Report

Town of Dedham, MA

2013 Year One Inflow Investigation

March 2014

Weston&Sampson

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Town of Dedham, Massachusetts
Weston & Sampson Project No. 2130225.A

March 18, 2014

Mr. Jason L. Mammone, P.E.
Director of Engineering
55 River Street
Dedham, Massachusetts 02026

Re: 2013 Year One Inflow Investigation

Dear Mr. Mammone:

Weston & Sampson is pleased to submit our report for the 2013 Year One Inflow Investigation which included smoke and dye testing within sewer subareas GG, KK, LL, OO, QQ, RR, and SS. A limited amount of smoke testing was also performed in sewer subarea XX in the Ledgewood Road area, at the town's request. These areas were selected for investigation because they were identified as likely to contribute inflow to the sanitary sewer system following the 2011 Town-Wide Flow Monitoring report. This report summarizes the results of the field work performed to identify sources of inflow to the sanitary sewer system. This report also presents a cost-effectiveness analysis (CEA) and preliminary design for rehabilitation of the identified inflow sources. The project areas are shown in Figure 1.

Project Description

The Town of Dedham, Massachusetts is a residential community located southwest of Boston. Wastewater collected in the town drains east toward Boston where it enters the MWRA interceptor. Flow is ultimately treated at the Deer Island Wastewater Treatment Plant. The town's wastewater collection system consists of approximately 95 miles of gravity sewer with an average daily flow of 4 million gallons per day (MGD). The Dedham sewer system is divided into 26 sewer subareas.

According to the *DEP Guidelines for Conducting I/I Analyses and Sewer System Evaluation Survey* (DEP Guidelines), sewer subareas that contribute at least 80 percent of the total inflow identified through monitoring are considered excessive. Based on data from the 2011 Town-Wide Flow Monitoring report, there were 14 sewer subareas contributing 80 percent of the peak flow that should be investigated for inflow. The 14 subareas are GG, HH, II, JJ, KK, LL, NN, OO, PP, QQ, RR, SS, TT and WW. The seven subareas that had the highest peak design storm inflow were investigated in 2012. The seven remaining subareas were investigated and included in this report.

Smoke Testing

Smoke testing consists of pumping a white, non-toxic smoke into the sanitary sewer collection system and observing the surrounding area for smoke escaping from the ground or from drainage structures. The appearance of smoke indicates either a direct or indirect connection through which surface runoff may enter the sewer system. Indirect sources include cracked pipes or offset joints in adjacent sewer and drain pipes that create an indirect connection between the drain and sewer systems. Direct sources include catch basins, driveway drains, patio drains, stairwell drains, yard drains or roof leaders, which discharge directly to the sewer system. It is assumed that 100 percent of direct inflow may be removed through rehabilitation.

An indirect source constitutes rain water that infiltrates into the ground before entering the sewer system at a sewer system defect, either in a manhole or in a sewer pipe. It is assumed that only 50 percent of indirect inflow may be removed through rehabilitation, as the rain water could possibly enter the sewer system at another defect that has yet to be identified. Indirect inflow sources can occur during a rain event when there is an opportunity for a drainage structure to be hydraulically connected to the sanitary sewer system. An example of this is a cracked service connection located below a cracked drain line. When a rain event occurs, rain water leaks out of the drain line, through the soil and into the cracked service connection.

Inflow sources contribute storm inflow to the sewer system. According to the DEP Guidelines, peak design storm inflow is defined as the peak amount of inflow that may enter the sanitary sewer during a one-year, six-hour storm event with an intensity of 0.87 inches per hour.

Smoke testing was performed by Weston & Sampson on approximately 148,000 linear feet (lf) of sanitary sewer in subareas GG, KK, LL, OO, QQ, RR, and SS, from September 9 to September 25, 2013. Twenty seven (27) defects were identified through smoke testing. Smoke Testing Defect Logs and photos for each defect are included in Appendix A. The defects are listed below:

Location	Defect No.	Description of Defect
99 Wildwood Drive	1	Defective Cleanout (at grade)
211 Central Avenue	2	Defective Cleanout (above grade)
76 Sanderson Avenue	3	Manhole RR-120 with Vent Holes in Cover
18 Sanderson Avenue	4	Manhole RR-90 with Vent Holes in Cover
82 Pratt Avenue	5	Moderate Smoke from Sump Hole (below grade)
73 Dale Street	6	Open Cleanout (below grade)
31 Cedar Street	7	Open Cleanout (below grade)
39 Winthrop Street	8	Manhole RR-400 with Vent Hole in Cover
140 Ashcroft Street	9	Manhole QQ-500 with Vent Holes in Cover
71 Quincy Avenue	10	Driveway Drain
75 Quincy Avenue	11	Driveway Drain
31 Flanagan Place	12	Light Smoke from Catch Basin
6 Liberty Street	13	Heavy Smoke from Broken Service
61 Bussey Street	14	Moderate Smoke from Broken Service

