commodities and future energy market projections
- Evaluate multiple future energy alternatives by creating:
  - Conceptual designs
  - Performance simulations
  - Economic analyses
- Will influence decision making for long-term energy plan

Energy System Alternatives

- Alternative Group 1: Existing Equipment with new electrical and natural gas supplies (4 Alternatives)
- Alternative Group 2: New CHP with existing fuels (4 Alternatives)
- Alternative Group 3: New CHP with the addition of natural gas (3 Alternatives)
- Alternative Group 4: Consultant Proposed Alternatives (2 Alternatives)

What Does This Really Mean?

- Compare options for cost competitiveness
  - Direct replacement of all equipment; vs
  - New fuel/power sources; vs
  - Installation of a new combined heat and power system

- New system could increase electrical generation 3 to 4 fold
- Deer Island renewables percentage could increase from 64% to >90%

Contract 6963A – Deer Island Combined Heat & Power Study

Recommended Consultant:	Black & Veatch
Price:	$1,149,500
Contract Term:	15 Months


WATER RESOURCES AUTHORITY
MASSACHUSETTS

Biosolids Processing Facility Capital Improvements Contract 7153

March 20, 2019

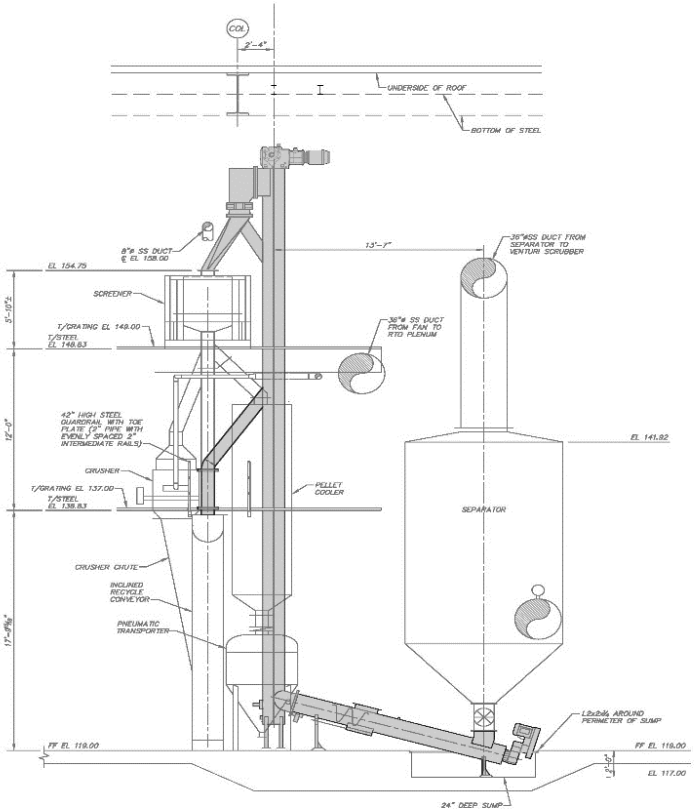
Biosolids Processing Facility

- Construction completed in 1991
- Operated by New England Fertilizer Company (under contract)
- Contract includes $7 million set aside for capital improvements

Contract 7153 Summary

- Contract will replace:
  - Separator Conveyors (9 of 12)
  - Dust Collection, Air Compressor and Nitrogen Purge Systems
  - Dome Cover Braces (4 storage tanks)
  - Gas Boiler
  - Sludge Dryer Drums (3)
  - Electrical Modifications

Separator Conveyor



Dust Collector System

Dust Collectors

Nitrogen Purge Generator
(fire suppression system)

Additional Work

Sludge Tank Roof Cover
(braces under roof cover)

Gas Boiler

Sludge Processing Rotary Dryers

Summary

- **Bids Received:**

Engineer's Estimate	*$7.850,200*
IPC Lydon, LLC	**$8,681,776**
Walsh Construction Co. II	$9,101,495
Waterline Industries Corp.	$9,577,677

- **Contractor:** IPC Lydon, LLC. (lowest responsive bidder)
- **Contract Price:** $8,681,776.00 (+15% Design/Construction Administration fee)
- **Contract Duration:** 500 days


WATER RESOURCES AUTHORITY
MASSACHUSETTS

Annual Update on Local Water System Financial Assistance Program

March 20, 2019

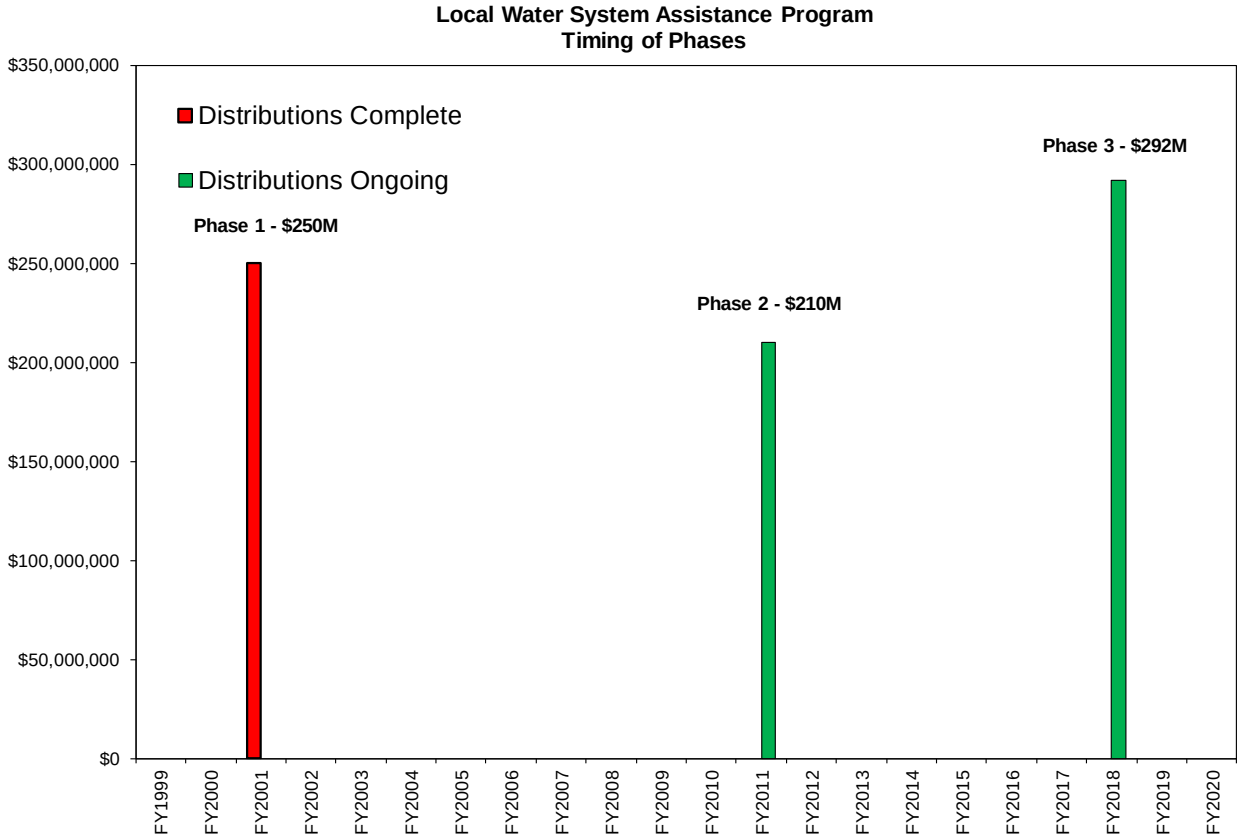
MWRA Local Water System Assistance Program

Unlined Cast-Iron Tuberculated Pipe

Cement-Lined Pipe

- Goal – Rehabilitation of local water systems to prevent loss of disinfectant residual

MWRA's Long-Term Commitment to Fund Local Water System Rehabilitation



MWRA Local Water System Assistance Program Funding Summary

MWRA LOCAL WATER SYSTEM ASSISTANCE PROGRAM
ALLOCATION AND FUND UTILIZATION BY COMMUNITY
THROUGH FEBRUARY 2019

Community	Community Total Allocation Phases 2 and 3	Total Distributions Phases 2 and 3	Percent Distributed	Funds Remaining
Arlington	$14,912,000	$4,400,000	30%	$10,512,000
Bedford *	$6,067,000	$2,418,000	40%	$3,649,000
Belmont	$7,329,000	$4,477,000	61%	$2,852,000
Boston	$91,541,000	$45,174,098	49%	$46,366,902
Brookline	$8,011,000	$660,000	8%	$7,351,000
Canton *	$6,187,000	$2,000,000	32%	$4,187,000
Chelsea	$8,853,000	$3,011,200	34%	$5,841,800
Dedham/Westwood *	$1,352,000	$503,000	37%	$849,000
Everett	$10,970,000	$4,441,000	40%	$6,529,000
Framingham	$16,360,000	$9,157,600	56%	$7,202,400
Lexington	$6,801,000	$1,145,015	17%	$5,655,985
Lynnfield Water Dist.	$3,074,000	$1,146,800	37%	$1,927,200
Malden	$17,877,000	$1,774,000	10%	$16,103,000
Marblehead	$9,349,000	$0	0%	$9,349,000
Marlborough *	$5,429,000	$1,283,800	24%	$4,145,200
Medford	$17,759,000	$2,075,000	12%	$15,684,000
Melrose	$10,853,000	$4,419,000	41%	$6,434,000
Milton	$10,090,000	$3,500,000	35%	$6,590,000
Nahant	$3,325,000	$1,142,100	34%	$2,182,900
Needham *	$2,688,000	$1,131,265	42%	$1,556,735
Newton	$34,439,000	$10,881,600	32%	$23,557,400
Northborough *	$2,498,000	$986,053	39%	$1,511,947
Norwood	$10,691,000	$5,654,200	53%	$5,036,800
Peabody *	$3,845,000	$3,845,000	100%	$0
Quincy	$24,757,000	$11,679,459	47%	$13,077,541
Reading	$9,219,000	$4,146,000	45%	$5,073,000
Revere	$10,349,000	$6,050,000	58%	$4,299,000
Saugus	$16,309,000	$4,012,054	25%	$12,296,946
Somerville	$18,210,000	$5,898,234	32%	$12,311,766
Southborough	$3,432,000	$0	0%	$3,432,000
Stoneham	$5,081,000	$2,339,000	46%	$2,742,000
Stoughton*	$6,053,000	$2,506,000	41%	$3,547,000
Swampscott	$9,031,000	$3,949,468	44%	$5,081,532
Wakefield *	$5,681,000	$3,325,000	59%	$2,356,000
Waltham	$25,197,000	$5,520,201	22%	$19,676,799
Watertown	$6,723,000	$3,478,000	52%	$3,245,000
Wellesley *	$5,618,000	$241,569	4%	$5,376,431
Weston	$3,920,000	$1,005,000	26%	$2,915,000
Wilmington *	$1,917,000	$611,000	32%	$1,306,000
Winchester *	$2,276,000	$775,000	34%	$1,501,000
Winthrop	$7,431,000	$7,431,000	100%	$0
Woburn *	$6,496,000	$2,591,000	40%	$3,905,000
SUBTOTAL	**$478,000,000**	**$180,783,716**	**38%**	**$297,216,284**
Chicopee	$16,927,000	$4,035,000	24%	$12,892,000
South Hadley F.D. 1	$3,564,000	$2,038,000	57%	$1,526,000
Wilbraham	$3,509,000	$0	0%	$3,509,000
SUBTOTAL	**$24,000,000**	**$6,073,000**	**25%**	**$17,927,000**
TOTAL	**$502,000,000**	**$186,856,716**	**37%**	**$315,143,284**

* Partially Served Communities

- $724 million approved (3 Phases)
- $409 million distributed (FY01 – February 2019)
- $260 million loans repaid to MWRA
- 42 communities participating
- 446 local projects funded
- 386 projects complete, 80 ongoing
- Community allocation based on % share water charge and % share unlined pipe

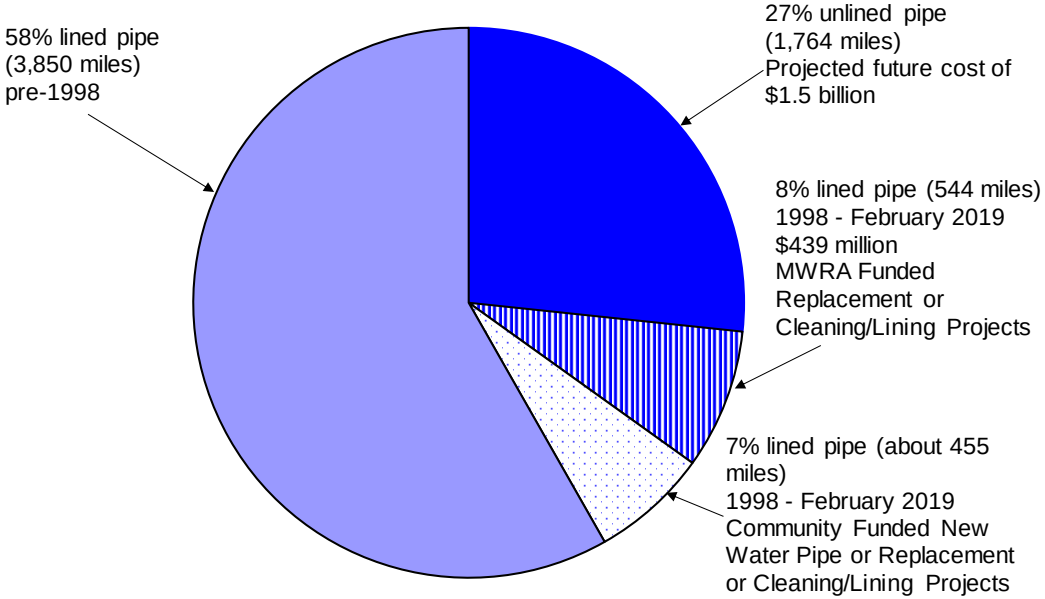
MWRA Funding for Local Water Projects

Water Main Replacement Construction

Water Storage Tank Rehabilitation

MWRA Funding for Local Water Projects

Regional Water System Lined and Unlined Pipe
6,613 Miles of Community Water Mains
Updated as of February 2019



- Remaining unlined pipe represents a $1.5 billion future cost

Lead Service Line Replacement Loan Program

- $100 million in 10-Year, Interest-Free Loans
- Fully Replace Lead Service Lines
- Distributed $10.1 million to 9 Communities to date:
  - Quincy: $1.5 million in FY17
  - Winchester: $500,000 in FY17, $500,000 in FY18
  - Newton: $4.0 million in FY17
  - Marlborough: $1.0 million in FY18
  - Revere: $195,000 in FY18
  - Winthrop: $284,000 in FY18
  - Needham: $1.0 million in FY18
  - Everett: $1.0 million in FY19
  - Chelsea: $100,000 in FY19


