



Sustainable Maintenance Approaches

Sanitary Sewer Siphons vs. Pump Stations

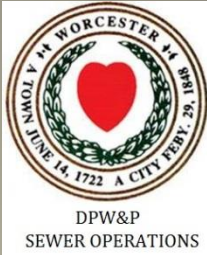
*An analysis of a recent siphon blockage in the
Millbury/Vernon Street Area*

Presentation by:

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Assistant Director of
Sewer Operations
City of Worcester DPW&P



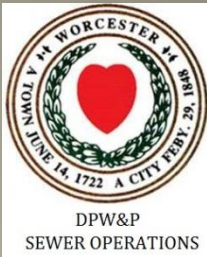
Mark Hollis, E.I.T.
Junior Sanitary Engineer
City of Worcester DPW&P



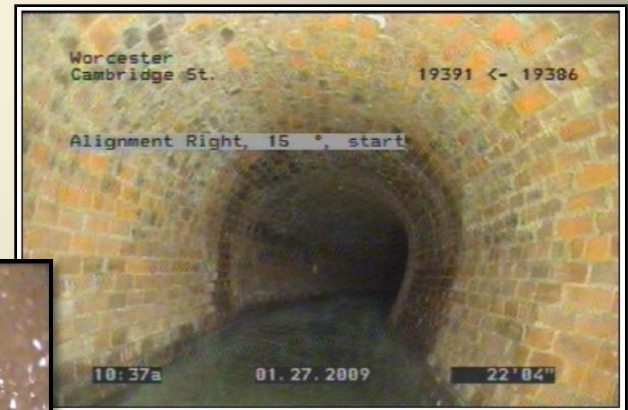
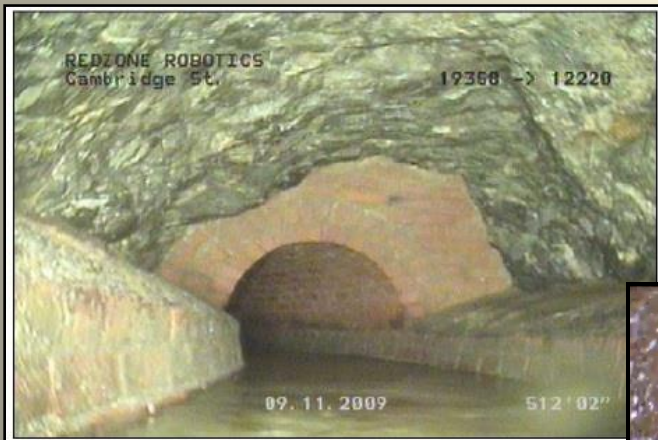
City of Worcester, MA

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508-929-1300



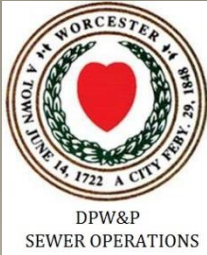
- Population: approximately 181,000 residents
- Miles of Sewers: 377 miles of sewers (8" to 96")
329 miles of drain (8" to 156")
59 miles of combination (8" to 240")



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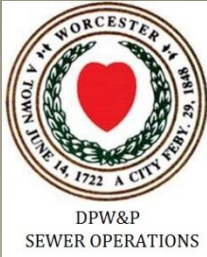
- Number of manholes:
 - 2,621 combination manholes
 - 13,919 drain manholes
 - 14,710 sewer manholes
 - 3,213 twin manholes



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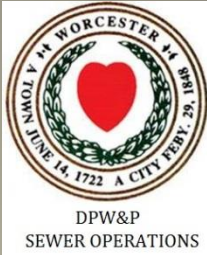
- Number of catch basins: 15,751
- Number of Outfalls: 344 (8" to 72"x74")



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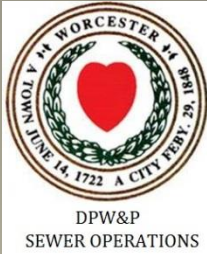
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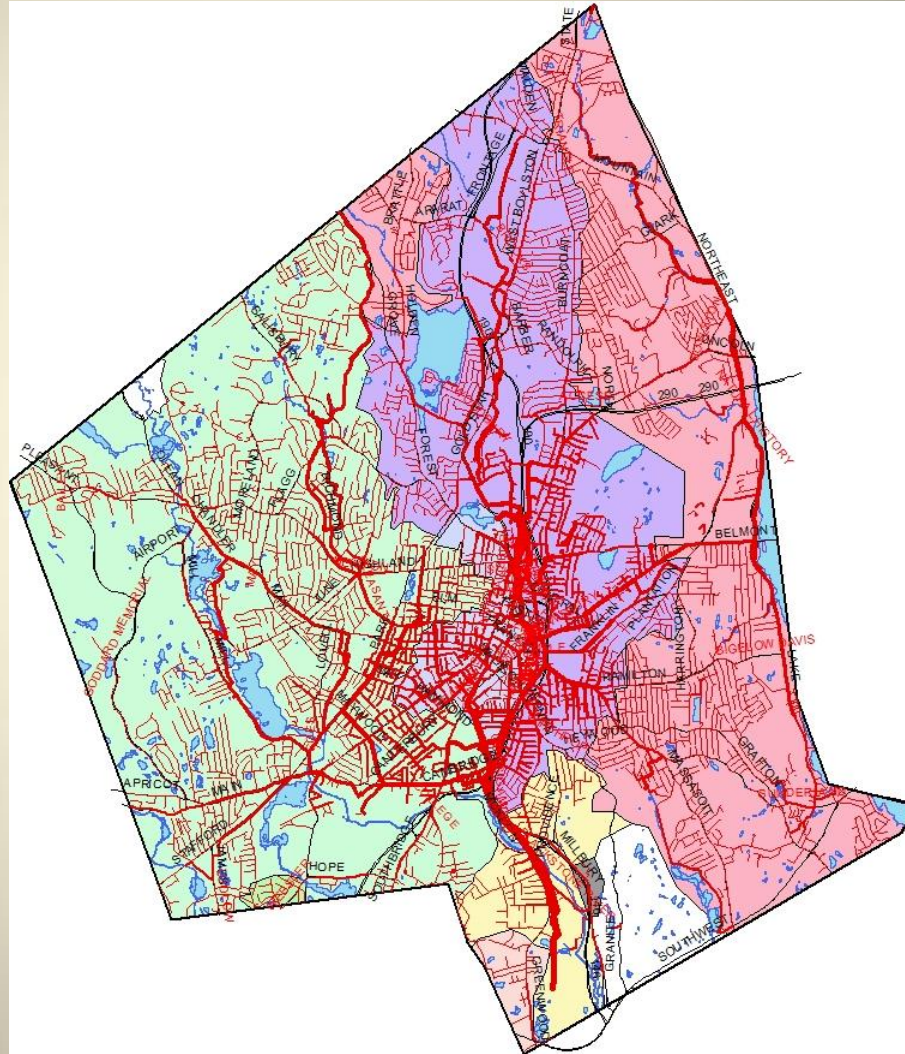
- Number of sewer pump stations: 30 (1,500 GPD to 4 MGD)
- Number of stormwater pump stations: 2
- One CSO treatment facility
- Number of siphons: 19
- Number of regulators: 30



