MWRA TRENCHLESS SUCCESS STORY

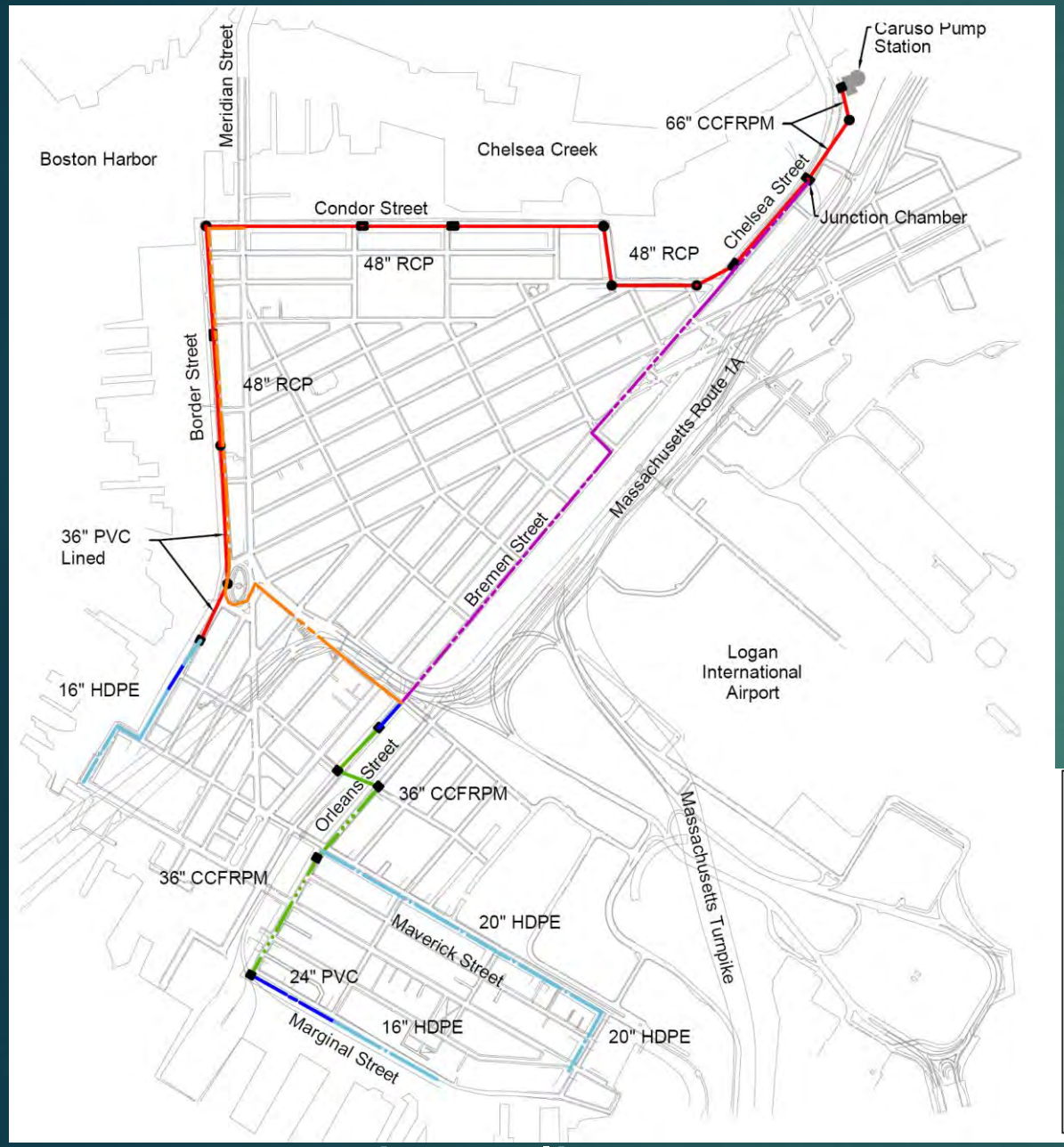
Multiple Trenchless Construction Methods Combine to Complete the East Boston Branch Sewer Relief Project