WATER RESOURCES AUTHORITY
MASSACHUSETTS

Memorandum of Agreement with the City of Newton Regarding Contract 6392

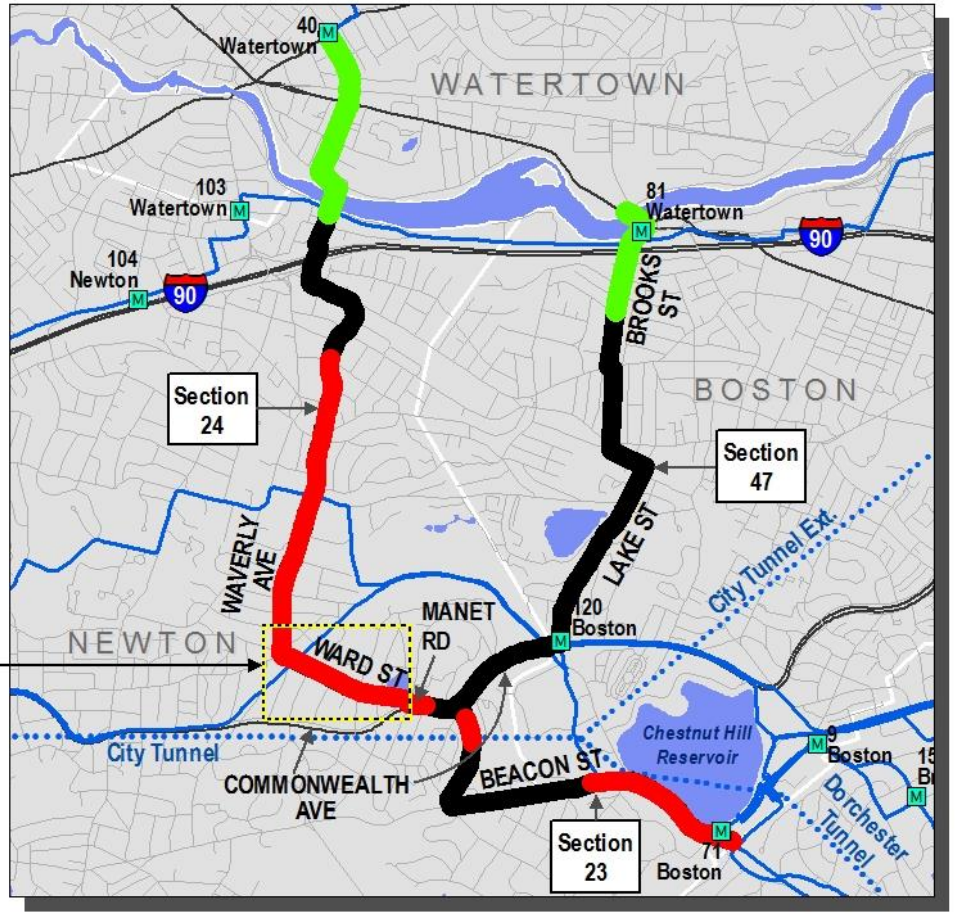
March 20, 2019

Memorandum of Agreement with the City of Newton

Legend

- Pipe Replacement Limits
- Pipe Cleaning & Lining Limits
- To Be Rehabilitated in Future Contract

Memorandum of Agreement



MWRA Contract 6392

Pipeline	Age (years)	Diameter (inches)	Length
City of Newton	140	20	2,400
MWRA Section 23	122	36	8,100
MWRA Section 24	122	20	9,391
MWRA Section 47	101	20	8,200

- Replace approximately 2,400 linear feet of City of Newton's water main
- Ward Street – between Manet Road and Waverly Avenue

Existing Conditions – MWRA Sections 23 and 24

Section 23

36-inch Cast Iron Main

Ward Street, Newton

Section 24

20-inch Cast Iron Main

St. James Terrace, Newton

Contract 6392

- Cost Estimate:

Newton work	$2.7 million
MWRA work	$14.5 million
Total	$17.2 million

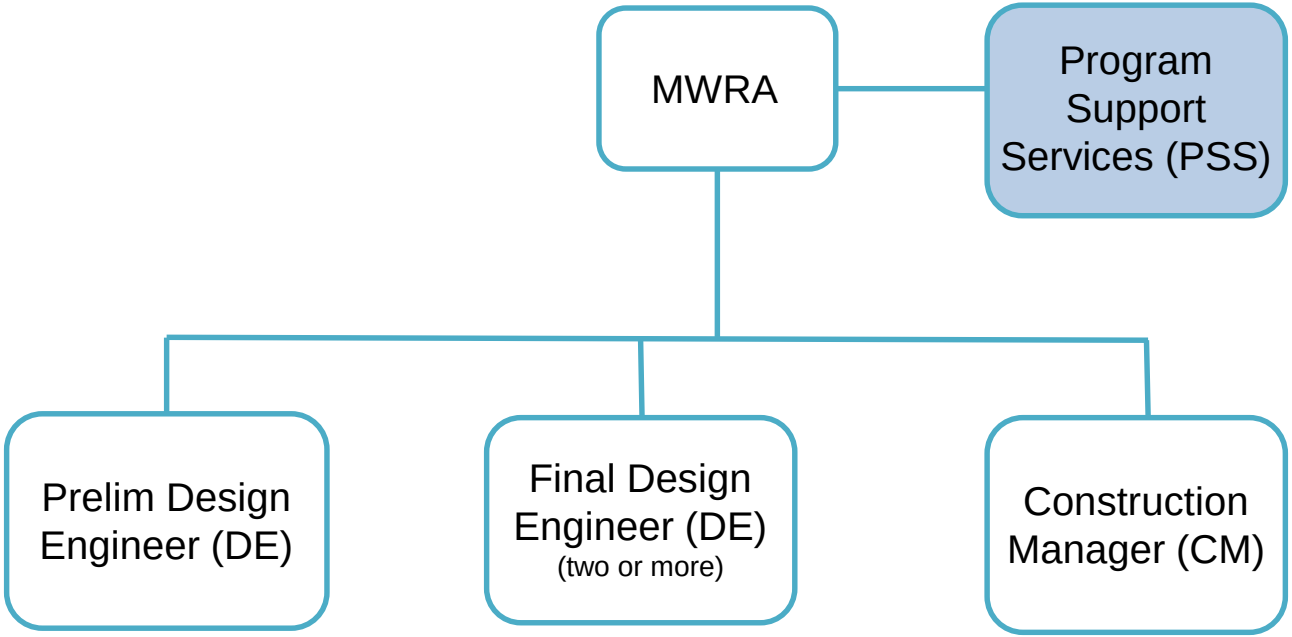
- Schedule:
  - Awaiting National Grid's firm schedule for relocation of gas mains (60% of pipe routing)


WATER RESOURCES AUTHORITY
MASSACHUSETTS

Metropolitan Tunnel Redundancy Program Support Services Contract Award and Program Update

March 20, 2019

Program Support Services Contract Award



Program-Wide Support Services

- Program-wide planning
- Risk management planning
- Quality management
- Design criteria and standardization
- Independent design review
- Design and Construction package planning
- Critical path scheduling, and
- Budget planning and management

Procurement Process

- Industry Outreach, pre-procurement:
  - American Council of Engineering Companies of Massachusetts (ACEC/MA)
  - George A. Fox Conference (annual national tunneling conference in NYC)

- RFQ/P Notice:
  - Central Register, Boston Herald, Banner Publications and El Mundo
  - Written notice was sent to over 35 engineering firms
  - 49 firms requested copies of the RFQ/P

Evaluation Criteria

- Cost (20 points)
- Qualifications and Key Personnel (20 points)
- Experience/Past Performance on Similar Non-Authority projects and Past Performance on Authority Projects (20 points)
- Technical Approach (20 points)
- Capacity/Organization and Management Approach (17 points)
- MBE/WBE Participation (3 points)

RFQ/P Response

- One proposal received

- Reasons for not submitting:
  - 12 firms to pursue future contracts
  - Other firms
    - Insufficient local personnel
    - Qualified personnel already committed
  - Small firms not qualified as a prime consultant
    - interested as subconsultants

- Re-procuring not likely to yield additional competition

JCK Underground Proposal Review

- Exceeds minimum qualifications
- Extensive experience with deep rock water/waste water tunnel projects similar in size and scope
- Providing similar services for other agencies
  - DC Water
  - Alexandria VA
  - Allegheny County Sanitary Authority
  - Silicon Valley Clean Water

Key Personnel

- Project Manager:
  - Locally based
  - 30 years of experience, with over 25 years specializing in tunnels and underground structures
  - Significant roles on the **MWRA** Boston Harbor Project Tunnels, MetroWest Water Supply Tunnel, and the Braintree Weymouth Tunnel

Other Key Personnel

- Industry leaders in:
  - Risk management
  - Project delivery for large complex tunnel programs
- Locally based
- Past MWRA Tunnel experience includes:
  - Boston Harbor Project
  - MetroWest Water Supply Tunnel
  - Braintree-Weymouth Tunnel
- Added Key Personnel, beyond RFQ/P minimum requirements

Technical Approach and References

- Excellent understanding of the Tunnel Redundancy Program and the services that are required

- Thoughtful enhancements for consideration

- Numerous references
  - All references were excellent
  - Strong satisfaction
  - Responsive and would rehire!

Cost and Level of Effort

	JCK Underground, Inc.	Engineer's Estimate
Proposed Cost (initial 60-month term)	$10,247,877.21	$10,250,000
Level of Effort	34,743 hours	25,660 hours

- Allowances for two additional optional 2-year renewals with Board approval
- Total potential contract of $17,497,877 over 9 years

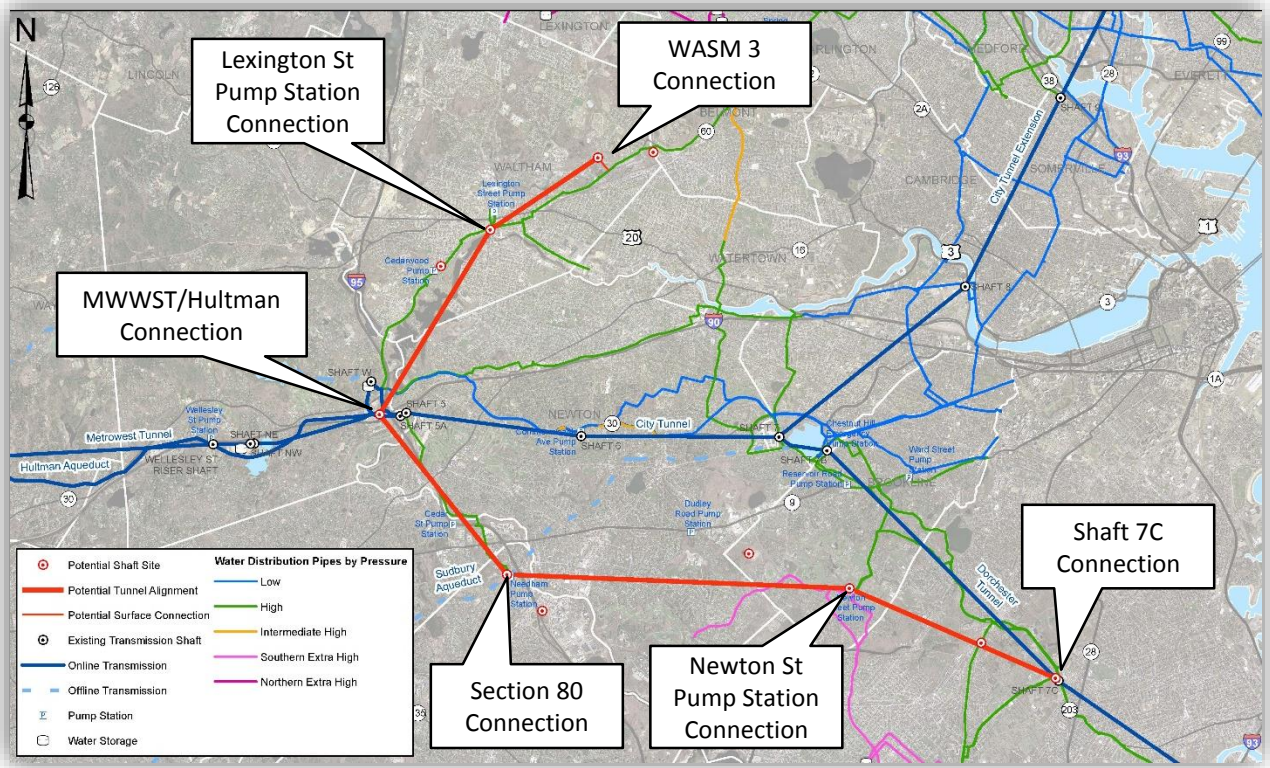
Cost Analysis

- Overhead and profit are very competitive
- Average direct labor rate is lower than estimated
  - Mix of senior and mid-level staff
- Result is a much lower fully burdened billable rate than estimated
- Value for the $!

Proposed Level of Effort

- JCK proposed a higher level of effort for certain tasks:
  - Project controls
  - Geotechnical database development
  - Incorporation of lessons learned into this project
  - Quality control of geotechnical field work
  - Independent review of design submittals
  - Risk management and mitigation planning
- Staff supports the increased level of effort for the proposed technical approach and staff mix

Revised Tunnel Alignment



The Tunnel Project Basics:

- 14 miles of deep rock tunnel
  - 4.5 mile to the north / WASM3
  - 9.5 miles to the south – Shaft 7C
- 10’ finished diameter
- 200’ – 500’ below ground (well into bedrock)
- Revised shaft location provides redundancy to Section 80 (Needham and Wellesley)
- Shaft locations and alignment are preliminary and may change during Design

Hydraulic Model Update

- Adding all proposed CIP Water Projects
  - New pipelines
  - Rehabilitated pipelines
- Population and Employment Projections
  - 2040 and beyond
- Potential System Expansion
- Temporary Loss of Local Sources (Drought/Emergency)
- Water age/quality

Planned Schedule

- Program Support Services Consultant
  - Award - pending Board approval
  - Notice to Proceed: April 1, 2019

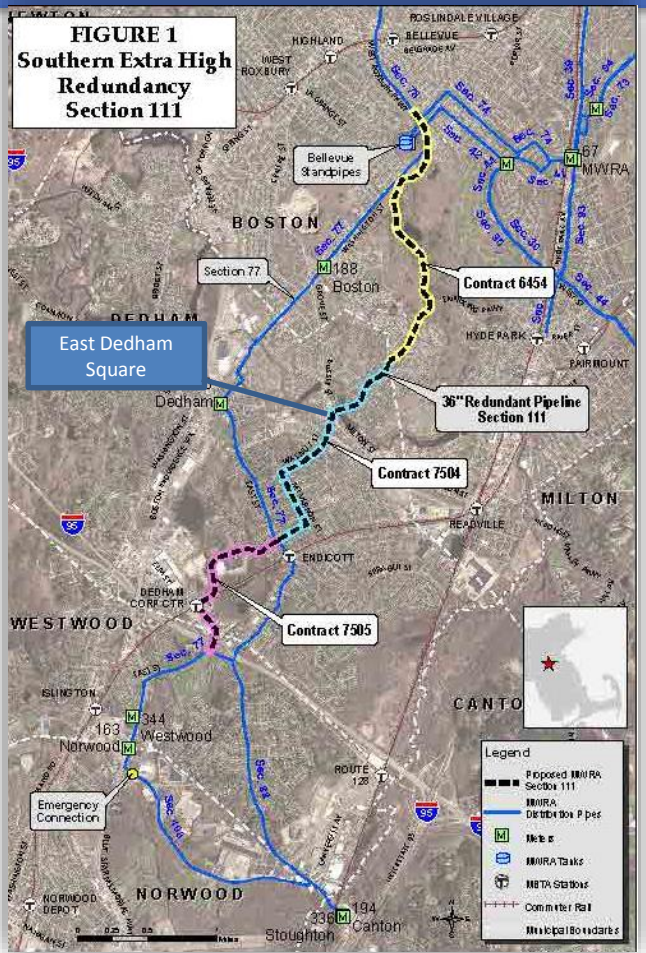
- Preliminary Design Engineering/MEPA Review
  - Issue RFQ: Mid 2019
  - Issue RFP: Late 2019
  - Notice to Proceed: Early 2020