Major Sewer Service Areas

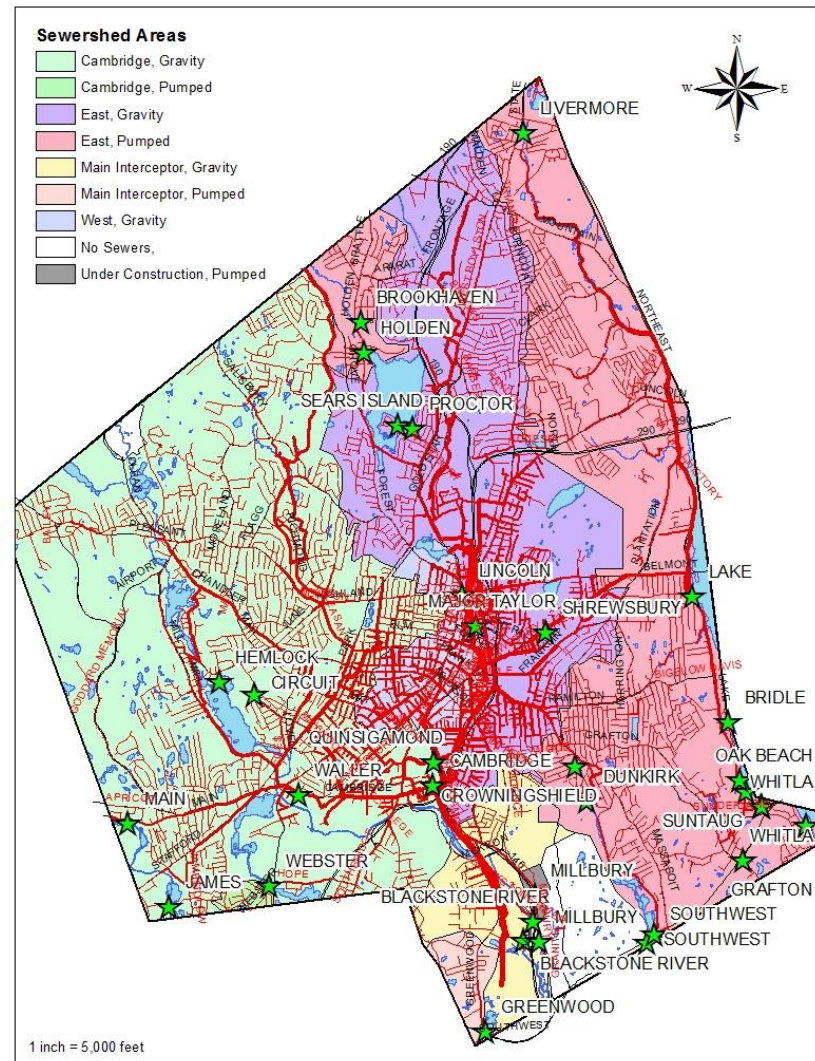


- Cambridge Street
- Western Interceptor
- Eastern Interceptor
- Lake Ave Corridor

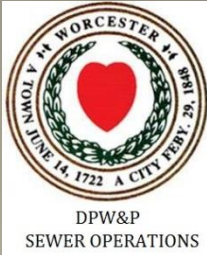


30 Pump Stations

Street Name/PS Name	Service Area Name
QUINSIGAMOND AVE	Cambridge - Gravity
GRAFTON ST	East - Pumped
DUNKIRK AVE	East - Pumped
MILLBURY ST	Under Construction - Pumped
HEMLOCK ST	Cambridge - Gravity
BRIDLE PATH	East - Pumped
SOUTHWEST CUTOFF	No Sewers
MAJOR TAYLOR BLVD	East - Gravity
CROWNSHIELD RD	East - Pumped
LIVERMORE ST	East - Pumped
OAK BEACH TER	East - Pumped
PROCTOR ST	East - Gravity
SHREWSBURY ST	East - Gravity
SUNTAUG RD	East - Pumped
BROOKHAVEN RD	East - Pumped
WHITLA DR	East - Pumped
PINELAND AVE	East - Pumped
BROOKHAVEN RD	East - Pumped
SEARS ISLAND DR	East - Gravity
JAMES ST	Cambridge - Gravity
WEBSTER ST	Cambridge - Pumped
LAKE AVE	East - Pumped
GREENWOOD ST	Main Interceptor - Pumped
HOLDEN ST	East - Pumped
MILLBURY ST	Main Interceptor - Gravity
CAMBRIDGE ST	Cambridge - Gravity
MAIN ST	Cambridge - Pumped
LINCOLN SQ	East - Gravity
WALLER AVE	Cambridge - Pumped
WHITLA DR	East - Pumped



Pump Stations Issues



- Software/SCADA can be a headache.
- Require maintenance & upgrades.
- Expensive. City has \$500,000/year maintenance budget.
- Mechanical parts break.
- Uses electricity.
- Finite life spans.