Babs Marquis

Outline

- Introduction to MWRA East Boston Project
- EBBS Construction Contract Packages
- Trenchless Construction Sequence
- Lessons Learned
- 2012 Annual Progress Report for CSO Control Plan
- Discussion

PROJECT LOCATION



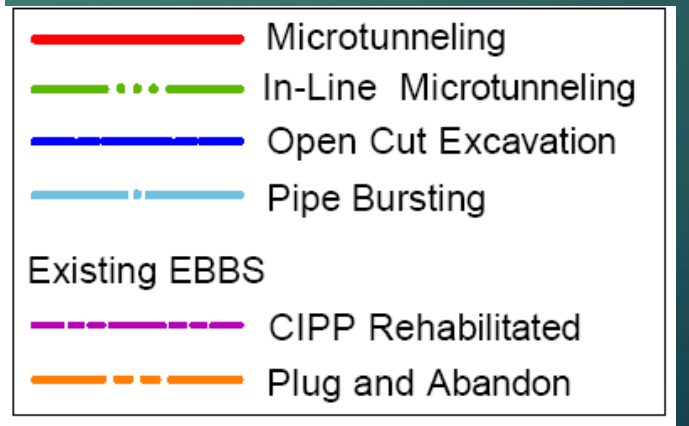
Project Alignment

EBBS Construction Contracts

1 - Rehabilitation by Cured-in-Place Pipe Line

2 - Microtunneling & In-line Microtunneling

3 - Pipe Bursting



- ~11,500 LF of Microtunneling
- 66” Φ,48”Φ & 36”Φ
  - 66”Φ HOBAS
  - 48”Φ RCP w/ CIPP Liner
  - 36”Φ RCP w/ Sliplined PVC
- 20 Work Shafts
  - 1-Sheet pile
  - 5-Soldier Pile + Lagging
  - 8-Secant Pile
  - 6-Mini Pile

Project Construction Sequence

- Pre-construction Survey
- Shaft layout and Dig-safe
- Utility test pits/Utility relocation
- Shaft/SOE construction
- Set-up Microtunneling Work zones
- Set-up bypass pumping
- Mobilize and launch MTBM
- Microtunnel 48-in and 66-in
- In-line microtunnel 36-in
- Post-construction survey
- Site restoration

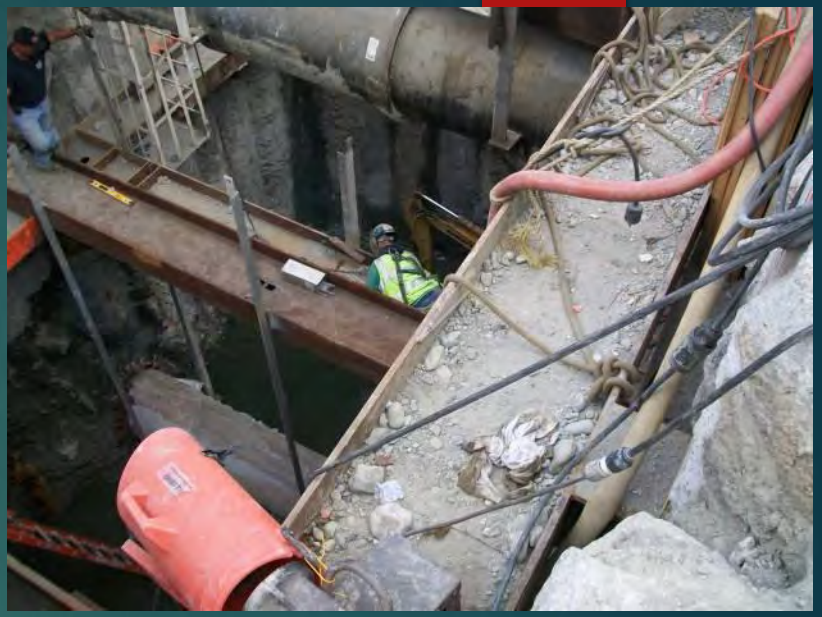
Utility Conflicts
Relocate, Support-in-Place or Monitor