WATER RESOURCES AUTHORITY
MASSACHUSETTS

Southern Extra High Pipeline – Dedham North
Contract 7504, Change Order 6

March 20, 2019

Southern Extra High Redundancy Project



CONTRACT 1

Approx. 11,000 LF
NTP 7/2016

CONTRACT 2

Approx. 10,000 LF
NTP 10/2017

CONTRACT 3

Approx. 6,800 LF
NTP 8/2018

Excavation at East Dedham Square

Cutting Dedham/Westwood 12” Water Main in East Dedham Square

Close-up of Un-restrained Dedham/Westwood Pipe

Reinstalled Dedham/Westwood 12” Water Main

Installing a Typical Bend


WATER RESOURCES AUTHORITY
MASSACHUSETTS

MWRA Retirement System Update

March 20, 2019

Introduction

- Retirement System was created in MWRA's Enabling Act in 1984
- Three members expanded to Five in 2006
  - Secretary of MWRA Board of Directors –Andrew Papastergion
  - Appointment by MWRA Board of Directors – Thomas Durkin
  - Elected by membership – James Flemming
  - Elected by membership – Kevin McKenna
  - Non-member elected by four – Frank Zecha

Statistics

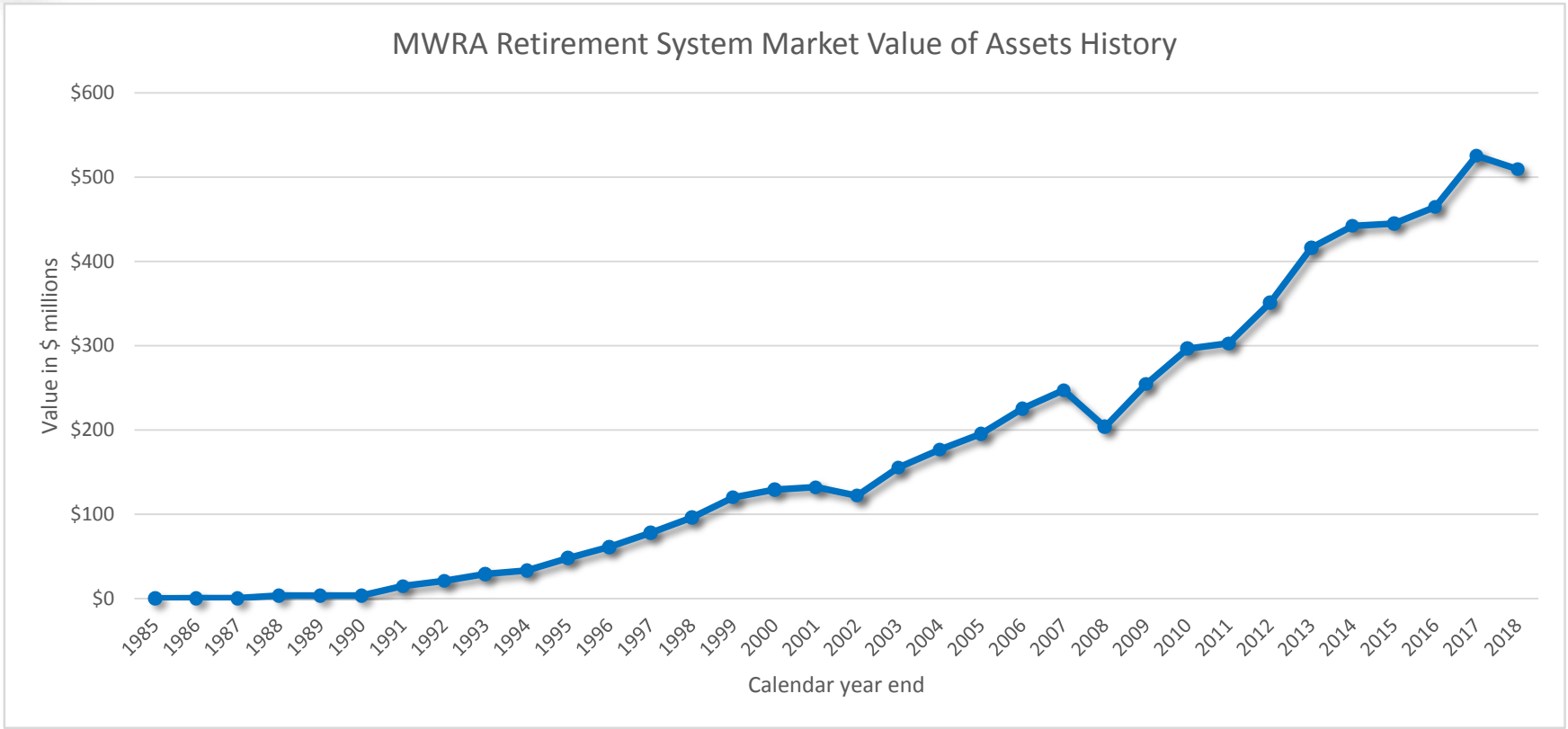
Number of Retired participants and beneficiaries	582
Number of Inactive vested participants	42
Number of inactive participants due a refund of employee contributions	64
Number of active participants	1,100

as of 1/1/2018

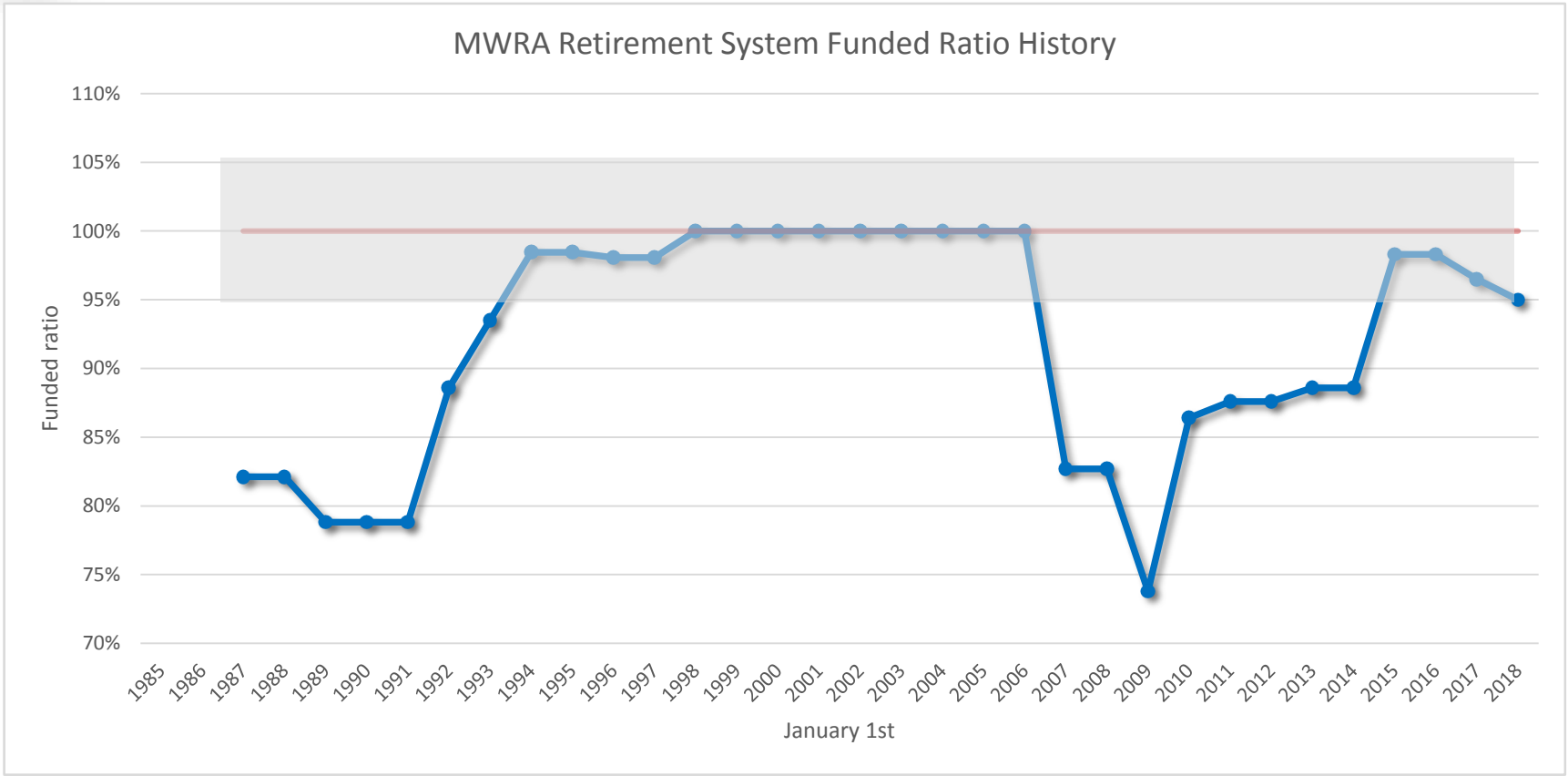
Number of MWRA employees in State (MDC) Retirement System	43