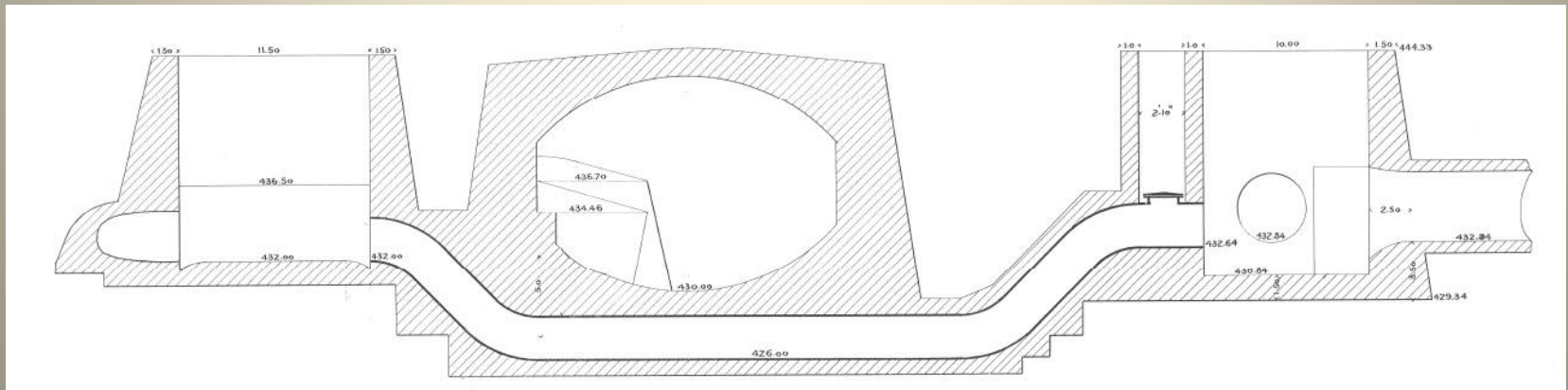


Siphons in the City of Worcester

Address	Size	Length	Directions
Newton Ave North @ Suburban Rd	15"	27.5	Flush from MH4 to MH5
267 Chandler	8"	52.2	Flush from MH9 to MH12
559 Park Ave	15" and 10"	66.3	Flush from MH8 to MH9 in 10" and 15" sewer
24 Mill St	30" and 18"	57.8	Flush both 30" and 18" sanitary from MH21388
19 Glenine St	Twin 10"	60.4	Flush both barrels from East to West
Glenine St @ Millbrook St	Twin 24"	64.8	Flush both barrels form MH 9 (South) to MH 9 1/2 (North)
151 West Boylston Dr	8" and 12"	38.7	Flush both 8" and 12" from MH 29 1/4 (West) to MH 29 1/2 (East)
Home Depot @ Gold Star Blvd	Twin 24"	48	Flush both barrels from MH 16 1/4 (South) to MH 16 1/2 (North)
160 Gold Star Blvd	Twin 18"	34.1	Flush both barrels from MH 17 (S) to MH 18 (N)
Garden St - A	Twin 10"	68	Flush both barrels from MH 2 1/2 (West) to MH 2 1/4 (East)
Garden St - B	Twin 15"	60.4	Flush both barrels from MH 3 (West) to MH 2 (East)
40 Webster St	18"	72.5 (?)	Flush from MH 6 (North) to MH 7 (South)
241 Grove St	20"	55	Flush from MH near North St (SE) to MH near Sagamore Rd (NW)
51 Summer St	4 x 24"	135	Flush four barrels from MH 13 or closer (SE) to MH 14 (NW)
Southbridge St Under 290 Bridge	24"	200	Flush from MH 7 (N) to MH 8 (S)
1090 Main St	30"	83.6	Flush from MH 1 (East) to MH 8 (W)
Quinsigamond Ave @ Cambridge St	3 x 30"	215	Flush three barrels from Cambridge St side towards Quinsig Ave
Quinsigamond Ave @ 146 on ramp	3 x 30"	65	Flush three barrels from Cambridge St side towards Millbury St
Millbury St Under 146	18"	110'	Flush from MH S-3 to MH S-2 (Millbury St)

Siphon Issues

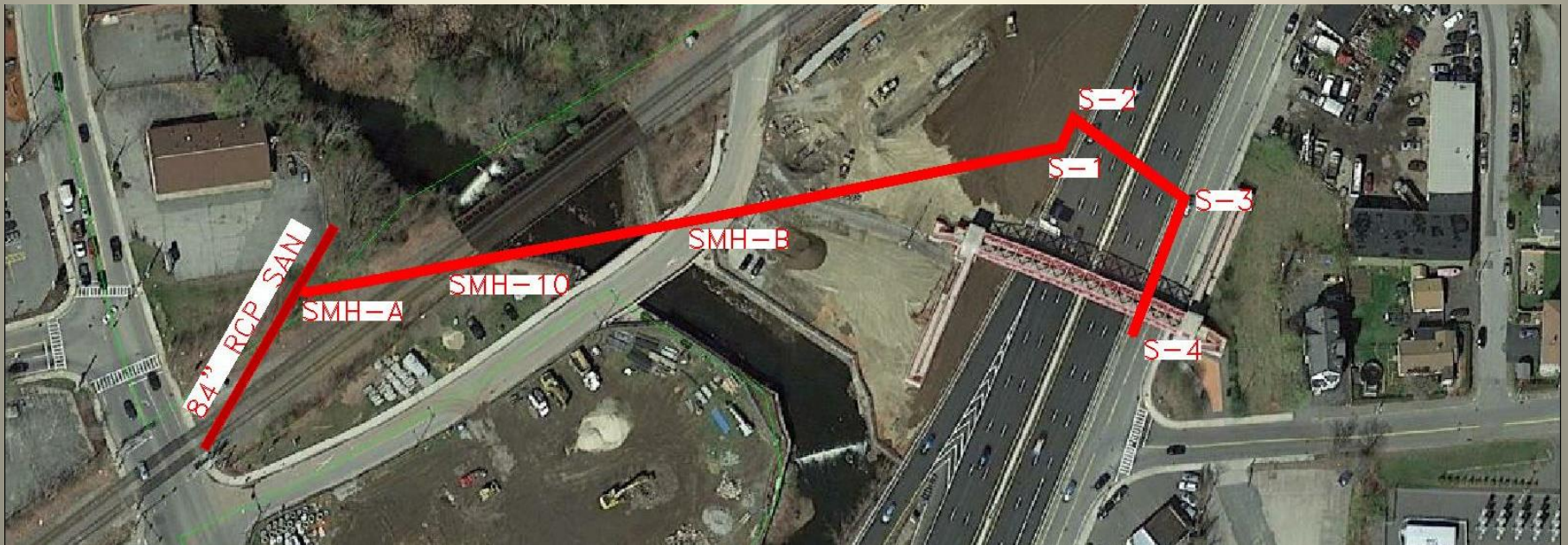
- Different designs and applications in the city.
- Lower maintenance than pump stations.
- Blockages can get messy and are tough to resolve.