- Major utility conflicts
- Communication & electric feed to Logan International Airport
- Public and Private Utilities
  - Verizon (Tel, Cable, Internet and Fiber optics)
  - Nationalgrid (Natural gas)
  - Nstar (Electric Duct bank and overhead wires)
  - Comcast (Cable and internet)
  - Boston Water & Sewer Commission
  - Conoco Phillips (Jet fuel pipe lines)
  - Boston fire alarm

Utilities

Sewer and Drain Relocation

Gas Line Relocation



Utilities Supported in Place

Overhead Wire Relocation

Shaft / Support of Excavation Installation

- 7 Secant Pile Shafts (5 Circular & 2 Rectangular)
  Depths ranging from 18-ft. to 45-ft.
- 1 Sheet Pile (Circular) Shaft
  Depth of 32 ft.
- 4 Soldier Pile and Lagging Shafts
  Depth s ranging from 34-ft. to 44-ft.
- 6 Mini Pile and Lagging Shafts
  Depths ranging from 18-ft. to 25-ft.

- Contractor eliminated 2 shafts for longer microtunnel drives

Work Shaft Dimensions

SHAFT EXCAVATION								
Shaft	**Type**	**Size (ft)**		**Depth (ft)**	**Volume (cu ft)**	**Weight (lbs)**	**Tons**	**Soil Group**
RS-9A	SP & L	20	10	39	7,800.00	865,800.00	432.90	I
JS-9	Secant	22		36.6	13,905.80	1,543,544.24	771.77	I
RS-8A	Secant	22.5	37	38	15,101.44	1,676,259.56	838.13	II-3
JS-8A	Secant	13	24	39	12,168.00	1,350,648.00	675.32	I
JS-7A	Secant	22		35.3	13,411.88	1,488,718.90	744.36	I
JS-6A	Secant	22		45	17,097.30	1,897,800.30	948.90	I
RS-6A	Sheet	16		31.3	6,290.05	698,195.33	349.10	I
JS-5A	SP & L	16	22	34.6	12,179.20	1,351,891.20	675.95	I
JS-4A	SP & L	16	22	43.5	15,312.00	1,699,632.00	849.82	I
RS-3A	Secant	14		30.7	4,723.50	524,308.72	262.15	I
JS-3	SP & L	16	22	37.2	13,094.40	1,453,478.40	726.74	I
RS-2	Secant	14		25	3,846.50	426,961.50	213.48	I
JS-1A	Secant	18		23	5,849.82	649,330.02	324.67	I
RS-1A	Mini Pile	12	16	22	4,224.00	468,864.00	234.43	I
JS-10A	Mini Pile	23	19	24	10,488.00	1,164,168.00	582.08	I
RS-11A	Mini Pile	14	16	27	6,048.00	671,328.00	335.66	I
JS-12A	Mini Pile	17	17	20	5,780.00	641,580.00	320.79	I
JS-13A	Mini Pile	14	19	22	5,852.00	649,572.00	324.79	I
RS-14A	Mini Pile	16	12.75	24	4,896.00	543,456.00	271.73	I