as of 3/11/2019

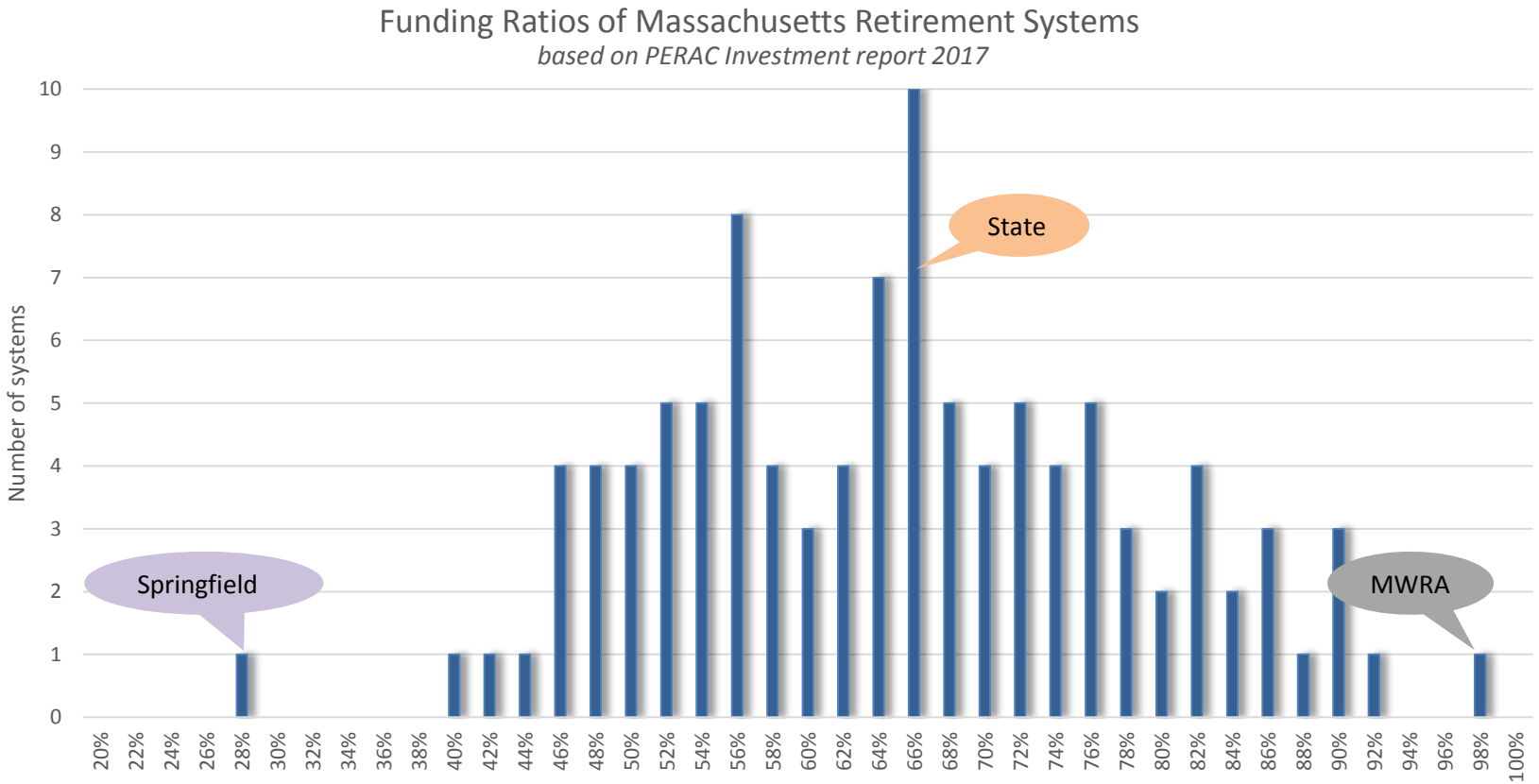
Market Value



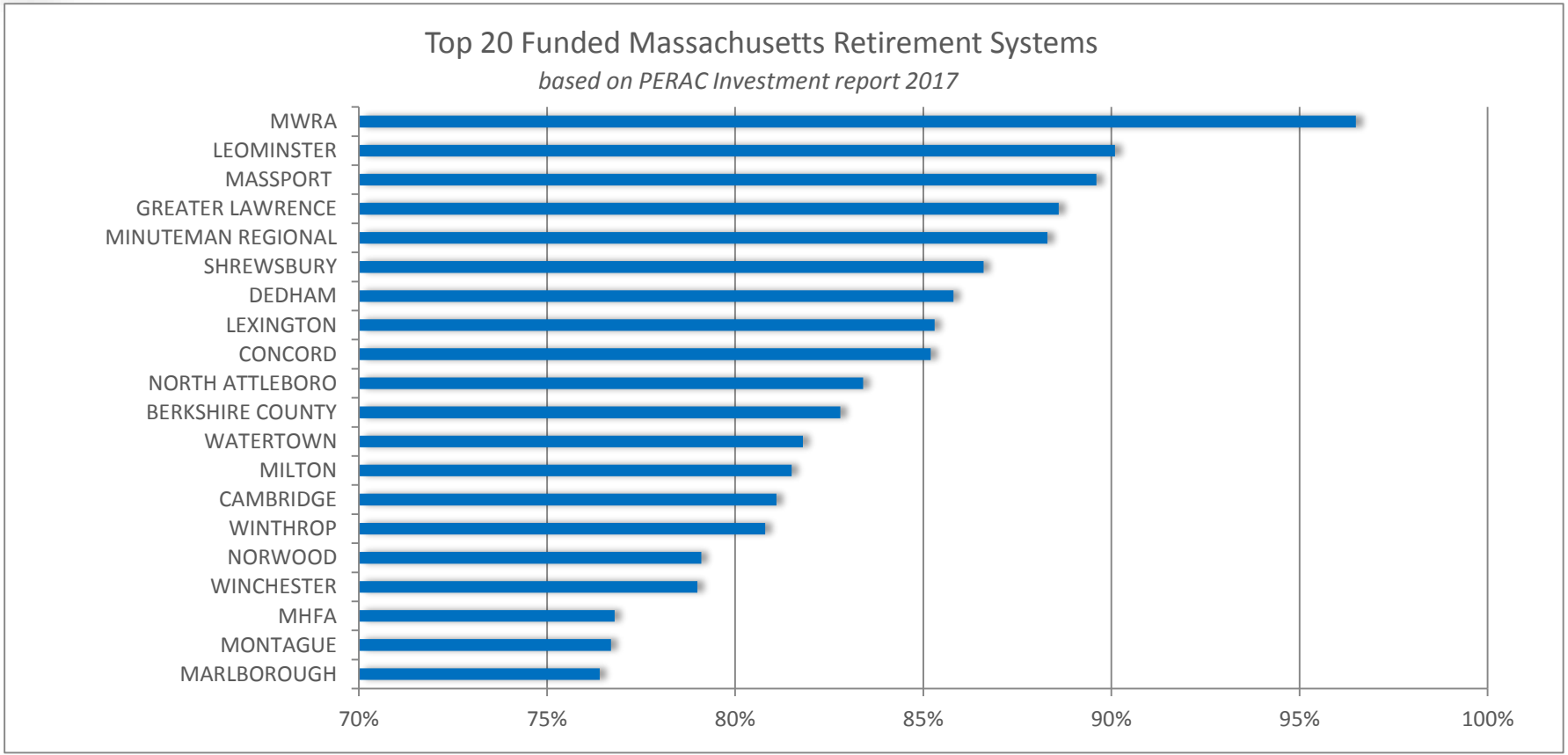
Funded Ratio



Funding Ratio



Funding Ratio



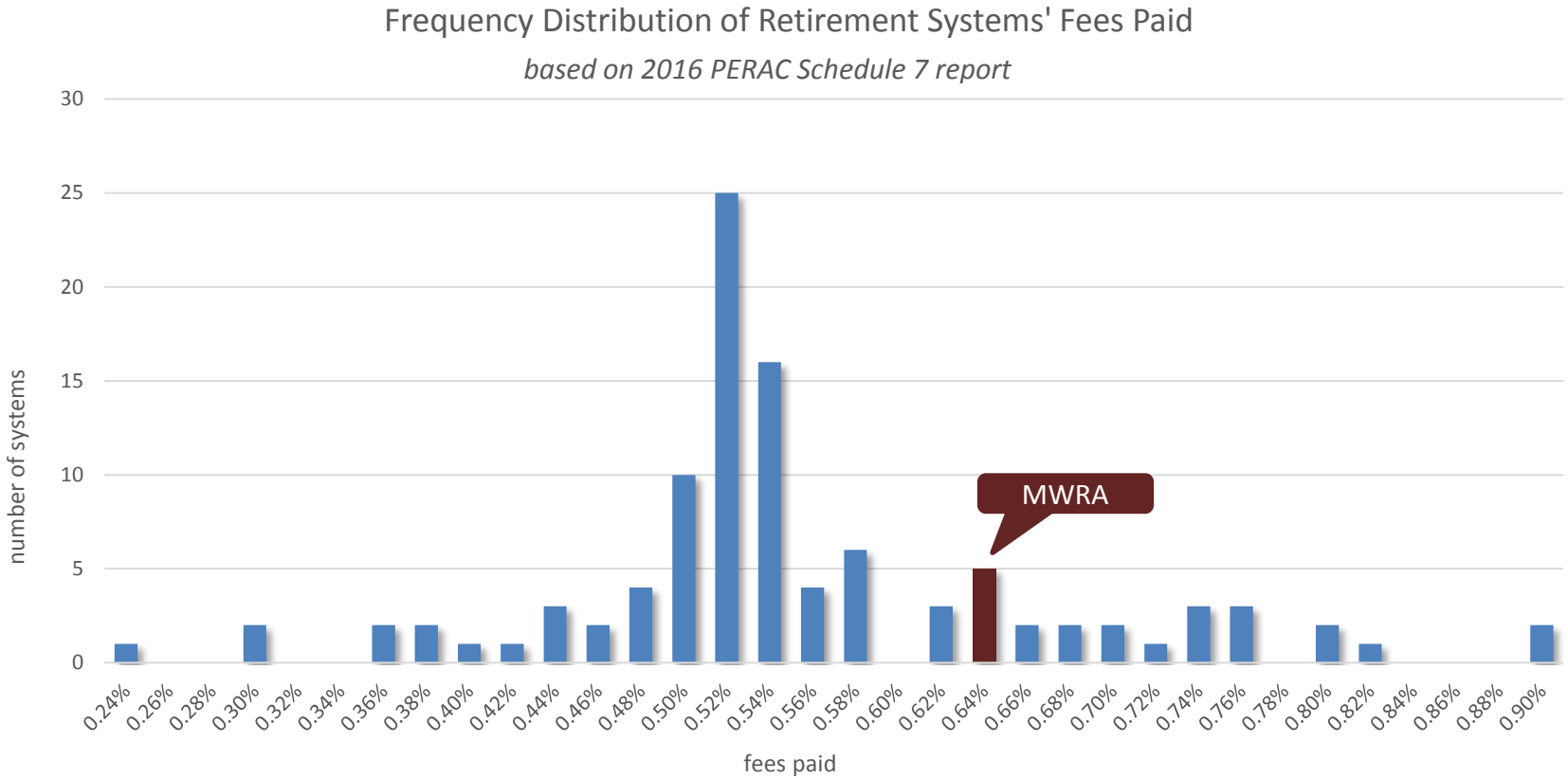
Investment Consultant

- New England Pension Consultants
  - Makes recommendations on asset allocations
  - Facilitates competitive procurement of investment manager services
  - Monitors and reports on investment performance

Fees

- Fees are paid to the investment managers based on complexity
  - Index Fund Manager e.g. Rhumbline S&P 500 Index Fund
    - Replicate index
    - 0.05%
  - Private Equity Manager e.g. Foundry Venture Capital 2007, L.P.
    - Develop expertise in specific industry
    - Search for opportunities to invest
    - Mentor entrepreneurs / serve on corporate board
    - 2.0% plus 20% on profit after 8% return hurdle

Fees


Frequency Distribution of Retirement Systems' Fees Paid
based on 2016 PERAC Schedule 7 report
number of systems
fees paid
MWRA
0
5
10
15
20
25
30
0.24%
0.26%
0.28%
0.30%
0.32%
0.34%
0.36%
0.38%
0.40%
0.42%
0.44%
0.46%
0.48%
0.50%
0.52%
0.54%
0.56%
0.58%
0.60%
0.62%
0.64%
0.66%
0.68%
0.70%
0.72%
0.74%
0.76%
0.78%
0.80%
0.82%
0.84%
0.86%
0.88%
0.90%

Asset Classes

- Domestic Equity
  - Large Cap
    - *S&P 500, Russell 1000 Value, Russell 1000 Growth*

RhumbLine Institutional Index Management

COHO FUNDS

POLEN | CAPITAL

  - Small Cap
    - *Russell 2000 Value, Russell 2000 Growth*

ROBECO The Investment Engineers

LOOMIS | SAYLES

Asset Classes

- International Equity
  - *MSCI ACWI ex USA, MSCI EAFE Small Cap*

LMCG

Schroders

BAXTER INVESTMENT MANAGEMENT

Trusted Investors Since 1924

Asset Classes

- Emerging Markets Equity
  - *MSCI Emerging Markets*

Asset Classes

- Fixed Income
  - *BBgBarc US Aggregate TR and BBgBarc US High Yield TR, BBgBarc US TIPS TR*

LORD ABBETT®

RhumbLine
Institutional Index Management

GH&A
GARCIA HAMILTON & ASSOCIATES, L.P.

LOOMIS | SAYLES

Asset Classes

- Hedge Funds
  - *HFRI Fund of Funds Composite Index*

CORBIN
Capital Partners

UBS

EnTrustPermal

Asset Classes

- Real estate
  - *NCREIF Property Index*

Morgan Stanley

Invesco

Mesirow Financial

Landmark Investments

Cerberus Capital Management, L.P.

TerraCap

TA Realty

Asset Classes

- Private Equity
  - *Cambridge Associates US All PE and NASDAQ W/O Income*

Asset Classes

- Private Equity **Cont.**
  - *Cambridge Associates US All PE and NASDAQ W/O Income*

Kayne Anderson Capital Advisors, L.P.

PineBridge Investments

J.F. Lehman & Company

Park Square

Private Advisor Group
Registered Investment Advisor

IRONSIDES Partners LLC

Asset Classes

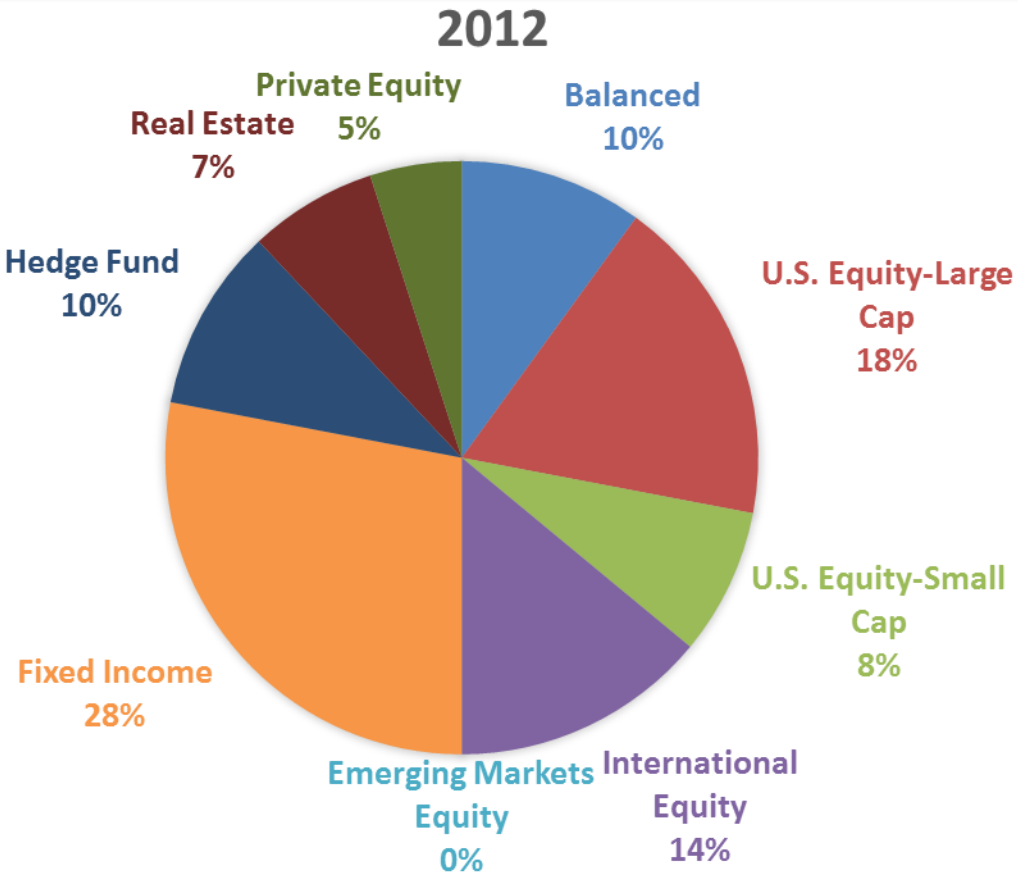
- Balanced
  - *65% MSCI ACWI (Net) / 35% BBgBarc Aggregate, PIMCO All Asset Index, 60% MSCI ACWI (Net) / 40% FTSE WGBI and ICE BofAML 91 Days T-Bills TR*