157 Robert Road	15	Driveway Drain
100 Robert Road	16	Light Smoke from Open Drain Outfall
1 Newcourt Lane	17	Heavy Smoke from Catch Basin (1)
1 Newcourt Lane	18	Light Smoke from Catch Basin (2)
27 Highland Street	19	Moderate Smoke from Catch Basin
832 High Street	20	Heavy Smoke from Manhole GG-170
832 High Street	21	Heavy Smoke from Manhole GG-160
57 Leonard Street	22	Driveway Drain
38 Leonard Street	23	Driveway Drain
81 Berlin Street	24	Driveway Drain
55 Thomas Street	25	Open Cleanout (at grade)
99 Ware Street	26	MWRA drain Manhole in Subarea KK with Hole in Cover
1 Newcourt Lane	27	Light Smoke from Catch Basin (3)

In addition to the 27 smoke testing defects described above, 33 suspect driveway drains, 7 suspect catch basins, 10 suspect roof leaders, and one (1) service connection manhole with a vent hole that did not smoke were identified during the testing. The suspect sources are considered as such because they discharge into the ground and their outlets were not visible.

Weston & Sampson identified additional I/I issues at two manholes. The cover of manhole SS-930 was cracked and should be replaced. Manhole SS-810 was surcharged during the time of smoke testing. Special attention and more detailed inspections should be conducted during future inspections of this area when the groundwater is at peak conditions.

Smoke testing defects and suspect sources are included in Table 1, *Smoke and Dye Testing Results*. Of the 78 total smoke testing and manhole defects and suspect sources, 62 required further investigation through dye testing or dye flooding.

The sewer vent pipes at 104 buildings did not smoke during the testing. These houses may be connected to a septic system, have an obstruction in their service lines or plumbing systems, or have traps on their service lines. A list of these buildings is included as Table 2, *Buildings With No Smoke From Sewer Vent*.

Dye Testing and Dye Flooding

Sources identified during the smoke testing process are usually confirmed by performing dye testing or dye flooding. Dye testing uses less than 10 gallons of water and is conducted by introducing dyed water into a suspected inflow source and observing the surrounding sewer and drain lines for the emergence of the dye. Appearance of dye in the sewer system indicates nature of the inflow source's connection to the sewer system.

Dye testing was necessary at 56 defect and suspect source locations to confirm their connection. Weston & Sampson performed dye testing of defects and suspect sources, identified through smoke testing, on October 2 and 3, 2013. Dye testing of defects and suspect sources included 39 driveway drains, 10 roof leaders and 7 catch basins. Eight of these defects were confirmed as connected to the sanitary sewer. The dye test results are summarized in Table 1.

Dye flooding was necessary at 6 smoke testing defect locations to confirm their connection. Dye flooding uses more than 10 gallons of water and was performed on November 7 and 8, 2013. No dye flooded catch basins were identified as having direct or indirect connections to the sanitary sewer. The results are summarized in Table 1 and logs are included in Appendix B. The remaining 16 sources were visually confirmed to be positive defects or not connected to the sanitary sewer.

Cost-Effectiveness Analysis

In order to determine if rehabilitation is justified for a particular source of I/I, a CEA is conducted. The CEA compares the estimated cost for removing I/I to the estimated savings in transportation and treatment (T&T) costs resulting from the removal of I/I. T&T costs consist of capital costs to expand and upgrade the wastewater system plus annual Operation and Maintenance (O&M) costs. O&M costs are directly related to the quantity of flow being discharged to pump stations and treatment facilities. Increased usage will be reflected by increased O&M costs for electricity, cleaning, equipment repair, etc.

The calculated T&T cost for Dedham, using MWRA and the Town of Dedham's O&M and capital costs, is $1.0563/gpd. In accordance with DEP Guidelines, the present worth of this T&T cost must be extended over the life of the rehabilitation method, estimated at 20 years, using a discount rate (or annual percentage rate) of 4.125% (DEP FY13). The present worth of the T&T costs for the Town of Dedham, assuming a 20-year rehabilitation life cycle, is $14.20/gpd. The calculation is provided in the T&T Memo in Appendix C.

It should be noted that T&T costs can change annually. Therefore, if the recommended rehabilitation program included in this letter is not conducted within a year, it is recommended the T&T costs at the time of construction be compared to the value used for this analysis. Typically, if T&T costs increase, the amount of "cost-effective" rehabilitation may also increase.

The evaluation of cost-effectiveness for a particular I/I source is also based upon the portion of I/I that can be eliminated through rehabilitation. The percentage of I/I that can be removed depends on the source and the rehabilitation method. It is estimated that indirect inflow and infiltration sources are 50 percent removable because indirect inflow and infiltration can migrate from a rehabilitated location to a location that did not previously show a need for rehabilitation. This is identified in the CEA as "removable." The percentage of direct inflow removed is assumed to be 100 percent because direct inflow repairs typically involve the redirection of 100 percent of this flow to drainage structures.