Siphon crossing under the Millbrook Conduit @ Quinsigamond Ave

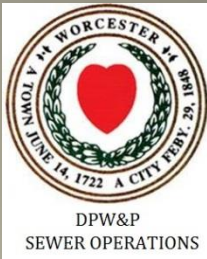
Millbury Street Siphon

- Approx. 650 feet in length.
- Entire length is under pressure.
- Two cleanouts.
- Enters into 84" RCP sanitary sewer near McKeon Rd.

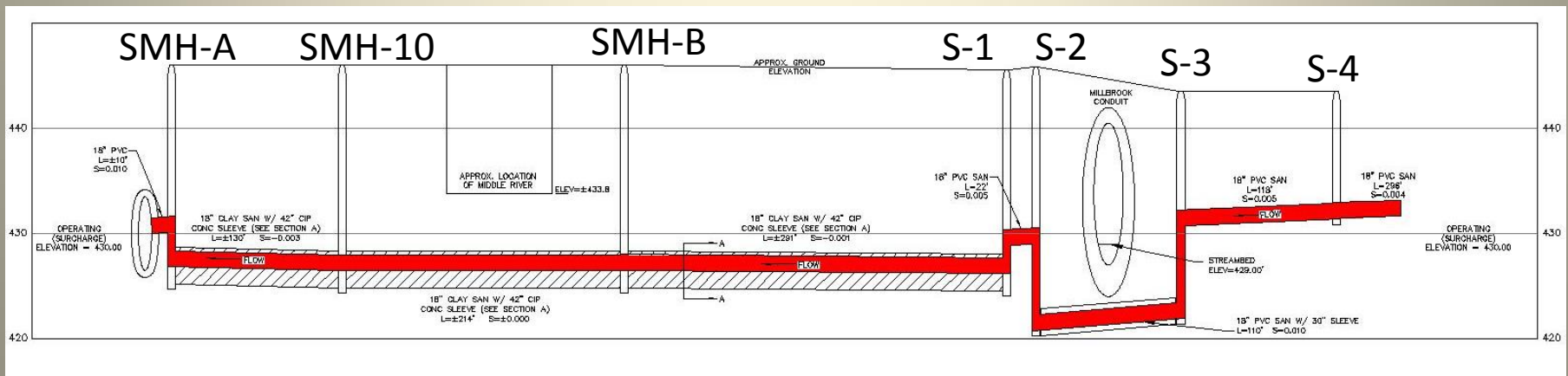
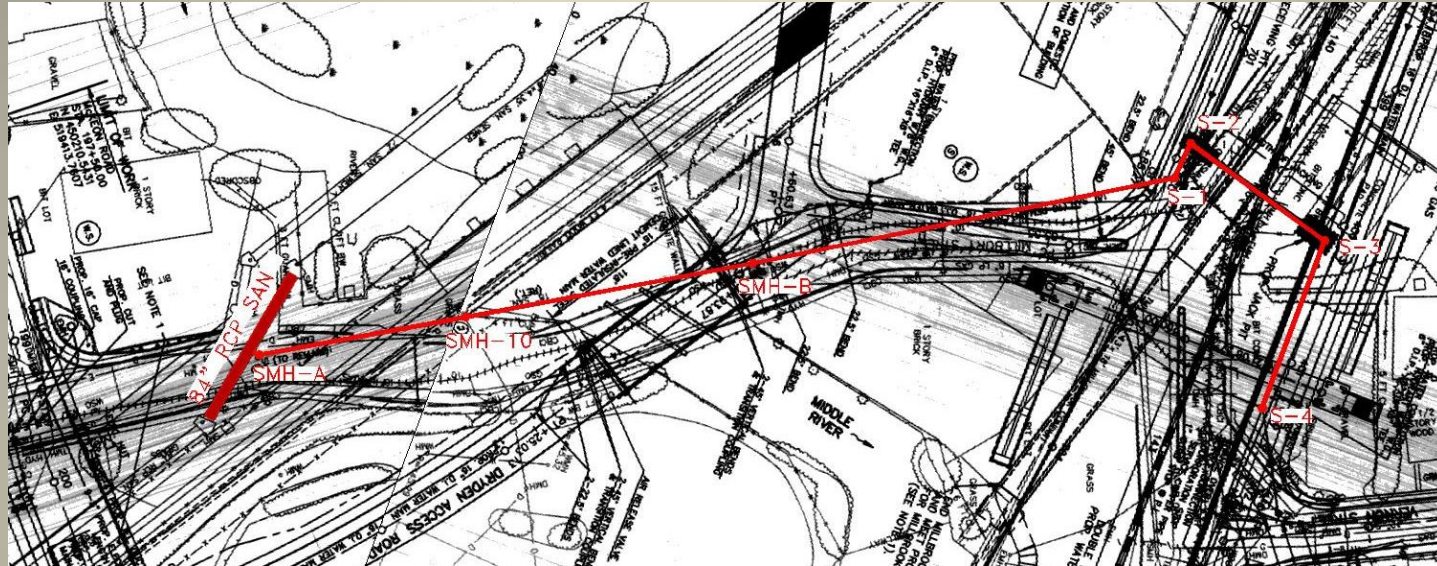
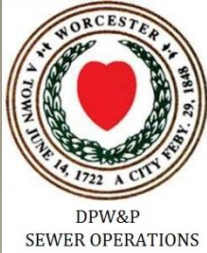