Shaft Installation– Secant Pile Walls

Shaft Installation – Sheet Pile

Shaft Installation – Sheet Pile

Shaft Installation – Soldier Pile & Lagging

Shaft Installation – Mini Piles and Lagging

Work Zone Setup

Work Zone Setup

Typical Timeline

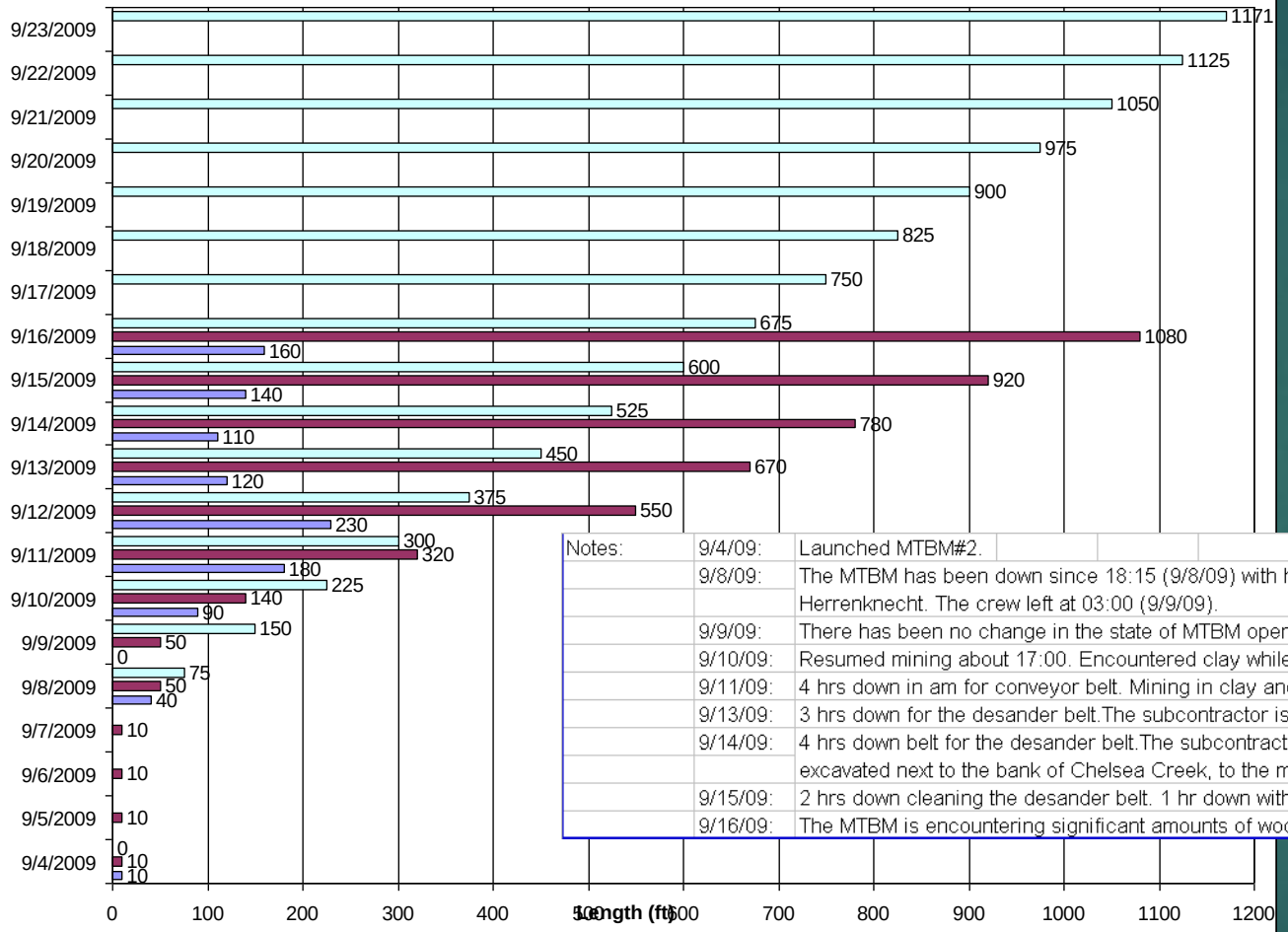
- 30 days – Shaft Layout & Utility Relocation
- 21 days – Install Support of Excavation
- 5 days – Excavate
- 24 days – Microtunnel Mobilization and set-up
- 20 days – Microtunneling
  - Average Drive Length = 664 LF
- 6 days – Microtunnel Demobilization
- 10 days – Site Restoration