The rehabilitation cost used in the CEA is based primarily on an estimate of the as-bid construction cost for the rehabilitation. Estimated rehabilitation costs were developed using prices from recent projects. The rehabilitation costs used in this report do not include the cost of additional investigation work or engineering services during design and construction. A list of rehabilitation unit costs used in the CEA is included in Appendix C.

The *MWRA Cost Effectiveness Analysis for I/I Sources*, Table 3, shows the T&T cost associated with the observed I/I as well as recommended rehabilitation methods and costs. The CEA results produce one of three conclusions:

- ***Excessive*** indicates that the cost to rehabilitate the line segment is less than the associated T&T cost and that rehabilitation is recommended.

- ***Non-Excessive*** indicates that the cost to rehabilitate the line segment is more than the associated T&T cost and rehabilitation is not recommended.

- ***Non-Excessive Recommended*** indicates that the cost to rehabilitate is more than the T&T cost, but rehabilitation is still recommended due to the severity of the defect. Also, non-excessive recommended rehabilitations that are in need of structural repairs could become sources of infiltration or emergency collapses if the defect is not repaired. As degradation occurs these defects could lead to infiltration entering the sewer system at these structural defects.

The CEA identified:

- 76,071 gpd of excessive removable peak design storm inflow and 2,160 gpd of excessive removable indirect inflow at an estimated rehabilitation cost of $86,000. The associated T&T cost is $1,110,880.
- 0 gpd of non-excessive removable indirect inflow at an estimated rehabilitation cost of $200.

The above figures total approximately 78,231 gpd of removable I/I that is excessive or recommended at an estimated rehabilitation cost of $86,200. Approximately $82,700 of the rehabilitation work is located on private property, as shown in Table 3.

Peak design storm inflow is calculated for the direct inflow sources identified during this investigation using the Rational Formula for runoff. A calculation is attached in Appendix C for reference.

Summary, Conclusions & Recommendations

Weston & Sampson performed smoke and dye testing in sewer subareas GG, KK, LL, OO, QQ, RR, and SS to identify sources of inflow to the sanitary sewer system. These areas had high quantities of inflow based on the data from the 2011 Town-Wide Flow Monitoring Program. Smoke and dye testing of approximately 148,000 lf of sewers were completed in these areas.

The following is a summary of our recommendations for removing the sources of I/I identified through smoke testing:

Install six cleanout caps:	$ 1,200
Install five manhole inflow dishes:	$ 1,000

Install two watertight frames and covers:	$ 2,500
Redirect two Catch Basins:	$ 30,000
Redirect five Driveway Drains:	$ 37,500
Replace two service connections (open cut):	$ 14,000
Total Estimated Construction Cost:	$ 86,200
Contingency (approximately 25% of construction):	$ 21,550
Total Estimated Cost:	***$107,750***

Approximately 2,321,106 gpd of peak design storm inflow was estimated in the 2012 Annual Program draft report for the seven subareas investigated in this project. A total of 78,231 gpd of peak design storm inflow was identified during smoke testing. This accounts for approximately 3.4% of the estimated peak design storm inflow. There is a large portion of inflow that is entering the sewer system that was not accounted for during this project. It is recommended that the town attempt to identify this excessive inflow by investigating potential private inflow sources through building inspections. Building inspections are an effective way to identify private inflow sources. However, a Private Inflow Removal Policy should be adopted by the town prior to performing building inspections.

A Private Inflow Removal Policy should be established to address the repair of defects which are located on private property and the identification of new private inflow sources. Inflow removal on private property can be a challenging task for communities seeking to reduce wet weather flows. Working with homeowners can be difficult and presents complex liability issues that may be undesirable for the town to undertake. Our experience has shown that a combination of town support, either through amnesty or financial programs (incentive or reimbursement), public education, and follow-up is essential to a successful Private Inflow Removal program.

Weston & Sampson can provide suggestions for components of a Private Inflow Removal Policy. The Town of Dedham will need to determine which components will garner the most success based on political climate, financial capabilities and accepting private inflow discharges. We are available to meet with the town to discuss those options and assist in developing a policy to be adopted.

It is recommended that smoke testing be continued in the following subareas: AA, BB, CC, DD, EE, FF, MM, UU, VV, XX, YY, and ZZ. These subareas represent approximately 192,700 lf of sewer lines and have an estimated peak design storm inflow of 1,688,000 gpd based on 2011 Town-Wide Flow Monitoring Report. The projected cost for smoke testing is $117,000.

We wish to thank you and the members of the Engineering Department staff for their assistance while completing this project. We are available to meet with you at your earliest convenience to discuss this report. Please do not hesitate to contact me at (978) 532-1900 with any questions or comments you may have.