WELLINGTON MANAGEMENT

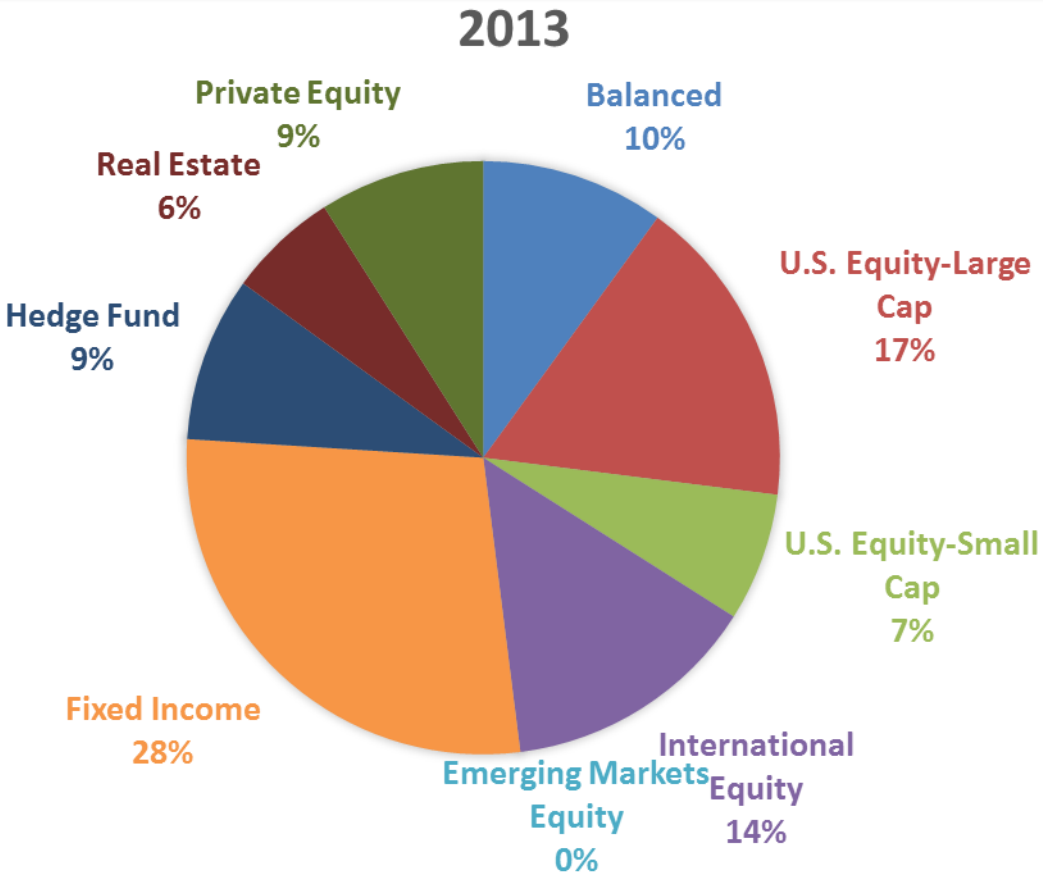
William Blair

PIMCO

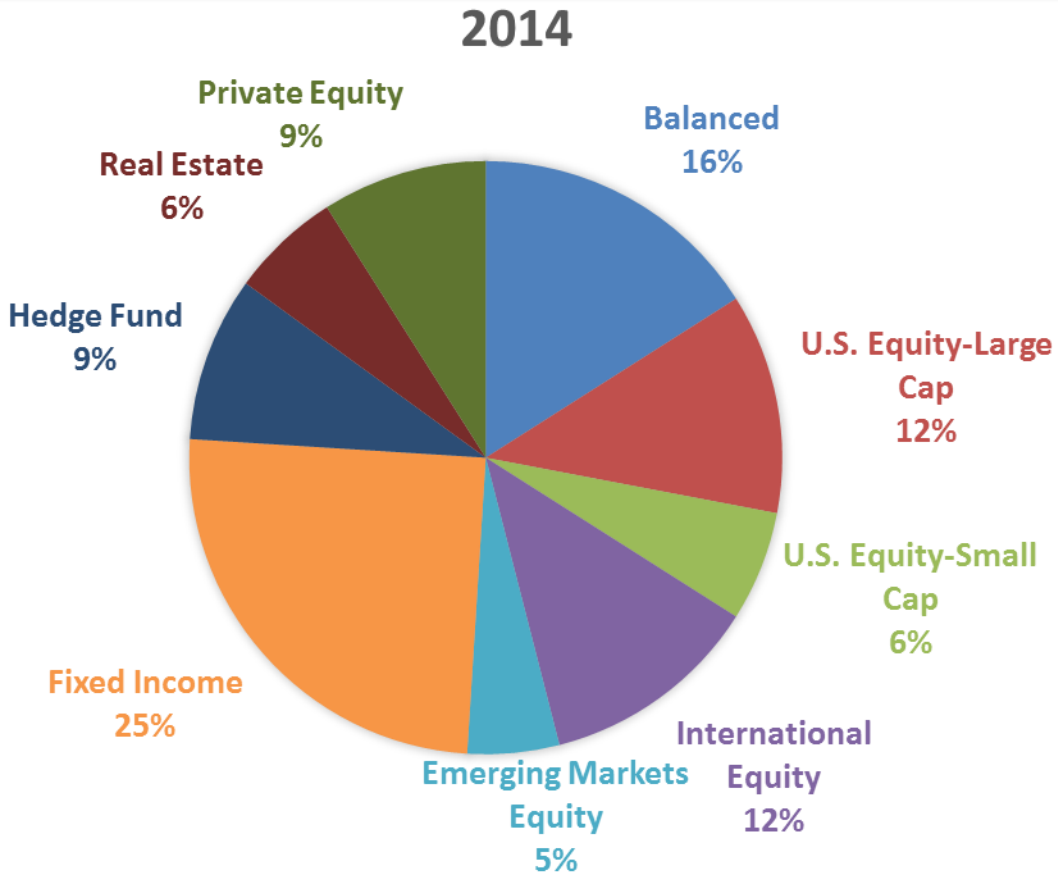
Asset Allocation



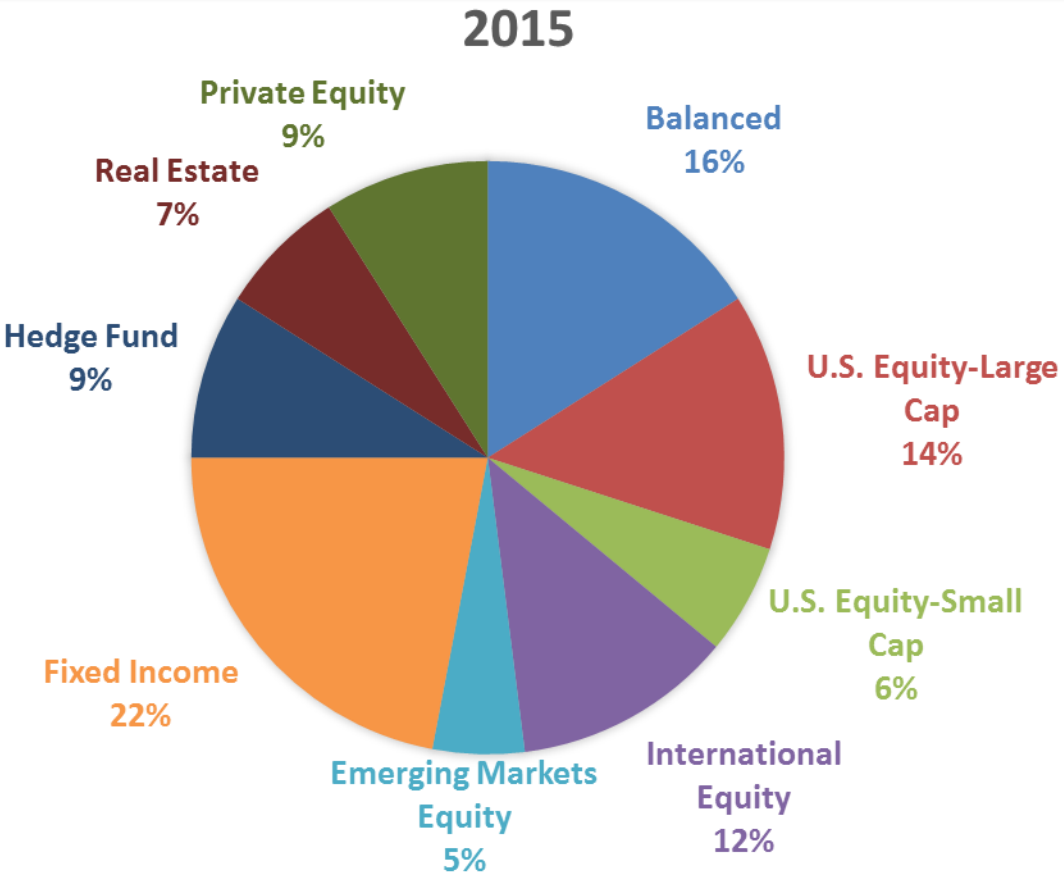
Asset Allocation



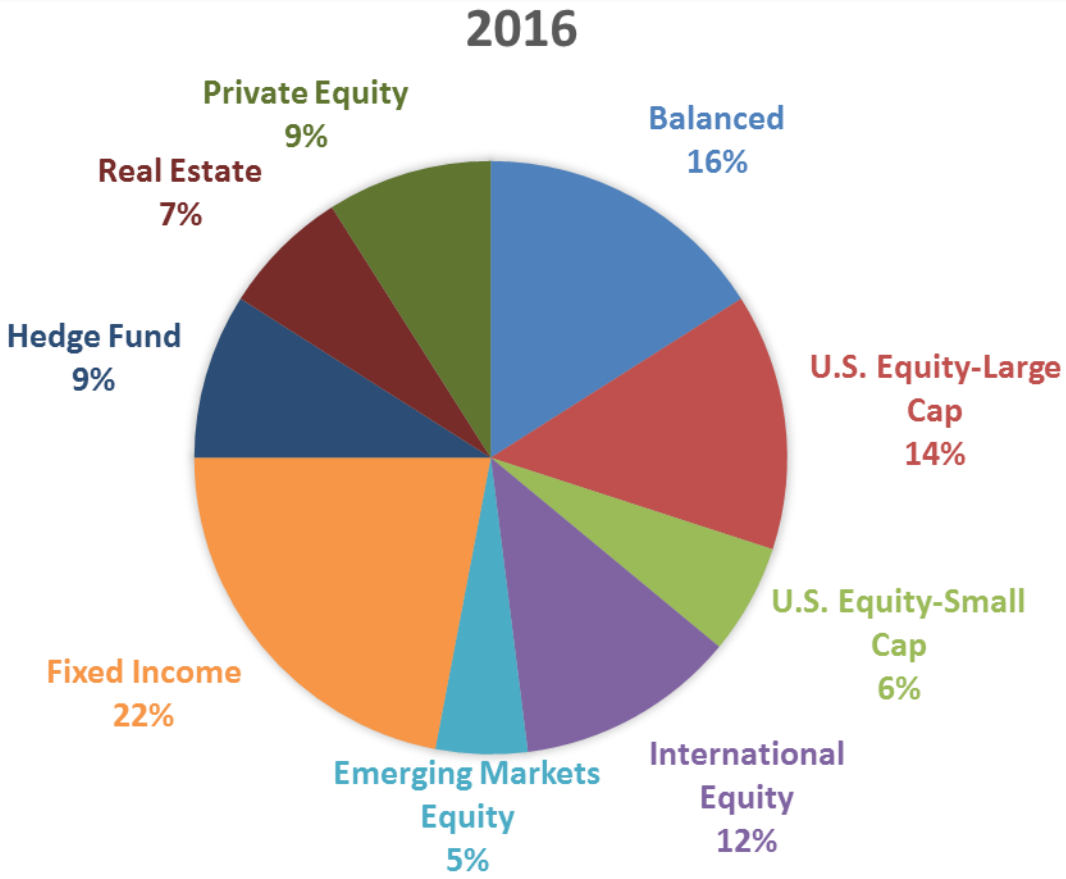
Asset Allocation



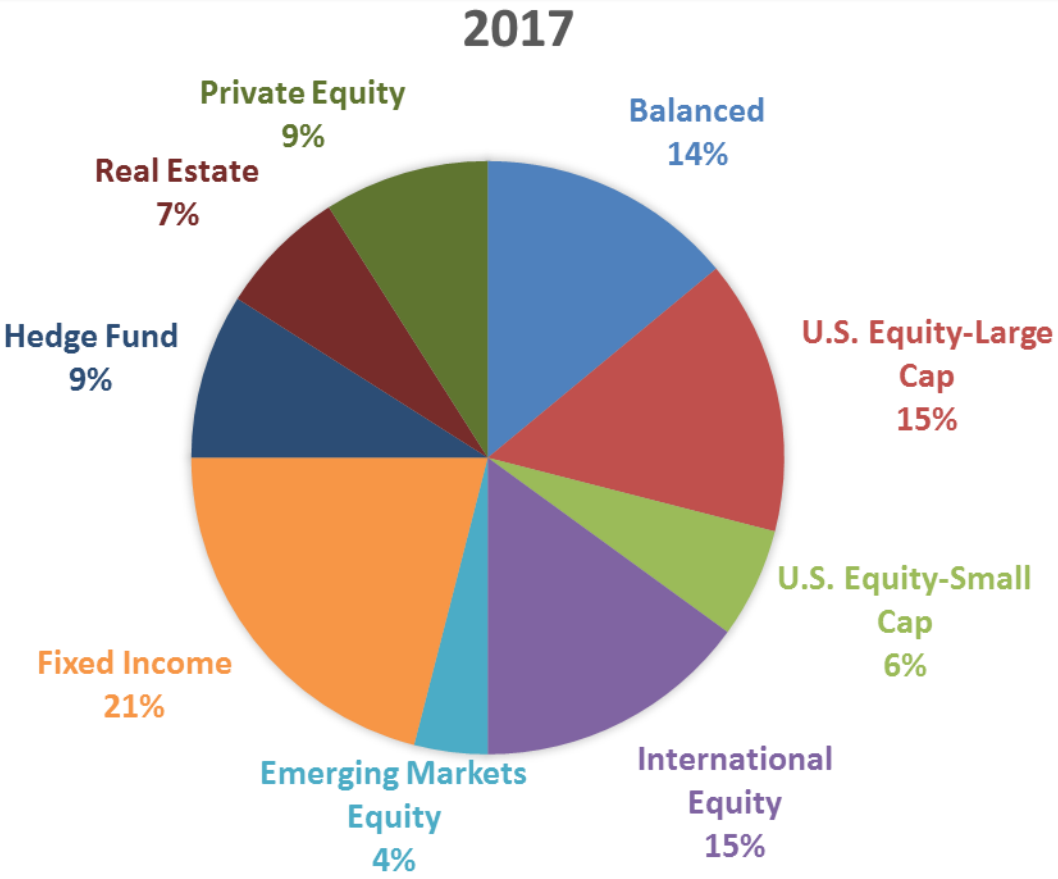
Asset Allocation



Asset Allocation



Asset Allocation



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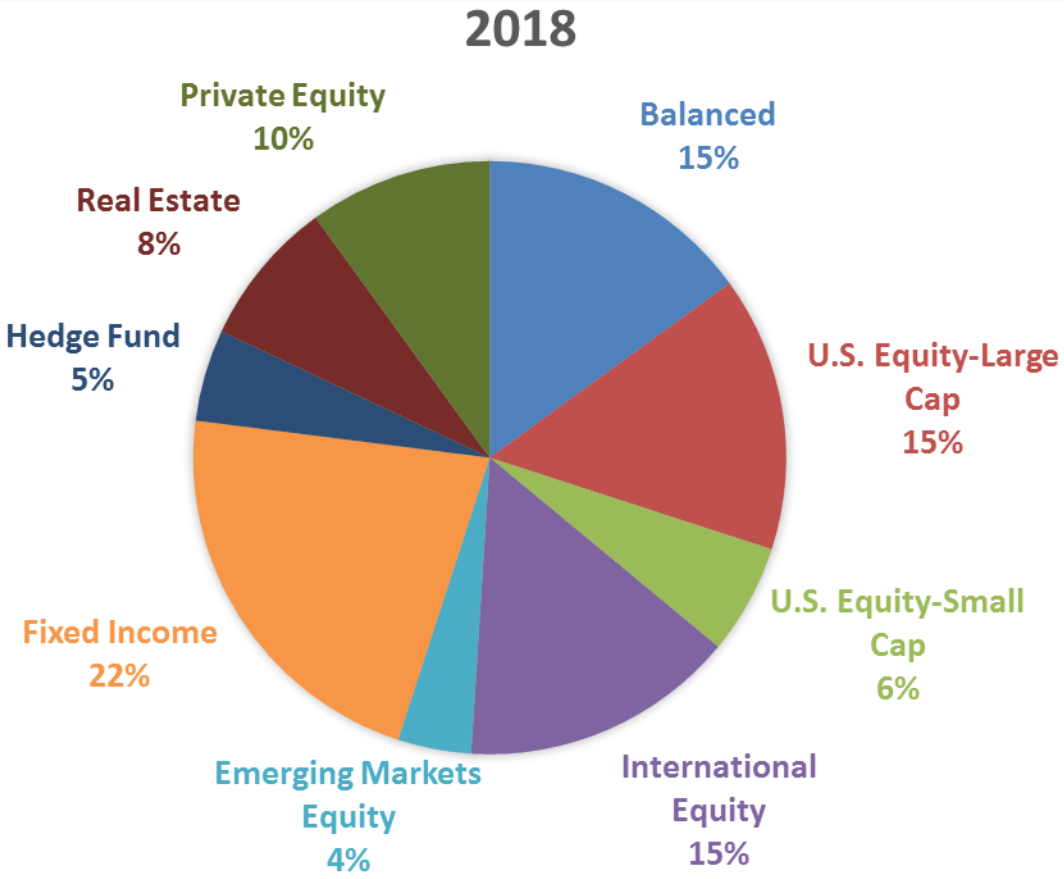
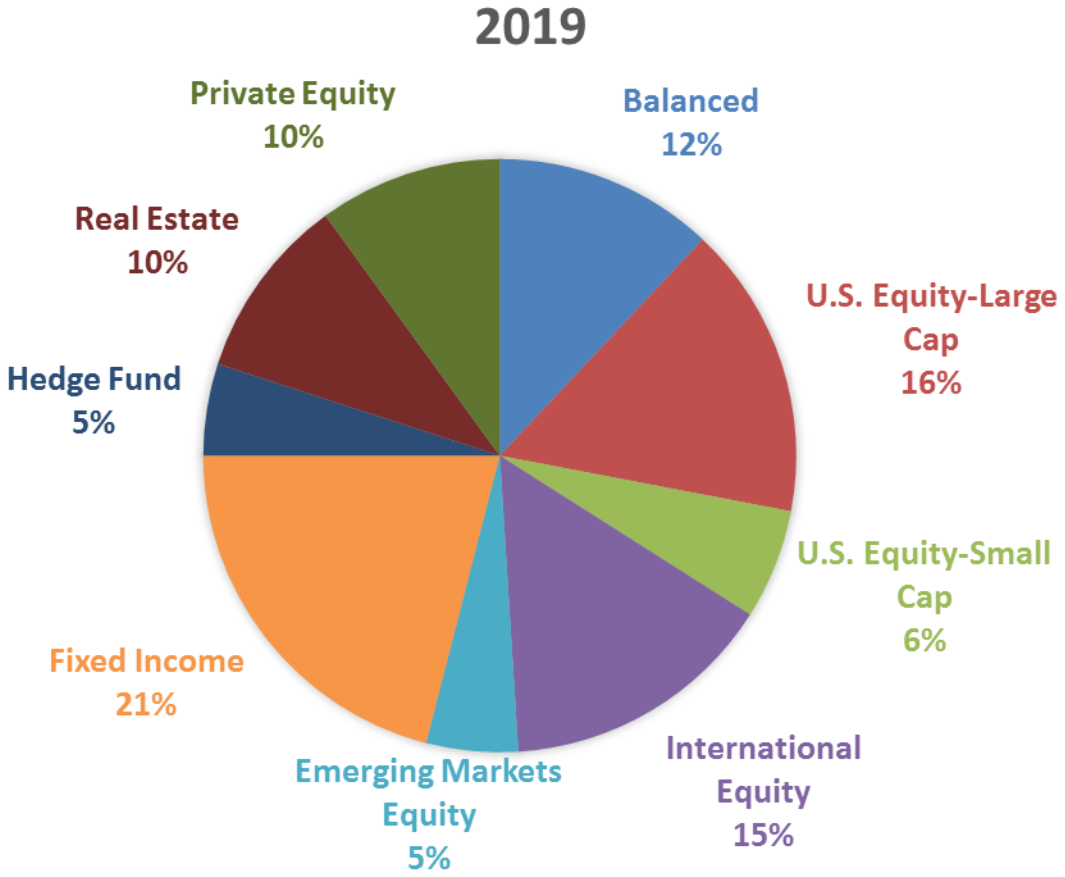
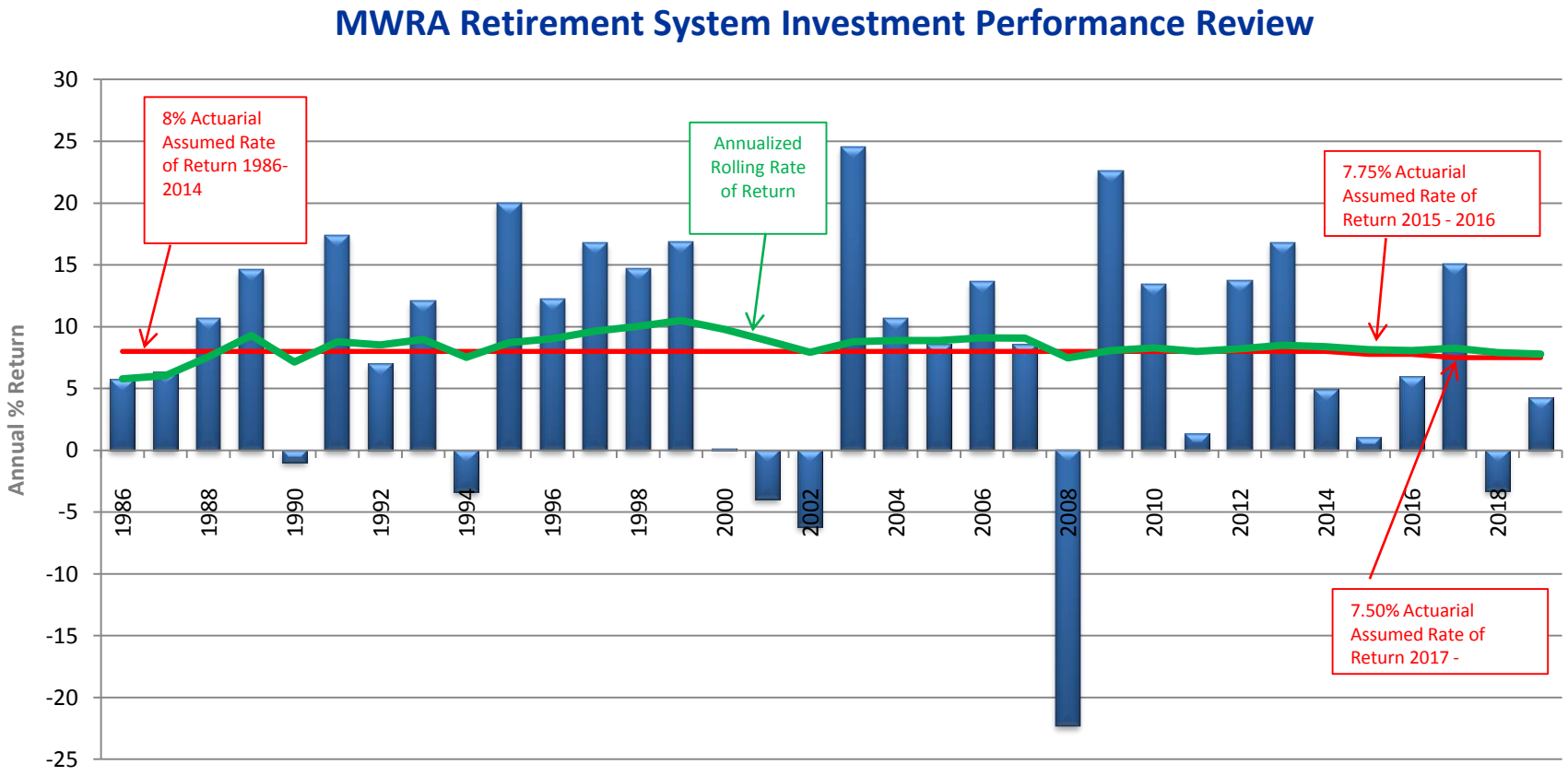