Sewer crosses under:

- Rt. 146
- Mill Brook Conduit
- P&W Railroad Location
- Middle River

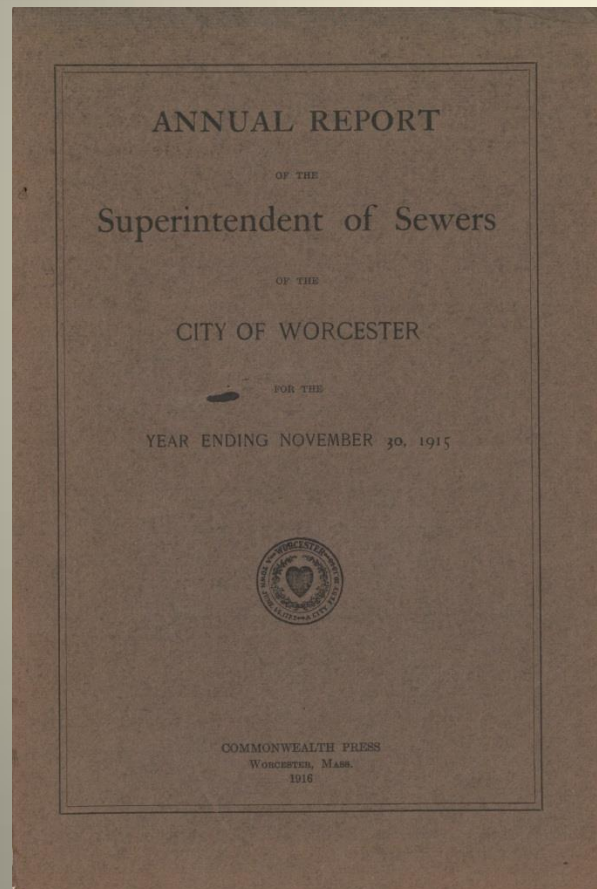
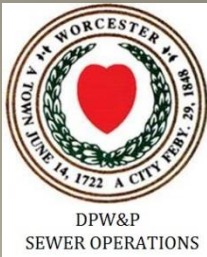


Millbury Street Siphon



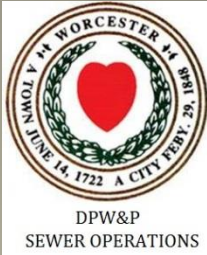
Siphon Timeline

- 18" sewer first mentioned in 1915 Annual Report.



Siphon Timeline

- Intended to flow as a gravity sewer.



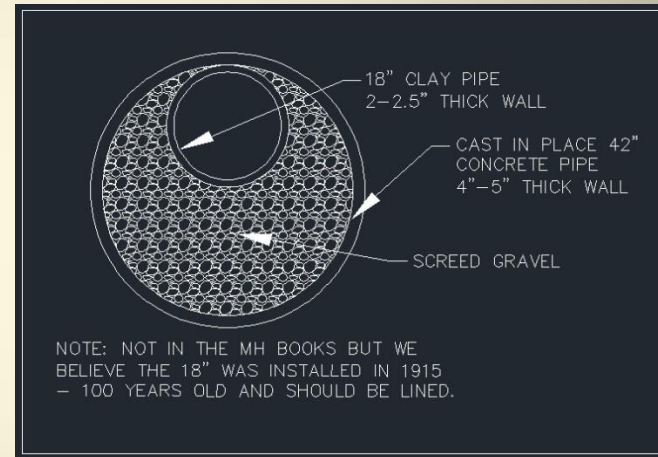
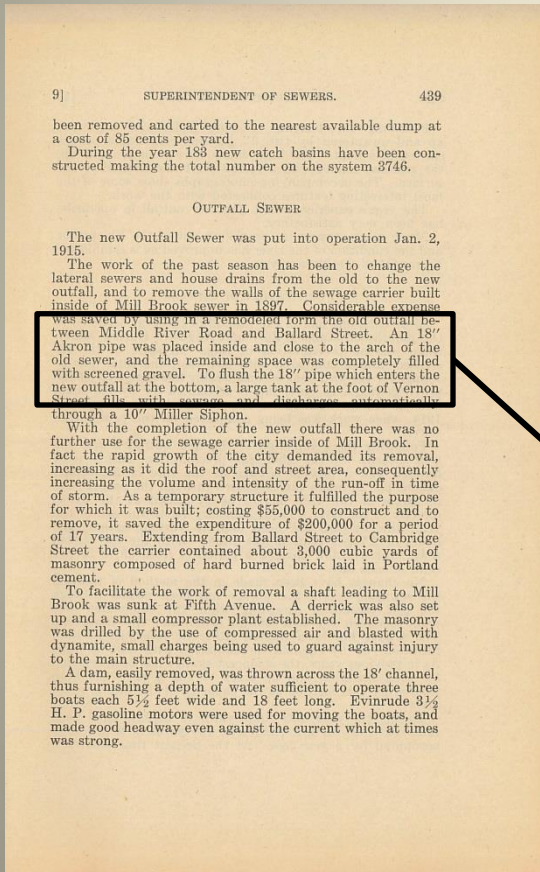
OUTFALL SEWER—FIRST SECTION OF COMPLETED COFFERDAM