Very truly yours,

WESTON & SAMPSON

Donald G. Gallucci, P.E.
Program Manager

cc: Ronald Lawrence, Project Engineer
Deborah A. Finnigan, P.E., Infrastructure Engineer

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FIGURES

2013 YEAR ONE INFLOW INVESTIGATION

Subarea Smoke Tested

SEWER SUBAREA SUMMARY

Subarea	Linear Feet	Inch Miles	Estimated Manholes
AA	17,171	28.22	114
BB	9,054	14.11	60
CC	10,987	16.98	73
DD	20,729	32.51	138
EE	14,356	23.62	96
FF	21,712	34.28	145
GG	26,768	44.77	178
HH	29,903	48.94	199
II	29,755	45.76	198
JJ	23,997	62.48	160
KK	15,044	22.77	100
LL	17,000	25.14	113
MM	17,930	28.40	120
NN	11,412	17.97	76
OO	25,824	52.77	172
PP	20,730	35.66	138
QQ	12,163	20.75	81
RR	19,376	29.72	129
SS	31,471	51.80	210
TT	18,030	28.29	120
UU	17,642	29.64	118
VV	13,804	24.16	92
WW	21,666	37.76	144
XX	16,279	25.02	109
YY	16,092	26.02	107
ZZ	16,911	24.69	113
TOTAL	**495,806**	**832.23**	**3,305**

Legend

- Temporary Flow Meter
- MWRA Meter

BasinID: AA, BB, CC, DD, EE, FF, GG, HH, II, JJ, KK, LL, MM, NN, OO, PP, QQ, RR, SS, TT, UU, VV, WW, XX, YY, ZZ

- MWRA Sewer Pipe

FIGURE 1

TOWN OF DEDHAM, MASSACHUSETTS
2013 YEAR ONE INFLOW INVESTIGATION

SEWER SYSTEM

JULY, 2012 SCALE: NOTED

Weston&Sampson®

TABLES

TABLE 1
SMOKE AND DYE TESTING RESULTS
Dedham, Massachusetts - Year One Inflow Investigations