Asset Allocation



Historic Performance



Relative Performance as of 2017 PERAC Annual Report

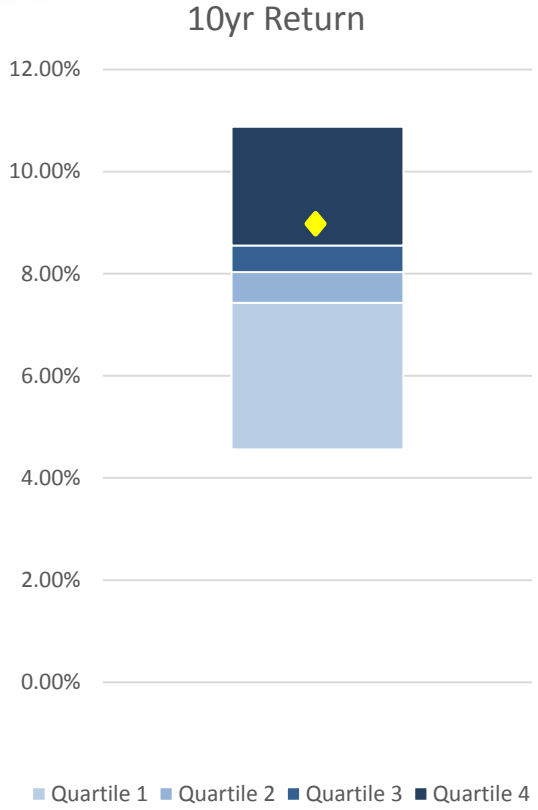
System	1yr	5yr	10yr	32yrs
MWRA Employees' Retirement System	15.05%	8.60%	6.54%	8.27%
PENSION RESERVES INVESTMENT MANAGEMENT BOARD	17.69%	9.89%	5.57%	9.69%

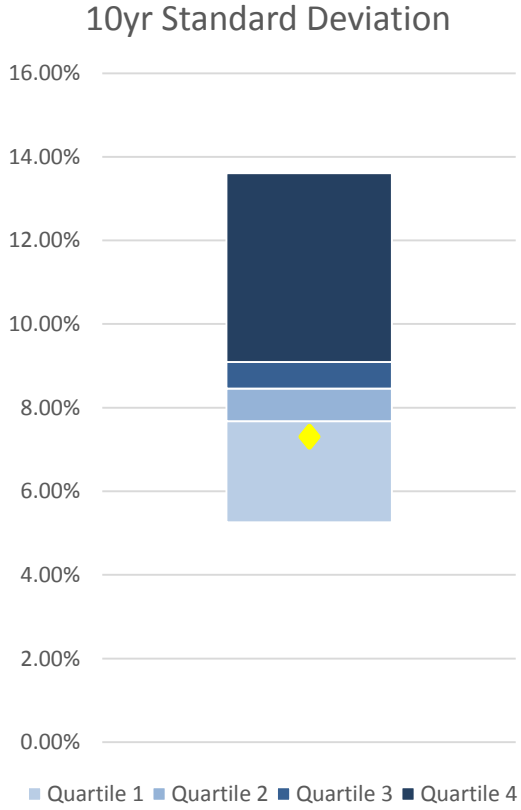
Sharpe Ratio

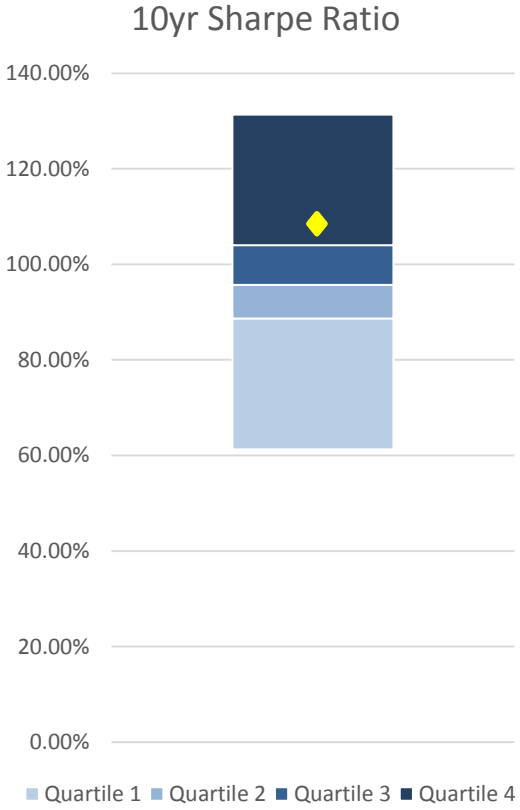
Measures how an investor is compensated for the risk taken

	Investment A	Investment B
Average Return in Excess of Risk-Free return	4.8%	6.5%
Volatility measured by Standard Deviation	8.0%	12.0%
Sharpe Ratio	.594	.542
	Preferred	