Tunneling Production Rate

Run	Tunnel Diameter (in)	Duration (days)	Length (ft)	Estimated Rate (ft/day)	Actual Rate (ft/day)	Primary Geologic Profile
1	48	12	664	35	55	Glaciomarine/ Marine Clay
5	48	18	1211	46	67	Glaciomarine/ Marine Clay
6	48	6	864	38	158	Glaciomarine
8	48	11	1171	34	106	Marine Clay
10	66	8	269	29	34	Glaciomarine

Contract 6257 East Boston Branch Sewer Relief Project
Drive #8: JS-5A (195 Condor) to RS-6A (237 Condor)

as of:



Notes:		
	9/4/09:	Launched MTBM#2.
	9/8/09:	The MTBM has been down since 18:15 (9/8/09) with head rotation (hydraulic issues). The subcontractor is waiting for advice from Herrenknecht. The crew left at 03:00 (9/9/09).
	9/9/09:	There has been no change in the state of MTBM operations in the past 24 hours.
	9/10/09:	Resumed mining about 17:00. Encountered clay while mining for pipe #11 (about 04:00am).
	9/11/09:	4 hrs down in am for conveyor belt. Mining in clay and a mixture of clay and sand.
	9/13/09:	3 hrs down for the desander belt.The subcontractor is waiting for the delivery of a replacement belt. Mining slowed due to clay seam.
	9/14/09:	4 hrs down belt for the desander belt.The subcontractor suspended mining for 6 hrs.to haul the contents of the pit, which was excavated next to the bank of Chelsea Creek, to the materials management stockpile area at JS-9A.
	9/15/09:	2 hrs down cleaning the desander belt. 1 hr down with electrical cable problems. 1 hr down with auxillary pumping problems.
	9/16/09:	The MTBM is encountering significant amounts of wood.

	9/4/09	9/5/09	9/6/09	9/7/09	9/8/09	9/9/09	9/10/09	9/11/09	9/12/09	9/13/09	9/14/09	9/15/09	9/16/09	9/17/09	9/18/09	9/19/09	9/20/09	9/21/09	9/22/09	9/23/09
Cumulative (Goal)	0				75	150	225	300	375	450	525	600	675	750	825	900	975	1050	1125	1171
Cumulative (Actual)	10	10	10	10	50	50	140	320	550	670	780	920	1080							
Daily (Actual)	10				40	0	90	180	230	120	110	140	160							

Pipe Bursting

Pipe Bursting

- General Contractor – P. Caliacco Corporation
- Court ordered 14-month construction duration
- NTP – April 27, 2009
- End Date – July 11, 2010
- Bid Price $7.4m

Upsize existing Vitrified Clay Pipe

- 12-in upsized to 16-in HDPE
- 15-in upsized to 20-in HDPE

Pipe Bursting Systems - Pneumatic and Static

Trenchless Construction Sequence

- Pre-construction Survey
- Shaft layout and Dig-safe
- Utility test pits/Utility relocation
- Shaft/SOE construction
- Set-up bypass pumping
- Fuse HDPE pipes
- Mobilize and launch Pipe bursting head
- Pipe burst 16-in and 20-in HDPE
- Site restoration
- Post-construction survey

Utility Conflicts

Relocate or Support-in-Place

- Water and gas lines relocated
- Electric and telephone duct banks supported in place

Shaft Construction

- Insertion Shaft – 12 ft. x 50 ft.
- Receiving Shaft – 12 ft. x 14 ft.
- Shaft depths ranging from 15 to 25 feet