Location	Subarea	Defect No.	Description of Defect	Source Location (Public/Private)	Smoke Test Result			Dye Test/Flood Result	Inflow		Recommendation
					Heavy	Light	None		Peak Design Storm Inflow (GPD)	Peak Indirect Inflow (GPD)[1]	
99 Wildwood Drive	OO	1	Defective Cleanout Cap (at grade)	Private		x		No Dye Test Performed, Visual Confirmation	98	0	Replace Cleanout Cap at 99 Wildwood Drive
211 Central Avenue	OO	2	Defective Cleanout Cap (above grade)	Private		x		No Dye Test Performed, Visual Confirmation	0	0	Replace Cleanout Cap at 211 Central Avenue
76 Sanderson Avenue	RR	3	Manhole RR-120 - Holes in Cover	Public		x		No Dye Test Performed, Visual Confirmation	587	0	Install Inflow Dish for SMH RR-120
18 Sanderson Avenue	RR	4	Manhole RR-90 - Holes in Cover	Public		x		No Dye Test Performed, Visual Confirmation	1,762	0	Install Inflow Dish for SMH RR-121
82 Pratt Avenue	RR	5	Sump hole in basement floor - Suspected Open Cleanout Cap (below grade)	Private	x			No Dye Test Performed, Visual Confirmation	11,980	0	Install Cleanout Cap at 82 Pratt Avenue
73 Dale Street	RR	6	Open Cleanout Cap (below grade)	Private	x			No Dye Test Performed, Visual Confirmation	15,621	0	Install Cleanout Cap at 73 Dale Street
31 Cedar Street	RR	7	Open Cleanout Cap (below grade)	Private	x			No Dye Test Performed, Visual Confirmation	4,005	0	Install Cleanout Cap at 31 Cedar Street
39 Winthrop Street	RR	8	Manhole RR-400 - Hole in Cover	Public		x		No Dye Test Performed, Visual Confirmation	294	0	Install Inflow Dish for SMH RR-400
140 Ashcroft Street	QQ	9	Manhole QQ-500 - Holes in Cover	Public	x			No Dye Test Performed, Visual Confirmation	587	0	Install Inflow DIsh for SMH QQ-500
71 Quincy Avenue	QQ	10	Driveway Drain	Private	x			Dye Observed in SMH QQ-380	8,785	0	Block Outgoing PVC only
75 Quincy Avenue	QQ	11	Indirect Driveway Drain	Private	x			Negative	0	1,440	
31 Flanagan Place	QQ	12	Indirect Catch Basin	Public		x		Negative	0	1,440	
6 Liberty Street	LL	13	Broken service connection	Private	x			N/A	0	720	
61 Bussey Street	LL	14	Broken service connection	Private	x			N/A	0	720	
157 Robert Road	GG	15	Driveway Drain	Private	x			Dye Observed in SMH GG-510	10,336	0	Redirect Driveway Drain at 157 Robert Road
100 Robert Road	GG	16	Outfall with Light Smoke	Public		x		Negatiuve	0	0	
1 Newcourt Lane	GG	17	Catch Basin directly connected to sewer	Private	x			Dye Observed in SMH GG-1370 and SMH GG-1380	7,611	0	Redirect Catch Basin from SMH GG-1380
1 Newcourt Lane	GG	18	Catch Basin directly connected to sewer	Private		x		Dye Observed in SMH GG-1370 and SMH GG-1381	4,228	0	Redirect Catch Basin from SMH GG-1380
27 Highland Street	GG	19	Catch Basin Smoking from Brick Walls	Public	x			Negative	0	0	
832 High Street	GG	20	Manhole GG-170 with loose frame and holes in cover	Public	x			No Dye Test Performed, Visual Confirmation	0	1,440	Install Watertight Frame and Cover for SMH GG-170
832 High Street	GG	21	Manhole GG-160 with loose frame and holes in cover	Public	x			No Dye Test Performed, Visual Confirmation	0	1,440	Install Watertight Frame and Cover for SMH GG-160
57 Leonard Street	KK	22	Driveway Drain	Private	x			Dye Observed in SMH KK-500	2,854	0	Redirect Driveway Drain at 57 Leonard Street
38 Leonard Street	KK	23	Driveway Drain	Private	x			Dye Observed in SMH KK-490	3,065	0	Redirect Driveway Drain at 38 Leonard Street
81 Berlin Street	KK	24	Driveway Drain	Private	x			Dye Observed in SMH KK-540	2,960	0	Redirect Driveway Drain at 81 Berlin Street
55 Thomas Street	KK	25	Open Cleanout Cap (below grade)	Private	x			No Dye Test Performed, Visual Confirmation	98	0	Install Cleanout Cap at 55 Thomas Street
99 Ware Street	KK	26	MWRA Drain Manhole with Holes in Cover	Public		x		N/A	0	0	
1 Newcourt Lane	GG	27	Catch Basin directly connected to sewer	Private			x	Dye Observed in SMH GG-1370 and SMH GG-1380	600	0	Redirect Catch Basin from SMH GG -1380
163 Central Avenue	OO	Suspect 1	Driveway Drain	Private			x	Negative	0	0	
155 Central Avenue	OO	Suspect 2	Driveway Drain	Private			x	Negative	0	0	
34 Arrowhead Lane	OO	Suspect 3	Driveway Drain	Private			x	Negative	0	0	
142 West Jersey Street	OO	Suspect 4	Driveway Drain	Private			x	Negative	0	0	
146 West Jersey Street	OO	Suspect 5	Driveway Drain	Private			x	Negative	0	0	
148 Fairbanks Road	OO	Suspect 6	Driveway Drain	Private			x	Negative	0	0	
32 Mckinley Avenue	OO	Suspect 7	Driveway Drain	Private			x	Negative	0	0	
65 Wentworth Street	OO	Suspect 8	Driveway Drain	Private			x	Negative	0	0	
18 Durant Avenue	OO	Suspect 9	Catch Basin in grass along Durant Avenue.	Private			x	Negative	0	0	
Monroe Street at East Street	SS	Suspect 10	Catch Basin with hood	Public			x	Negative	0	0	
709 East Street	SS	Suspect 11	Driveway Drain	Private			x	Negative	0	0	
23 Ford Street	SS	Suspect 12	Driveway Drain	Private			x	Negative	0	0	
24 Ford Street	SS	Suspect 13	Driveway Drain	Private			x	Negative	0	0	
799 East Street	SS	Suspect 14	Driveway Drain	Private			x	Negative	0	0	
127 Jefferson Street	SS	Suspect 15	Driveway Drain	Private			x	Negative	0	0	
92 Dartmouth Avenue	RR	Suspect 16	Roof Leader	Private			x	Negative	0	0	
17 Cedar Street	RR	Suspect 17	Roof Leader (1)	Private			x	Negative	0	0	
17 Cedar Street	RR	Suspect 18	Roof Leader (2)	Private			x	Negative	0	0	
22 Dartmouth Avenue	RR	Suspect 19	Driveway Drain	Private			x	Negative	0	0	
86 Lincoln Street	RR	Suspect 20	Catch Basin with hood (1)	Public			x	Negative	0	0	
86 Lincoln Street	RR	Suspect 21	Catch Basin with hood (2)	Public			x	Negative	0	0	
14 Russell Road	RR	Suspect 22	Driveway Drain	Private			x	Negative	0	0	
48 Reed Street	RR	Suspect 23	Roof Leader	Private			x	Negative	0	0	
18 Wood Road	SS	Suspect 24	Driveway Drain	Private			x	Negative	0	0	
6 Fairvew Street	QQ	Suspect 25	Roof Leader	Private			x	Negative	0	0	
408 Whiting Avenue	QQ	Suspect 26	Catch Basin with hood (1)	Public			x	Negative	0	0	
408 Whiting Avenue	QQ	Suspect 27	Catch Basin with hood (2)	Public			x	Negative	0	0	
408 Whiting Avenue	QQ	Suspect 28	Catch Basin with hood (3)	Public			x	Negative	0	0	
171 Milton Street	QQ	Suspect 29	Service Manhole with one Vent Hole	Public			x	No Dye Test Performed, Visual Confirmation	600	0	Install Inflow Dish
41 Paradise Lane	QQ	Suspect 30	Cast Iron Roof Leader	Private			x	Negative	0	0	
11 Russel Road	LL	Suspect 31	Driveway Drain (1)	Private			x	Negative	0	0	
11 Russel Road	LL	Suspect 32	Driveway Drain (2)	Private			x	Negative	0	0	