Performance Among Peers

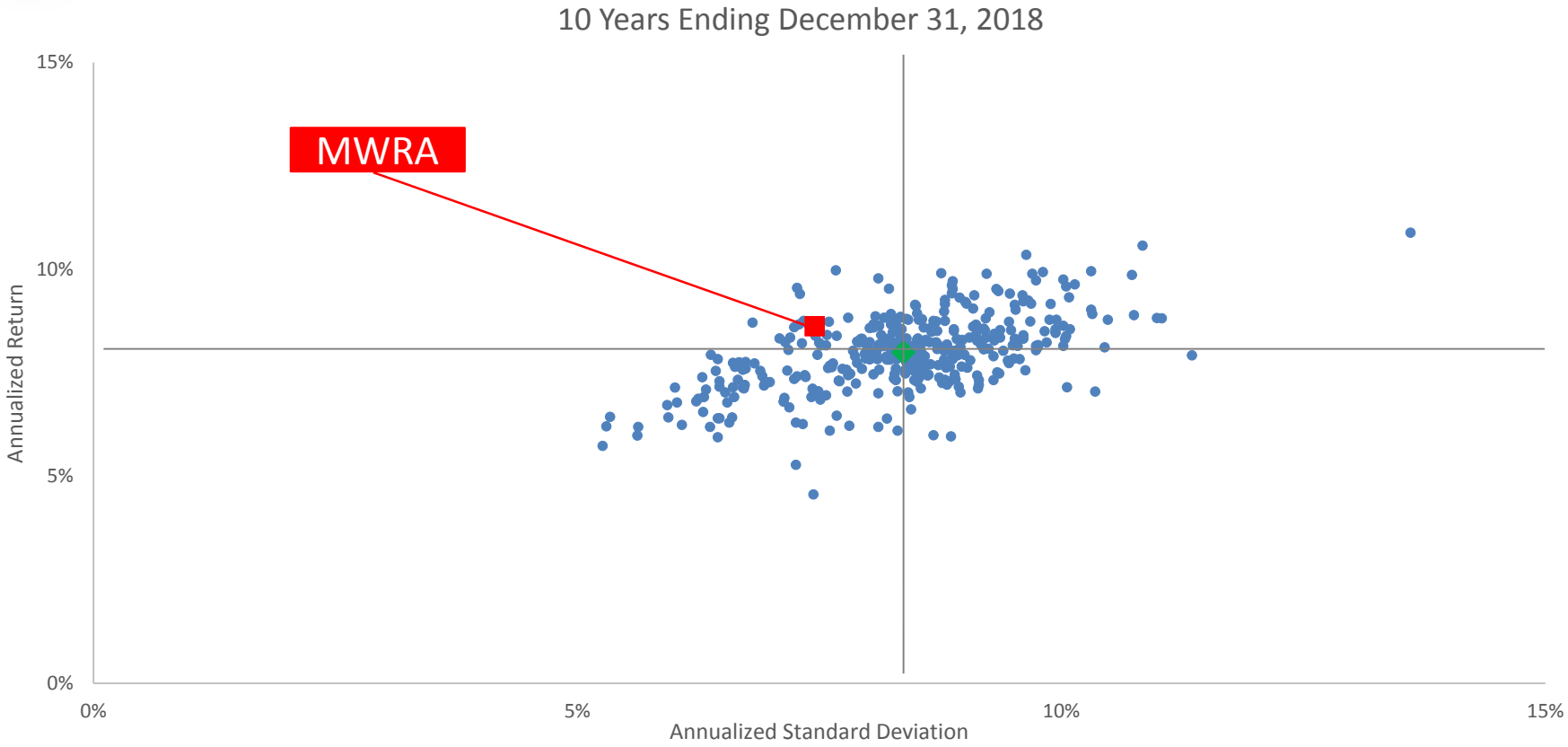




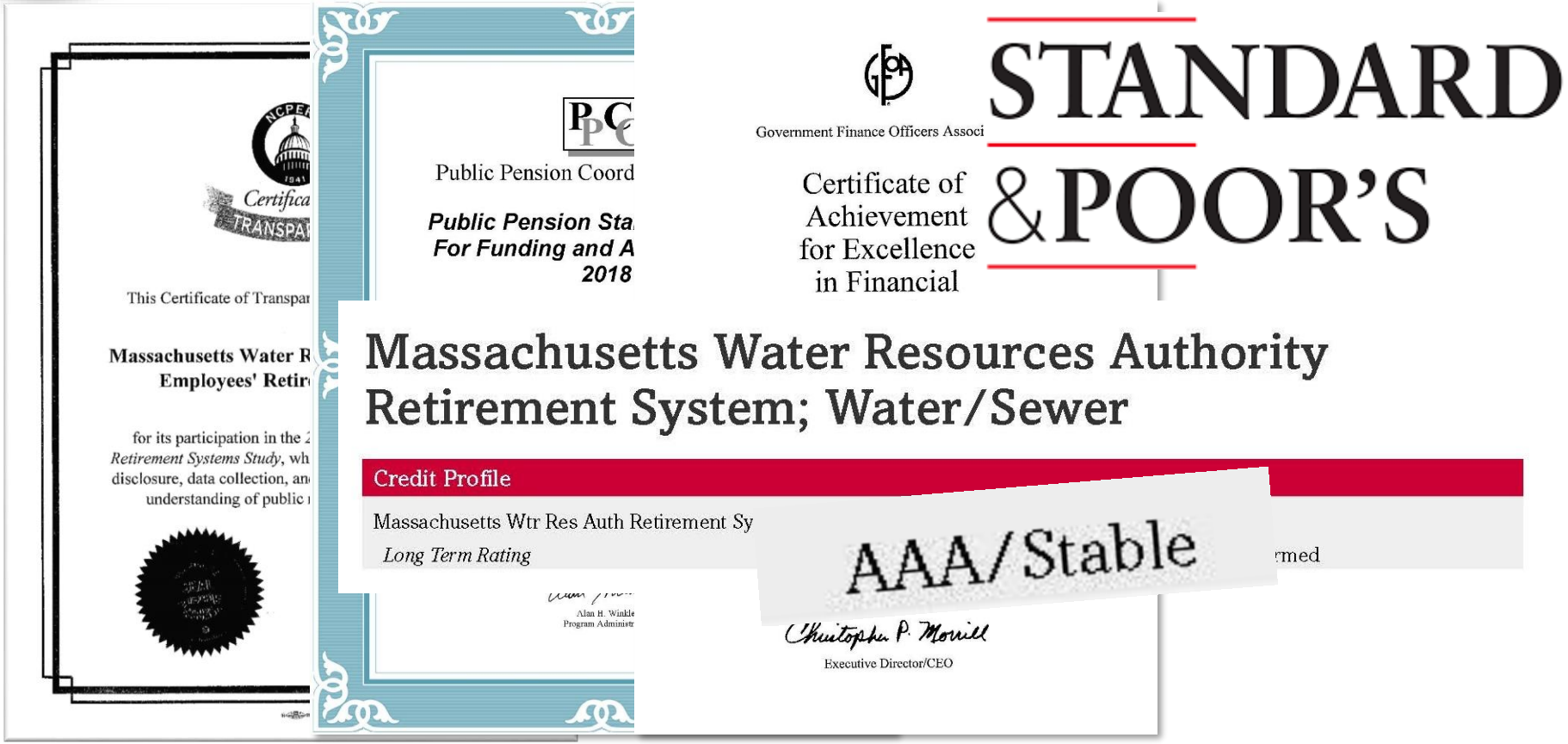


MWRA

Performance Among Peers



Conclusion

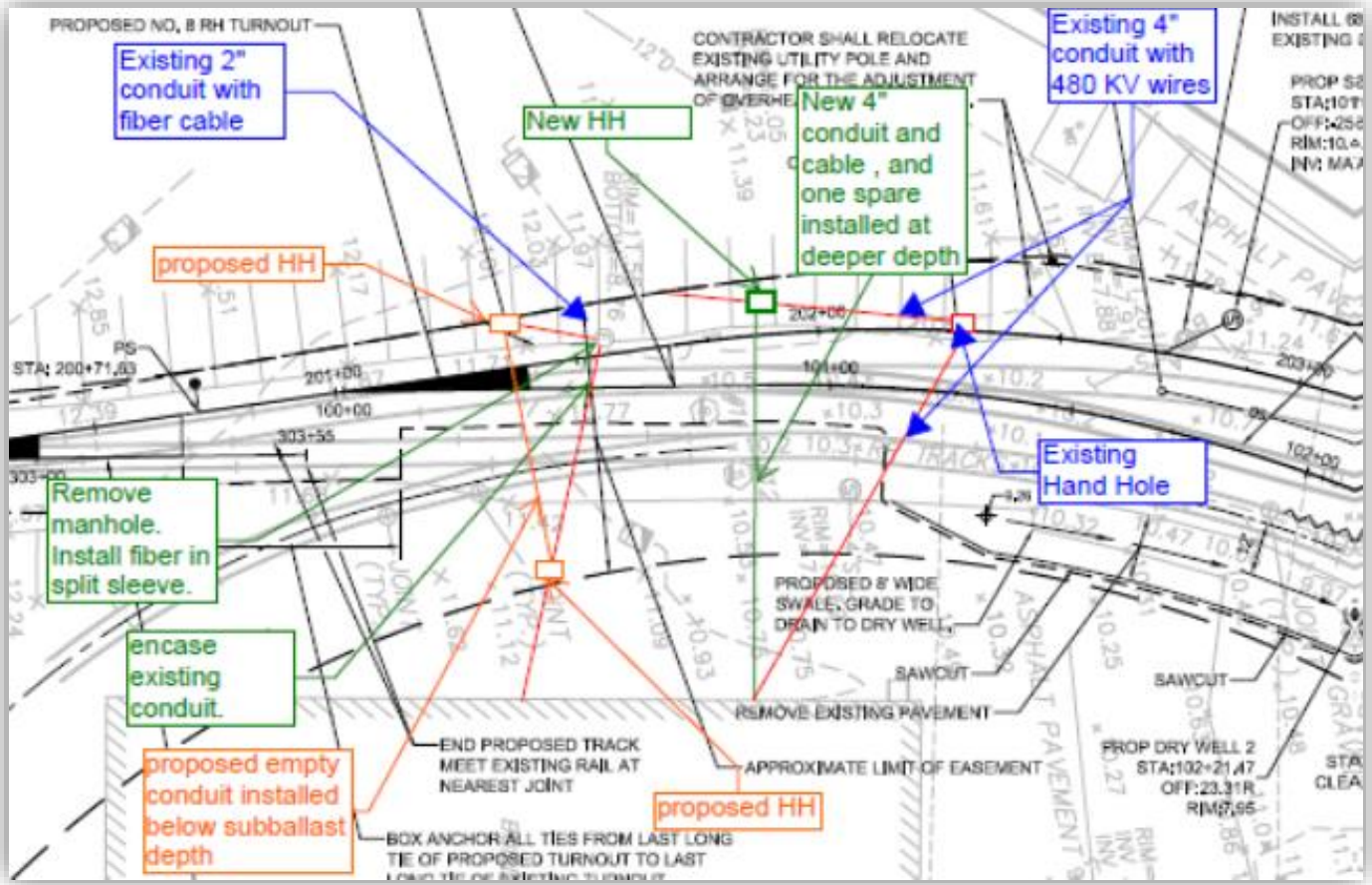

Certificate of Achievement for Excellence in Financial
STANDARD &POOR'S
Public Pension Coord
Public Pension Sta
For Funding and A
2018
This Certificate of Transpar
Massachusetts Water R
Employees' Retir
for its participation in the
Retirement Systems Study, wh
disclosure, data collection, an
understanding of public
Massachusetts Water Resources Authority
Retirement System; Water/Sewer
Credit Profile
Massachusetts Wtr Res Auth Retirement Sy
Long Term Rating
AAA/Stable
Executive Director/CEO


WATER RESOURCES AUTHORITY
MASSACHUSETTS

Fore River Railroad Main Line Adjustment
Contract FRR32, Change Order 2

March 20, 2019

Fore River Railroad Main Line Adjustment



Fore River Railroad Main Line Adjustment

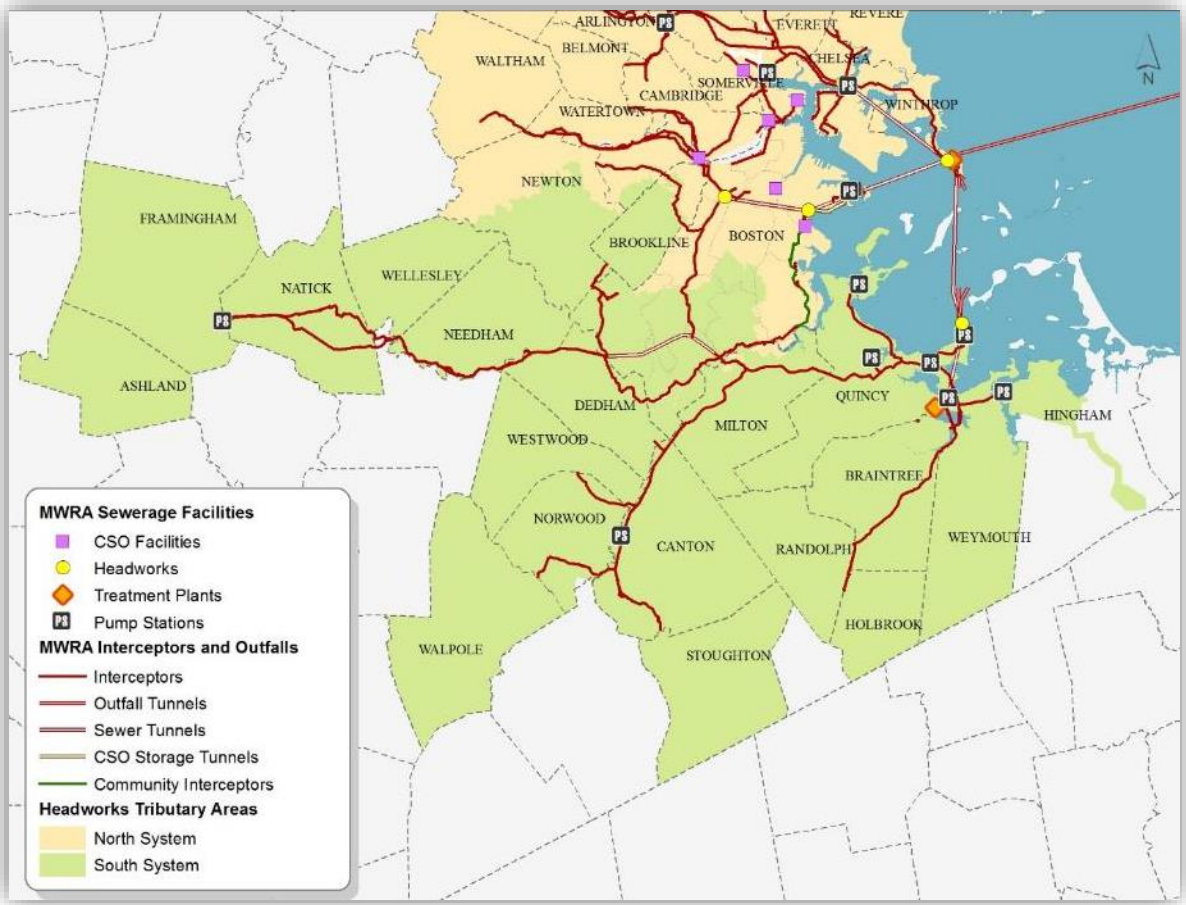
- Both the fiber optic cable and electrical service were installed in abandoned shipyard pipes