OUTFALL SEWER—DRIVING STEEL PILES FOR COFFERDAM

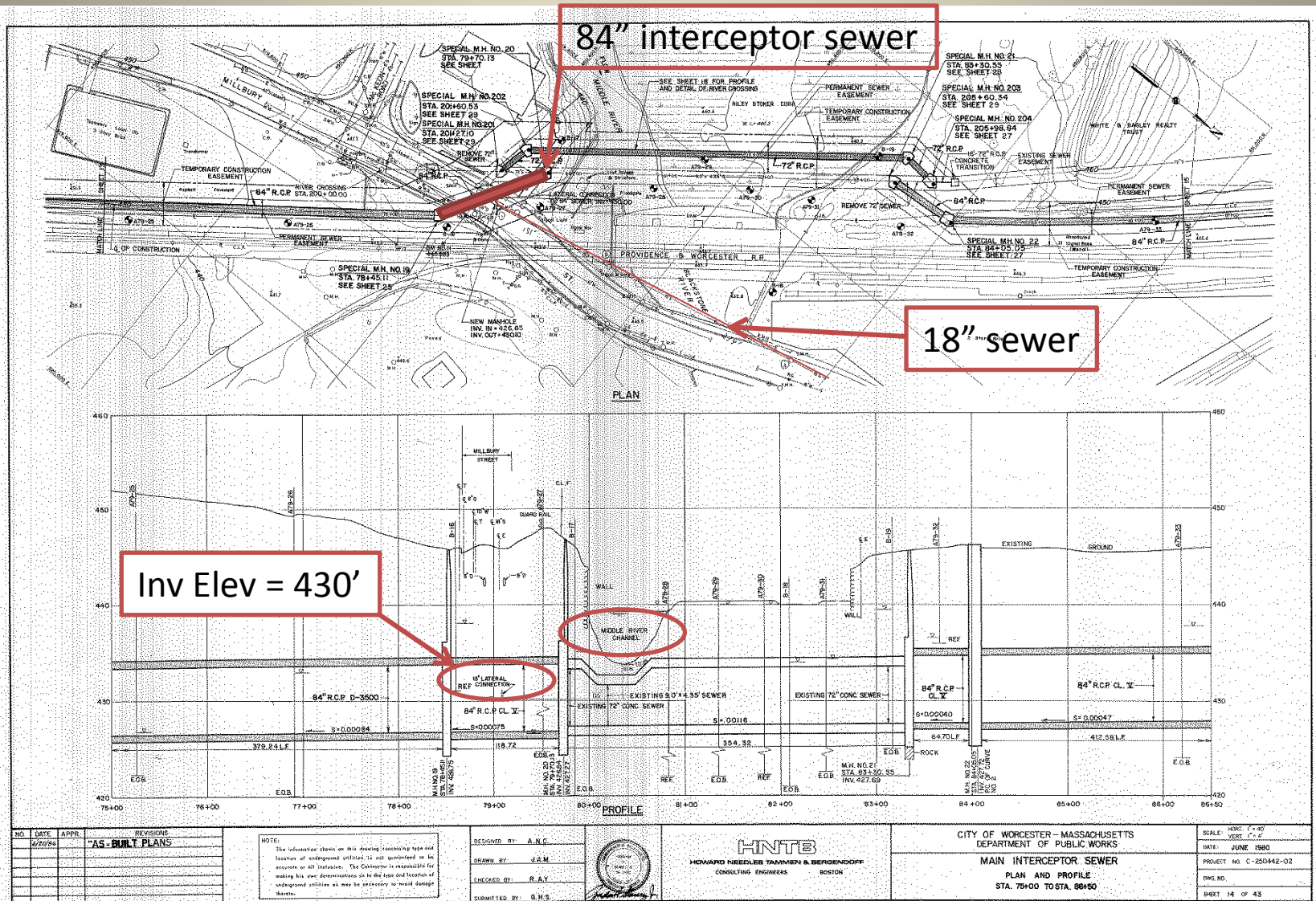
1915: Conversion to 18"

- Pipe was installed in an existing 42" host pipe.

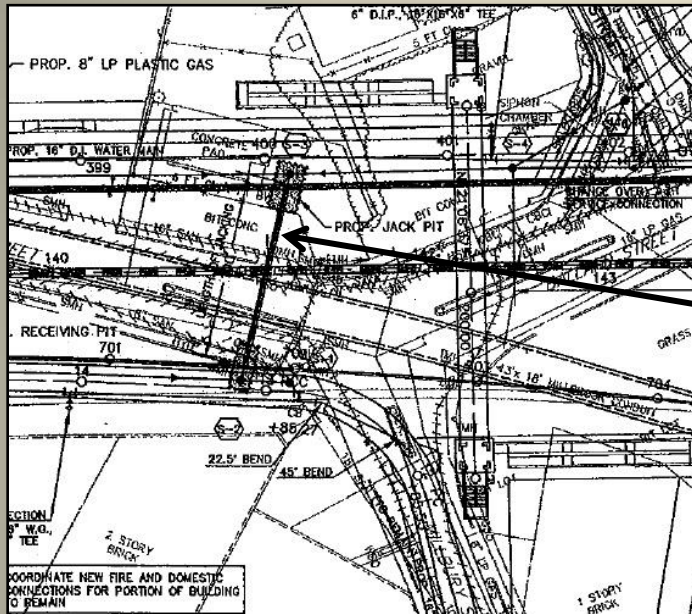


"An 18" Akron pipe was placed inside and close to the arch of the old sewer, and the remaining space was completely filled with screened gravel."