TABLE 1
SMOKE AND DYE TESTING RESULTS
Dedham, Massachusetts - Year One Inflow Investigations

Location	Subarea	Defect No.	Description of Defect	Source Location (Public/Private)	Smoke Test Result			Dye Test/Flood Result	Inflow		Recommendation
					Heavy	Light	None		Peak Design Storm Inflow (GPD)	Peak Indirect Inflow (GPD)[1]	
58 Thomas Street	LL	Suspect 33	Roof Leader	Private			x	Negative	0	0	
60 Thomas Street	LL	Suspect 34	Driveway Drain	Private			x	Negative	0	0	
45 Congress Place	LL	Suspect 35	Driveway Drain	Private			x	Negative	0	0	
26 Oakland Street	LL	Suspect 36	Driveway Drain	Private			x	Negative	0	0	
29 Birch Street	LL	Suspect 37	Driveway Drain	Private			x	Negative	0	0	
33 Fleming Street	LL	Suspect 38	Driveway Drain with Hood	Private			x	Negative	0	0	
128 Booth Road	GG	Suspect 39	Roof Leader	Private			x	Negative	0	0	
21 Booth Road	GG	Suspect 40	Driveway Drain	Private			x	Negative	0	0	
103 Court Street	GG	Suspect 41	Driveway Drain	Private			x	Negative	0	0	
20 Highland Street	GG	Suspect 42	Driveway Drain	Private			x	Negative	0	0	
50 Martin Bates Road	GG	Suspect 43	Roof Leader	Private			x	Negative	0	0	
42 Martin Bates Road	GG	Suspect 44	Roof Leader	Private			x	Negative	0	0	
69 Common Street	GG	Suspect 45	Driveway Drain	Private			x	Negative	0	0	
119 Harding Terrace	KK	Suspect 46	Driveway Drain	Private			x	Negative	0	0	
75 Berlin Street	KK	Suspect 47	Driveway Drain	Private			x	Negative	0	0	
112 Whitehall Street	KK	Suspect 48	Driveway Drain	Private			x	Negative	0	0	
11 Cleveland Street	KK	Suspect 49	Driveway Drain (1)	Private			x	Negative	0	0	
11 Cleveland Street	KK	Suspect 50	Driveway Drain (2)	Private			x	Negative	0	0	
49 Whitehall Street	KK	Suspect 51	Driveway Drain	Private			x	Negative	0	0	
								Total Public	**3,830**	**4,320**	
								Total Private	**72,241**	**2,880**	
								Total	**76,071**	**7,200**	

NOTE: **1** - Indirect Inflow is assumed to be at least 720 GPD for lateral defects, 1,440 GPD for manhole defects and 2,880 GPD for mainline defects.

TABLE 2
BUILDINGS WITH NO SMOKE FROM SEWER VENT
Dedham, Massachusetts - Year One Inflow Investigations

Subarea	House No.	Street Name
GG	92	Booth Road
GG	74	Booth Road
GG	21	Booth Road
GG	225	Court Street
GG	120	Court Street
GG	27	Martin Bates Street
GG	1133	High Street
GG	1123	High Street
GG	235	Lowder Street
GG	1061	High Street
GG	1031	High Street
KK	133	Harding Terrace
KK	103	Greenhood Street
KK	182	Harding Terrace
KK	94	Dedham Boulevard
KK	100	Dedham Boulevard
LL	61	Veterans Road
LL	67	Veterans Road
LL	21	Hanson Street
LL	11	Hanson Street
LL	5	Hanson Street
LL	17	Rowan Street
LL	20	Fleming Street
LL	33	Fleming Street
LL	25	Fleming Street
LL	182	Colburn Street
LL	173	Colburn Street
LL	83	Thomas Street
LL	78	Thomas Street
LL	63	Clisby Avenue
LL	70	Clisby Avenue
LL	54	Clisby Avenue
LL	45	Congress Place
LL	55	Sherwood Street
LL	77	Leonard Avenue
LL	75	Leonard Avenue
LL	71	Emmet Avenue
LL	83	Emmet Avenue
LL	31	Lewis Lane
LL	162	Dedham Boulevard
LL	115	Rockland Street
LL	99	Bussey Street
LL	21	Clisby Avenue
LL	21	Congress Place
OO	535	East Street
OO	11	Puritan Lane
OO	45	Ice House Lane
OO	37	Ice House Lane
OO	112	Wentworth Street
OO	75	Mckinley Avenue
OO	343	Mckinley Avenue
OO	287	Madison Street
OO	18	Drayton Road