WATER RESOURCES AUTHORITY
MASSACHUSETTS

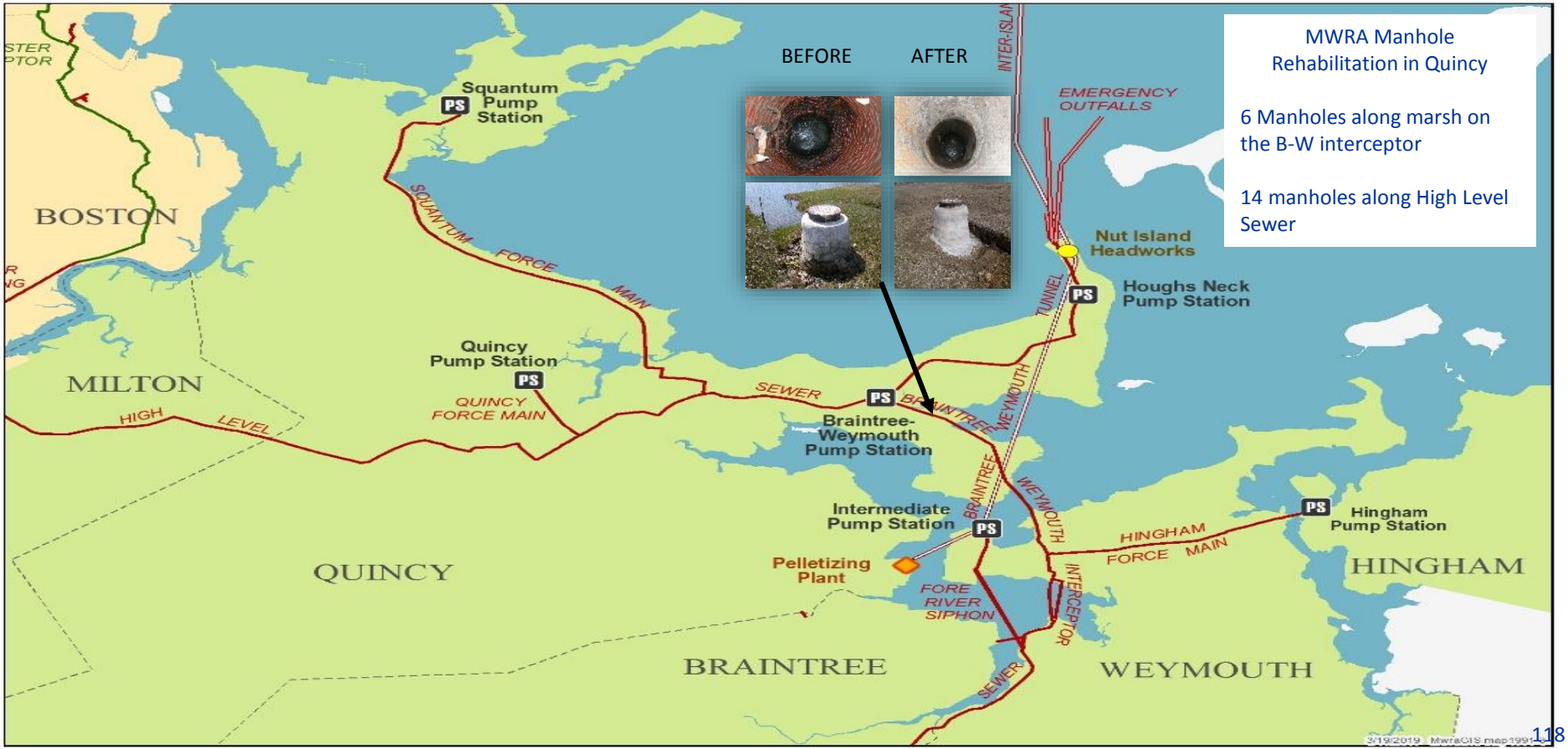
Update on Quincy Sewer Issues

March 20, 2019

MWRA Southern Sewer System

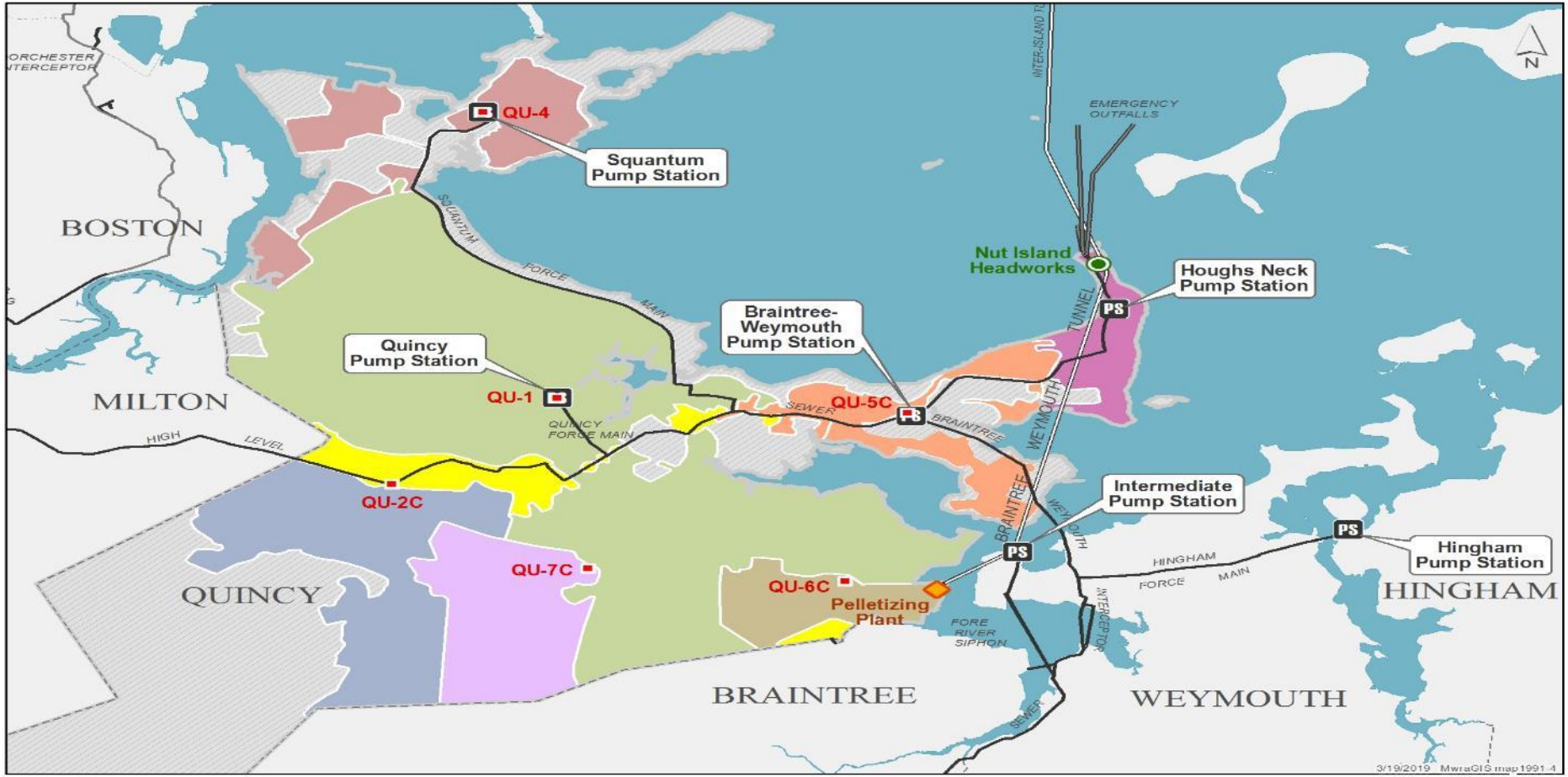


Manhole Rehabilitation in Quincy

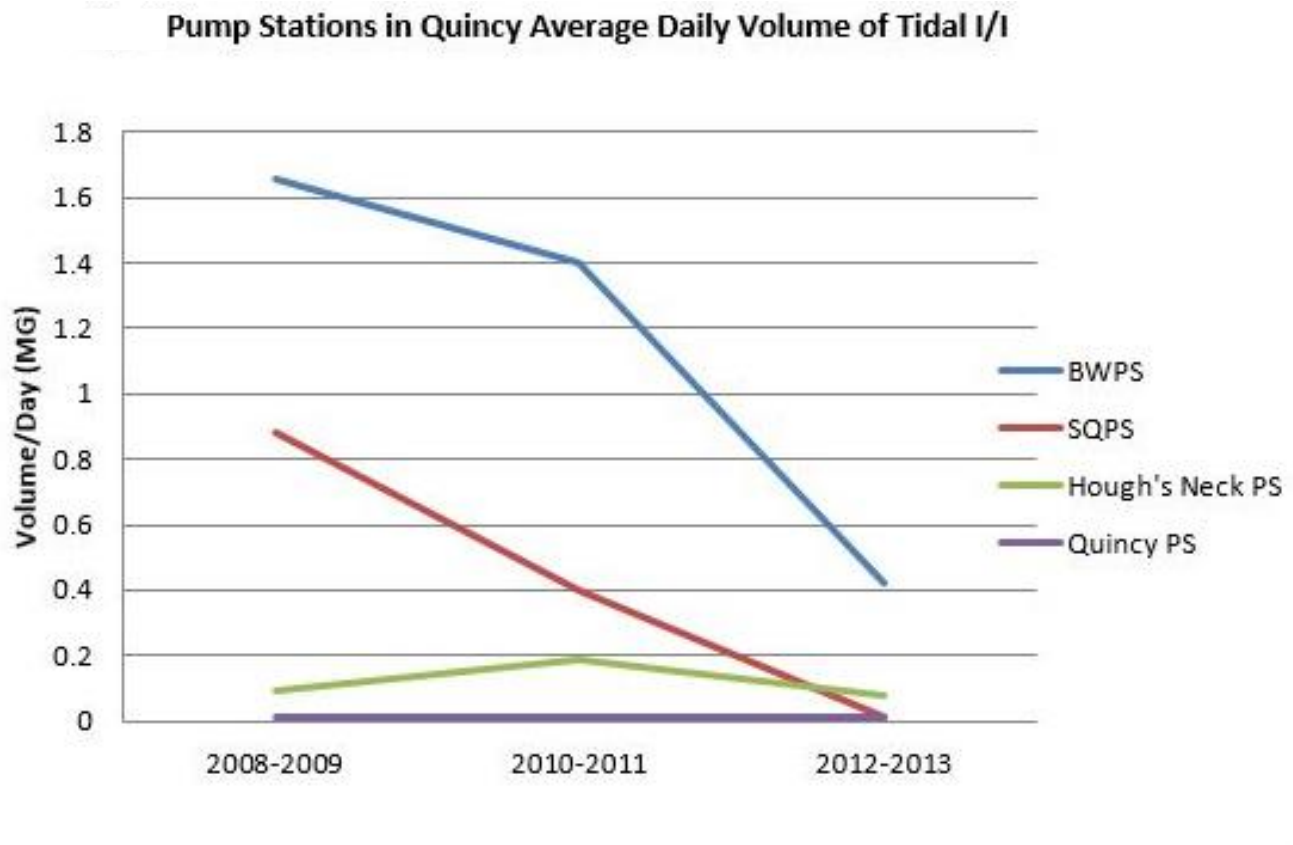


In House Manhole Structure Replacement Section 622 – Braintree Weymouth Interceptor, Station 13+95, Quincy

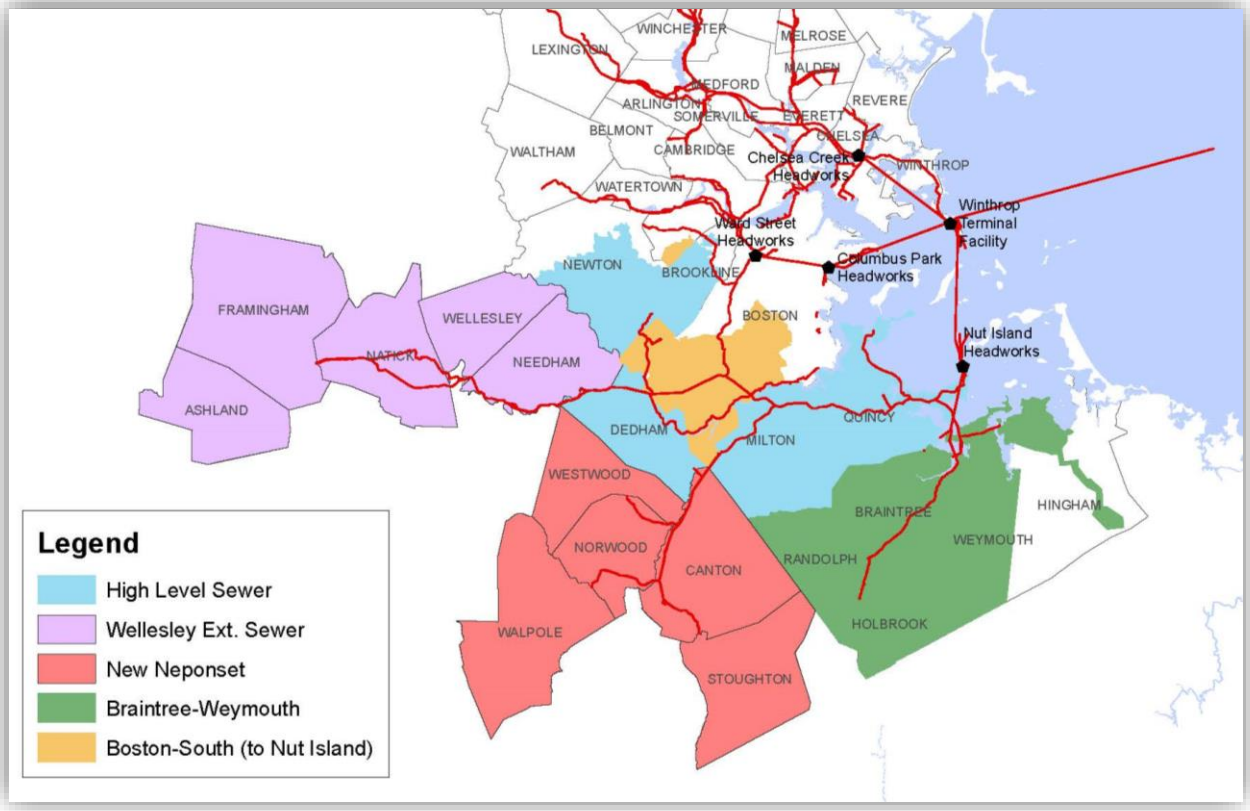
Quincy Sewer System



Results from 2013 Tidal Inflow Study



South System by Subarea - % Change in Wastewater Flow - 20 Year Snapshot



High Level Sewer: - 24%
Newton-South, Brookline-South, Dedham, Milton, Quincy

Wellesley Extension Sewer: - 22%
Ashland, Framingham, Natick, Needham, Wellesley

New Neponset Sewer: - 11%
Canton, Norwood, Stoughton, Walpole, Westwood

Braintree/Weymouth Sewer: - 4%
Braintree, Hingham, Holbrook, Randolph, Weymouth

Boston-South: + 6%


WATER RESOURCES AUTHORITY
MASSACHUSETTS

Section 4 - Webster Avenue Pipe and Utility Bridge Replacement

March 20, 2019

New 48-inch Pipe And Utility Bridge

Northern Low Service System

Pipe On Bridge Crossing MBTA Commuter Tracks

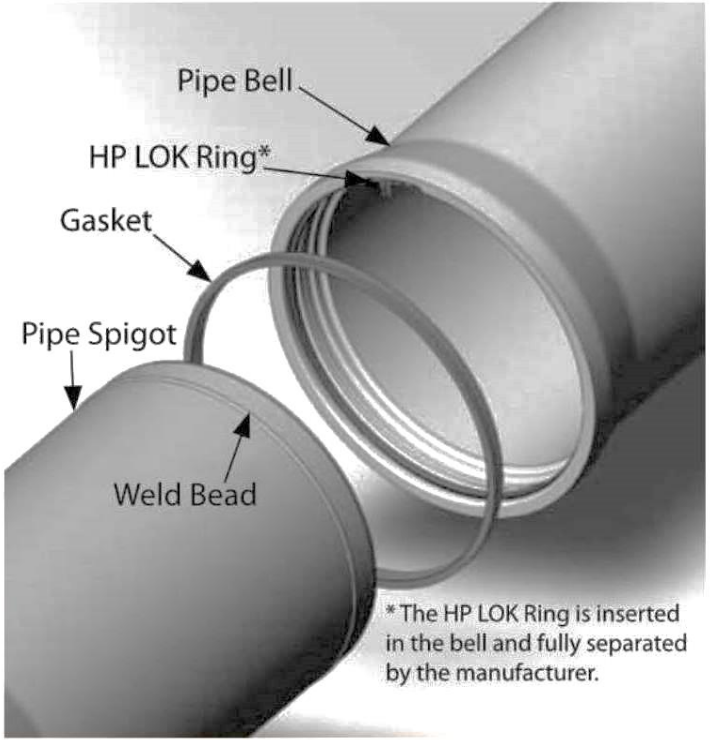
Vertical Mechanical Joint Bends With Megalug Restraints

HP LOK Pipe by U.S. Pipe

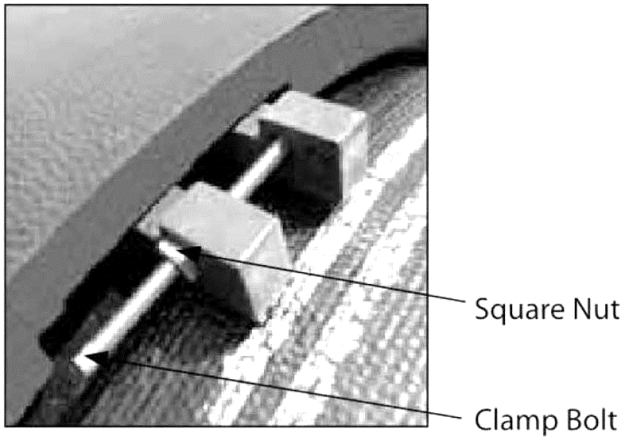
Bent HP LOK Ring From Pressure Test 1

Bent HP LOK Ring After Disassembly

HP LOK Joint Components



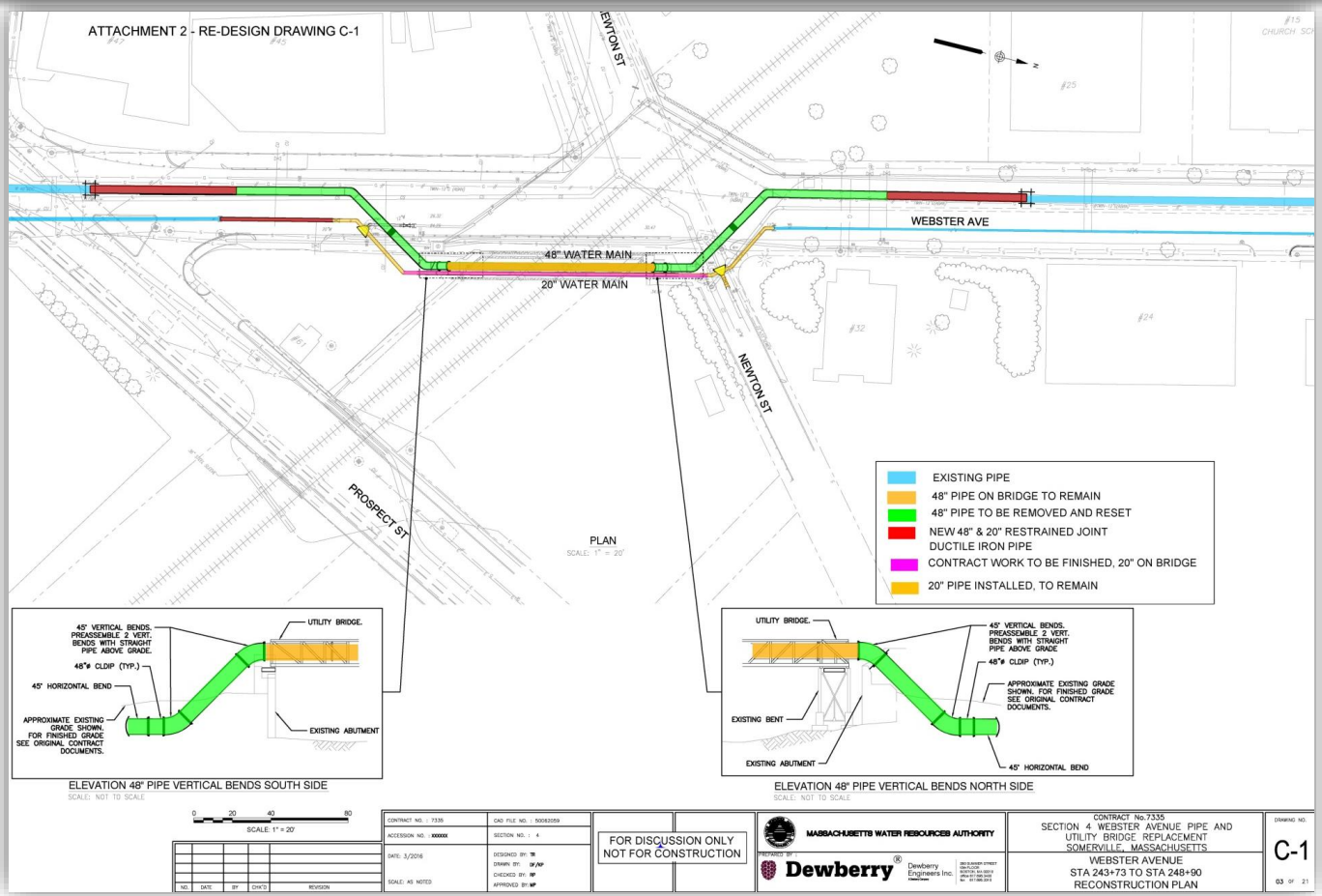
a) Components of HP LOK Joint



b). Final Assembled HP LOK Joint

Source: US Pipe and Foundry Company, LLC (2013). "HP-LOK Restrained Pipe", 2013 Edition.

Redesign Drawing




WATER RESOURCES AUTHORITY
MASSACHUSETTS