- 8 Insertion shafts
- 12 Receiving shafts

HDPE Pipe Fusion

Launching Pipe Bursting Head

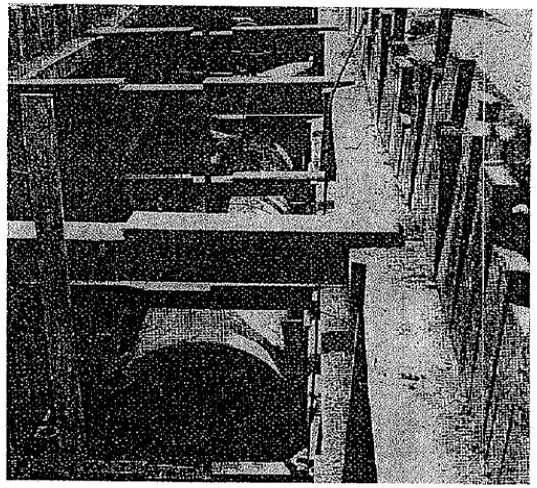
Unknown Subsurface Conditions

First pipe bursting run (347 feet)

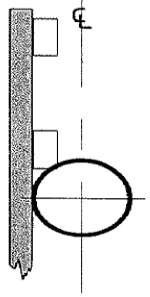
- Bursting refusal at approximately 85 feet
- Emergency recovery shaft
- Change in subsurface condition
- Wood sheeting
- Soil conditions

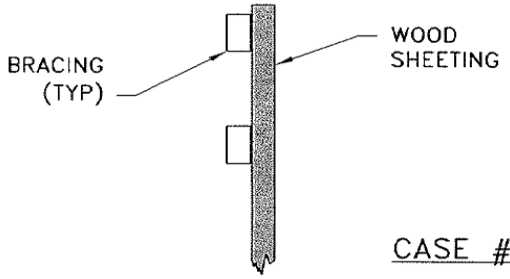
Different Site Condition I

PIPE BURSTING 12"ø CLAY TO 16"ø HDPE



PIPE INSTALLATION (typical)

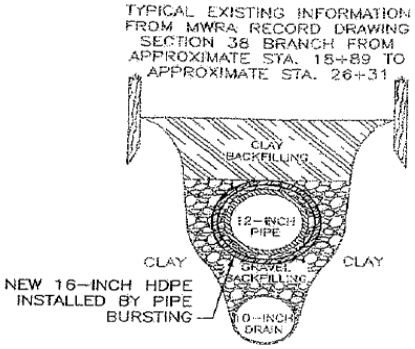




CASE #1

NOT TO SCALE

TYPICAL EXISTING INFORMATION FROM MWRA RECORD DRAWING SECTION 38 BRANCH FROM APPROXIMATE STA. 15+89 TO APPROXIMATE STA. 26+31