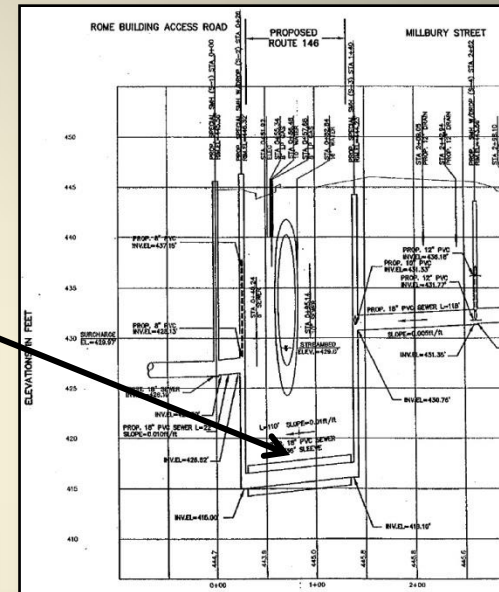
1980s: Contract 19



2002: Rt. 146/Hurley Sq. Contract



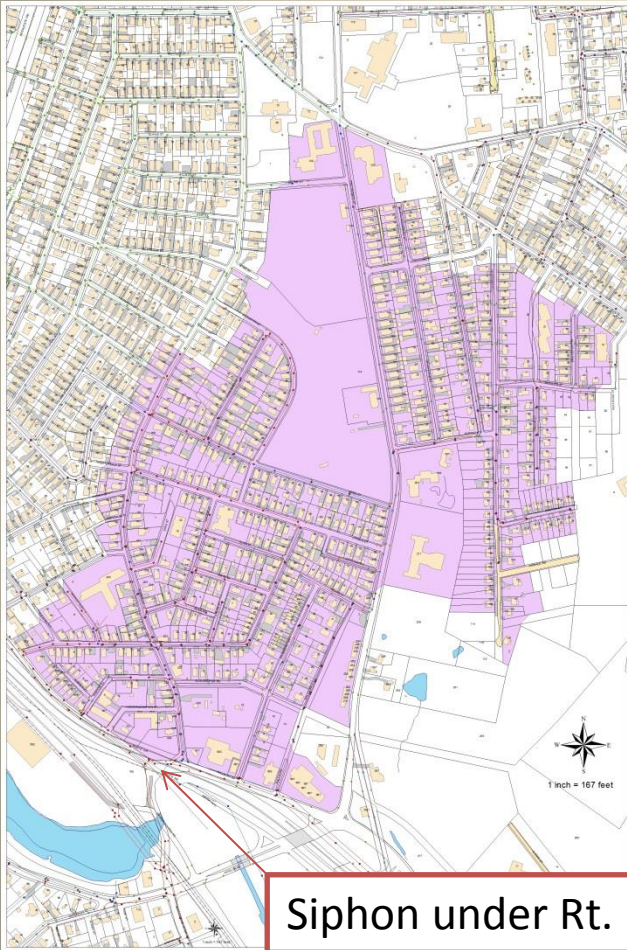
Siphon



Siphon Blockage and SSO



Millbury St Siphon Service Area

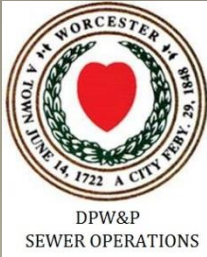


Siphon under Rt. 146

- Approximately 600 parcels.
- An estimated 6,600 gallons of sewage entered the Blackstone due to blockage.



Saturday 9/24/16

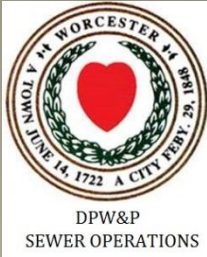


- Passerby see sewage coming out of manhole on Millbury St and calls customer service.



***This is not the actual SSO**

Saturday



- Flusher responds and frees blocked sewer.
- We believe debris was flushed downstream and blocked up the siphon.



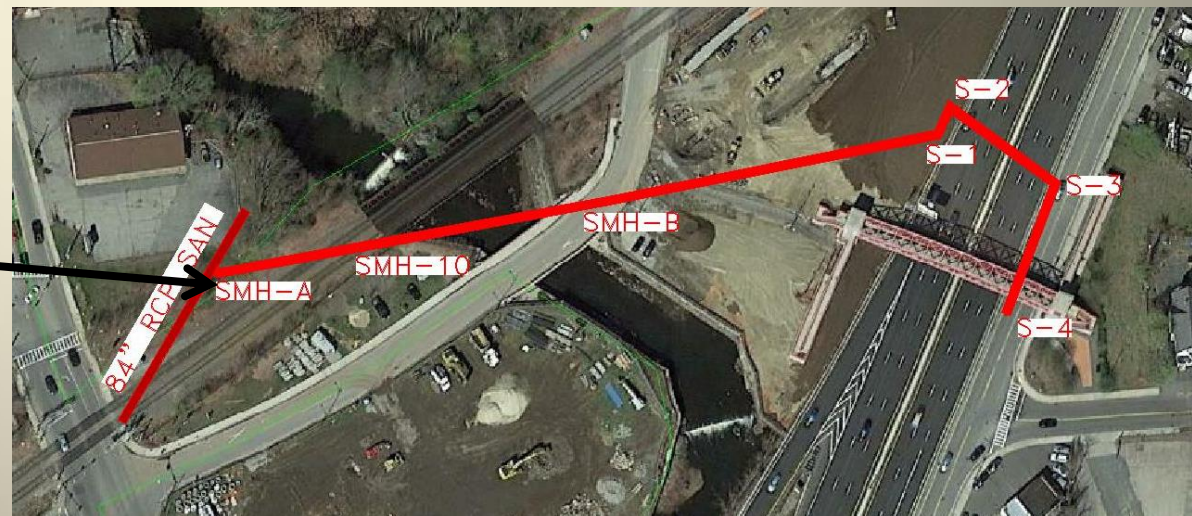
Saturday night into Sunday

- Flow is managed by three hired septic haulers.
- No loss of service reported in the area.
- Dumped sewage into a local gravity sewer.



Monday Morning

- Septic haulers continue to work around the clock.
- A pump is set up on the downstream side of the second siphon to lower the operating elevation of the system.

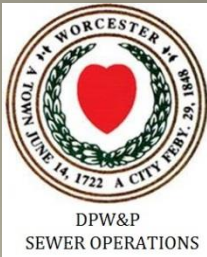


Monday – Siphon is blocked

- Catch basin machine set up on Rt. 146 due to limited access to downstream MH.
- Dredger removes 6-10 yards of rags, flushable wipes and grease from MH.