TABLE 2
BUILDINGS WITH NO SMOKE FROM SEWER VENT
Dedham, Massachusetts - Year One Inflow Investigations

Subarea	House No.	Street Name
QQ	374	Whiting Avenue
QQ	15	Atkins Street
QQ	11	River Street
QQ	15	River Street
QQ	42	Ashcroft Street
QQ	50	Ashcroft Street
QQ	94	Quincy Avenue
QQ	442	Whiting Avenue Extension
QQ	21	River Street
QQ	25	River Street
RR	60	Sanderson Avenue
RR	133	Quincy Avenue
RR	47	Dale Street
RR	105	Oakdale Avenue
RR	37	Border Street
RR	30	Benjamin Street
RR	99	Dale Street
RR	98	Dale Street
RR	62	Cedar Sreet
RR	63	Lincoln Street
RR	48	Winthrop Street
RR	6	Prevett Terrace
RR	147	Oakdale Avenue
RR	130	Dale Street
RR	178	Dale Street
RR	39	Border Street
RR	41	Border Street
RR	65	Reed Street
SS	36	Dresser Avenue
SS	23	Dresser Avenue
SS	138	Sprague Street
SS	390	Sprague Street
SS	870	East Street
SS	878	East Street
SS	885	East Street
SS	709	East Street
SS	188	Madison Street
SS	154	Adams Street
SS	208	Adams Street
SS	58	Hamilton Avenue
SS	31	Rustcraft Road
SS	146	Jefferson Street
SS	120	Jefferson Street
SS	112	Jefferson Street
SS	85	Grant Avenue
SS	86	Madison Street
SS	112	Adams Street *
SS	210	Jefferson Street
SS	178	Jefferson Street
SS	146	Jefferson Street
SS	28	Netta Road
Total Buildings	**104**	

* Secondary vent smoking, Primary vent no smoke.

TABLE 3
MWRA COST EFFECTIVENESS ANALYSIS FOR I/I SOURCES
Dedham, Massachusetts - Year One Inflow Investigations