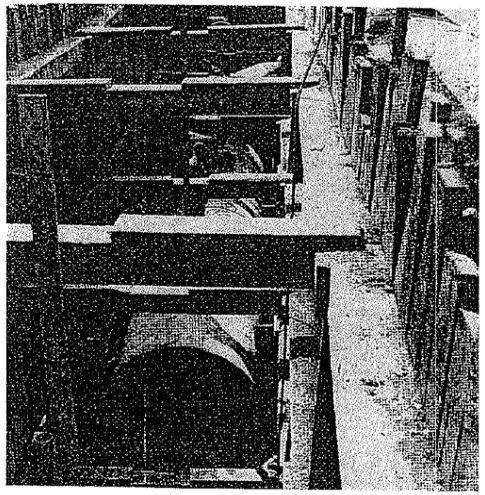


DETAIL 5 / D-12

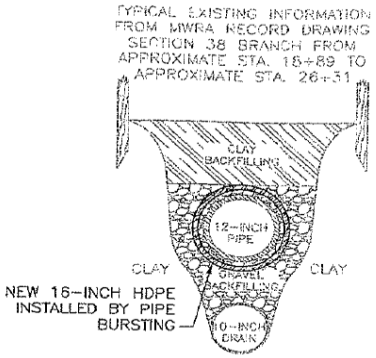
NOT TO SCALE

Different Site Condition II

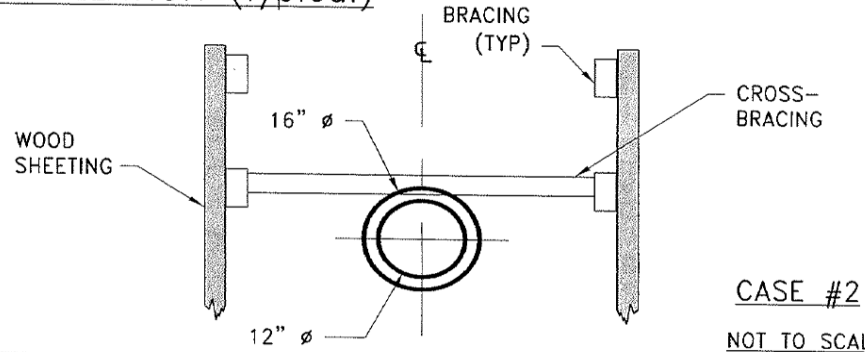
PIPE BURSTING 12"ø CLAY TO 16"ø HDPE



PIPE INSTALLATION (typical)



DETAIL 5 / D-12
NOT TO SCALE



CASE #2

NOT TO SCALE

Typical Timeline

- 22 days – Shaft Layout & Utility Relocation
- 6 days – Support of Excavation & Excavate
- 4 days – Set Up for Pipe Bursting
- 1 day – Pipe Bursting
- 2 days – Demobilization
- 10 days – Site Restoration

Pipe Bursting Production Rate

Run	Pipe Diameter (in)	Duration (hrs)	Length (ft)	Rate (ft/hr)	Rate (ft/min)	Average (ft./min)
1	12-inch upsize to 16-inch	3.25	300	92.31	1.54	3.33
2		2	300	150.00	2.50	
3		2	508	254.00	4.23	
4		1	268	268.00	4.47	
5		0.75	218	290.67	4.84	
6		1.25	172	137.60	2.29	
7		0.75	153	204.00	3.40	
8	15-inch upsize to 20-inch	2	422	211.00	3.52	3.52

Lessons Learned…

- Utility Relocations – Early start
- Microtunneling Transitioning into Clay (Clogging)
- Operation of New Vs. Old MTBM (familiarity and productivity)
- Contractor Staging area as part of bid
- Disposal of excess Microtunneling slurry
- Building Inspections (Pre and Post Construction Survey)
- Rodent control limits (Expanded Limits)
- Public/ Community Meetings, frequency and timing
- Microtunnel work hours
- Noise control
- Accurate and Reliable As-built and maintenance/repair record and photos

2012 Annual Progress Report for CSO Control Plan

25. EAST BOSTON BRANCH SEWER RELIEF

Receiving Water:
Boston Harbor and Chelsea Creek

Completed:
2010

Capital Cost:
$85,709,000

Description:
Upgraded MWRA's 115-year-old interceptor system serving most of East Boston, using a combination of construction methods: microtunneling, pipe-bursting, open-cut excavation and pipe relining.

CSO Control

Water Quality Benefit:
Minimizes CSO discharges to meet B(cso) water quality standards (>95% compliance with Class B).

CSO Outfalls:
BOS003, BOS004, BOS005, BOS009, BOS010, BOS012, BOS013, BOS014 (BOS006 and BOS007 closed by BWSC)

Frequency of discharges (typical year):
Before project: 31
With project: 6

Annual Discharge Volume (typical year):
Before project: 41.0 million gallons
With project: 8.6 million gallons

CSO Reduction by Volume: 79%

Discussion

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