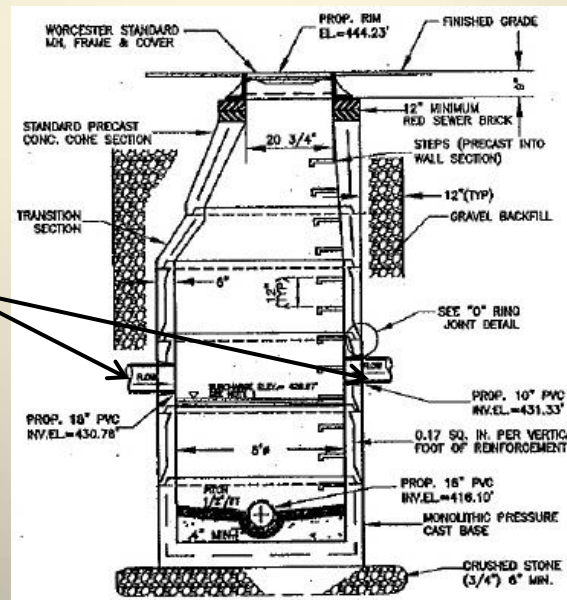


Tuesday



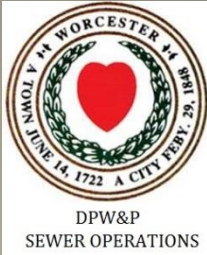
- Dredger work shuts down at 4 PM due to safety concerns.
- Two legs coming into the siphon became exposed overnight on Tuesday due to the low flow conditions and increased capacity downstream.

Flow into the siphon was plugged overnight on Tuesday



Upsteam MH S-3

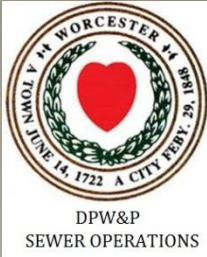
Wednesday



- 3" submersible pump brought in to expose invert of outgoing siphon pipe.
- Hired vac-flusher brought in to clean 18" siphon from upstream MH.
- One yard of gravel removed from siphon.

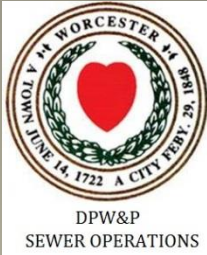


Cost



- 10 Sewer Operations personnel dedicated to this location over a three day span.
- Overnight supervision of job site.
- Three large septic haulers: three straight days.
- Hired vac-flusher for 15 hours.
- Police detail for Rt. 146 – two officers for three eight-hour shifts.
- **Still much cheaper than designing, building and maintaining a pump station to service this area.**

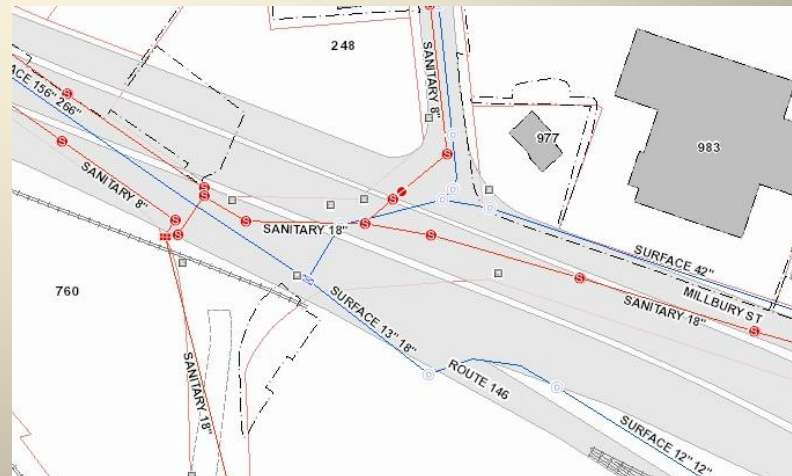
Lessons learned/conclusions



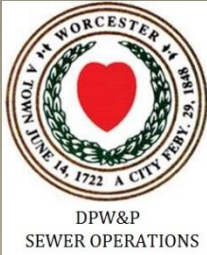
- Improve monitoring of pre-1900 sewers.
- Schedule & document inspections and cleanings when necessary.
- Record drawings need to be readily available and properly catalogued.
- GIS needs to be updated to ensure accuracy.

LIST OF REFERENCE DRAWINGS

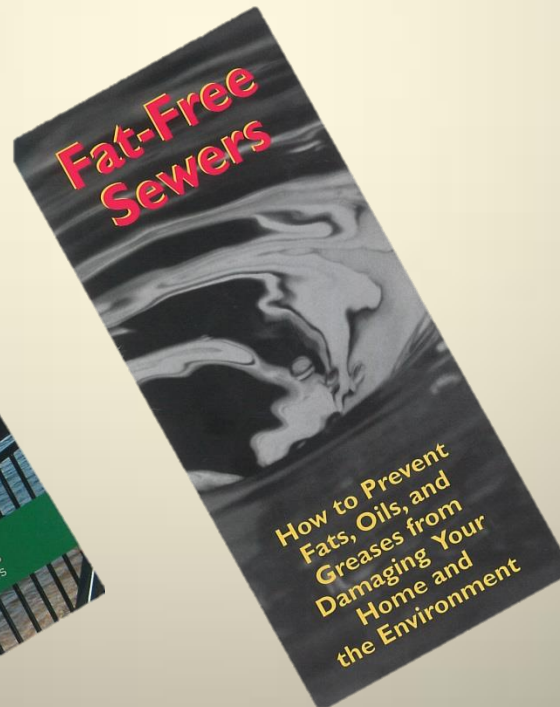
- 1915 Annual Report
- Worcester Sewer Dept. 40-Scales
Book 10 - Sheets 14 and 15
- Rt.146 - Hurley Sq Contract
Utility Plan Sheet 3 and 6
- Contract 19
Sheet 14



Lessons learned/conclusions



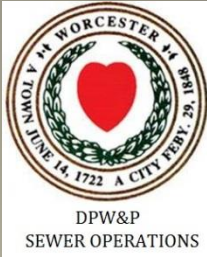
- Targeted public outreach/education associated with flushable wipes, grease, etc. to entire service area.



@WorcesterDPW

@TweetWorcester

Questions?



Joseph Buckley, P.E.
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Sewer Operations
City of Worcester DPW&P



Mark Hollis, E.I.T.
Junior Sanitary Engineer
City of Worcester DPW&P



Thanks!