Location	Subarea	Defect No.	Description of Defect	Source Location (Public/Private)	Direct Inflow	Indirect Inflow		MWRA T&T Cost	Recommended Rehabilitation	Rehabilitation Cost	Conclusion
					Peak Design Storm Inflow (GPD)	Peak Indirect Inflow (GPD)[1]	Removable Peak Indirect Inflow (GPD)				
99 Wildwood Drive	OO	1	Defective Cleanout Cap (at grade)	Private	98	0	0	$1,392	Install Cleanout Cap at 99 Wildwood Drive	$200	Excessive
211 Central Avenue	OO	2	Defective Cleanout Cap (above grade)	Private	0	0	0	$0	Install Cleanout Cap at 211 Central Avenue	$200	Non-Excessive
76 Sanderson Avenue	RR	3	Manhole RR-120 - Holes in Cover	Public	587	0	0	$8,335	Install Inflow Dish	$200	Excessive
18 Sanderson Avenue	RR	4	Manhole RR-90 - Holes in Cover	Public	1,762	0	0	$25,020	Install Inflow Dish	$200	Excessive
82 Pratt Avenue	RR	5	Sump hole in basement floor - Suspected Open Cleanout Cap (below grade)	Private	11,980	0	0	$170,116	Install Cleanout Cap at 82 Pratt Avenue	$200	Excessive
73 Dale Street	RR	6	Open Cleanout Cap (below grade)	Private	15,621	0	0	$221,818	Install Cleanout Cap at 73 Dale Street	$200	Excessive
31 Cedar Street	RR	7	Open Cleanout Cap (below grade)	Private	4,005	0	0	$56,871	Install Cleanout Cap at 31 Cedar Street	$200	Excessive
39 Winthrop Street	RR	8	Manhole RR-400 - Hole in Cover	Public	294	0	0	$4,175	Install Inflow Dish	$200	Excessive
140 Ashcroft Street	QQ	9	Manhole QQ-500 - Holes in Cover	Public	587	0	0	$8,335	Install Inflow Dish	$200	Excessive
71 Quincy Avenue	QQ	10	Driveway Drain	Private	8,785	0	0	$124,747	Redirect Driveway Drain at 71 Quincy Avenue	$7,500	Excessive
6 Liberty Street	LL	13	Broken service connection	Private	0	720	360	$10,224	Open Cut Point Repair (Station Unknown / TV Required)	$7,000	Excessive
61 Bussey Street	LL	14	Broken service connection	Private	0	720	360	$10,224	Open Cut Point Repair (Station Unknown / TV Required)	$7,000	Excessive
157 Robert Road	GG	15	Driveway Drain	Private	10,336	0	0	$146,771	Redirect Driveway Drain at 157 Robert Road	$7,500	Excessive
1 Newcourt Lane	GG	17	Catch Basin directly connected to sewer	Private	7,611	0	0	$108,076	Redirect Catch Basin from SMH GG-1380	$15,000	Excessive
1 Newcourt Lane	GG	18	Catch Basin directly connected to sewer	Private	4,228	0	0	$60,038	Cost included in Defect 17 Rehabilitation	$0	Excessive
832 High Street	GG	20	Manhole GG-170 with loose frame and holes in cover	Public	0	1,440	720	$20,448	Install Watertight Frame and Cover for SMH GG-170	$1,250	Excessive
832 High Street	GG	21	Manhole GG-160 with loose frame and holes in cover	Public	0	1,440	720	$20,448	Install Watertight Frame and Cover for SMH GG-160	$1,250	Excessive
57 Leonard Street	KK	22	Driveway Drain	Private	2,854	0	0	$40,527	Redirect Driveway Drain at 57 Leonard Street	$7,500	Excessive
38 Leonard Street	KK	23	Driveway Drain	Private	3,065	0	0	$43,523	Redirect Driveway Drain at 38 Leonard Street	$7,500	Excessive
81 Berlin Street	KK	24	Driveway Drain	Private	2,960	0	0	$42,032	Redirect Driveway Drain at 81 Berlin Street	$7,500	Excessive
55 Thomas Street	KK	25	Open Cleanout Cap (below grade)	Private	98	0	0	$1,392	Install Cleanout Cap at 55 Thomas Street	$200	Excessive
99 Ware Street	KK	26	MWRA Drain Manhole with Holes in Cover	Public	0	0	0	$0	No Rehabilitation Required	$0	N/A
1 Newcourt Lane	GG	27	Catch Basin directly connected to sewer	Private	600	0	0	$8,520	Redirect Catch Basin from SMH GG-1380	$15,000	Excessive
171 Milton Street	QQ	Suspect 25	Service Manhole with one Vent Hole	Public	600	0	0	$8,520	Install Inflow Dish	$200	Excessive
			Total Excessive Public:		**3,830**	**2,880**	**1,440**	**$95,282**	**Total Excessive Public:**	**$3,500**	
			Total Non-Excessive Recommended Public:		**0**	**0**	**0**	**$0**	**Total Non-Excessive Recommended Public:**	**$0**	
			Total Non-Excessive Public:		**0**	**0**	**0**	**$0**	**Total Non-Excessive Public:**	**$0**	
			Total Excessive Private:		**72,241**	**1,440**	**720**	**$1,046,270**	**Total Excessive Private:**	**$82,500**	
			Total Non-Excessive Recommended Private:		**0**	**0**	**0**	**$0**	**Total Non-Excessive Recommended Private:**	**$0**	
			Total Non-Excessive Private:		**0**	**0**	**0**	**$0**	**Total Non-Excessive Private:**	**$200**	
			Total:		**76,071**	**4,320**	**2,160**	**$1,141,552**			
			Total Removable:		**76,071**	**N/A**	**2,160**	**$1,110,880**	**Total:**	**$86,200**	

NOTE: 1 - Indirect Inflow is assumed to be at least 720 GPD for lateral defects, 1,440 GPD for manhole defects and 2,880 GPD for mainline defects.

APPENDIX A

SMOKE TESTING DEFECT LOGS

SMOKE TESTING DEFECT PHOTOS

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson
DATE: 09/09/13
DEFECT: 1 thru 1

OWNER: Town of Dedham
SKETCH NO.: 1
MAP NO.: OO

PROJECT: Fall 2013 Smoke Testing
CREW: PMC, MJD, JC

LOCATION: 99 Wildwood Drive

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
1	Defective Cleanout Cap	5' x 5'	Grass			X	1

SKETCH:

DEFECT SOURCE ○
DRAINAGE AREA


Weston&Sampson
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
01

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson
DATE: 09/09/13
DEFECT: 2 thru 2

OWNER: Town of Dedham
SKETCH NO.: 2
MAP NO.: OO

PROJECT: Fall 2013 Smoke Testing
CREW: PMC, MJD, JC

LOCATION: 211 Central Avenue

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
2	Defective Cleanout Cap	0	Above Grade			X	2

SKETCH:

DEFECT SOURCE ○
DRAINAGE AREA


211
Weston&Sampson
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
0 2

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson
DATE: 09/12/13
DEFECT: 3 thru 3
OWNER: Town of Dedham
SKETCH NO.: 3
MAP NO.: RR
PROJECT: Fall 2013 Smoke Testing
CREW: PMC, MJD, JC
LOCATION: 76 Sanderson Avenue

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
3	MH RR-120 - Holes in Cover	10' x 5'	Asphalt			X	3

SKETCH:

DEFECT SOURCE ○
DRAINAGE AREA ■

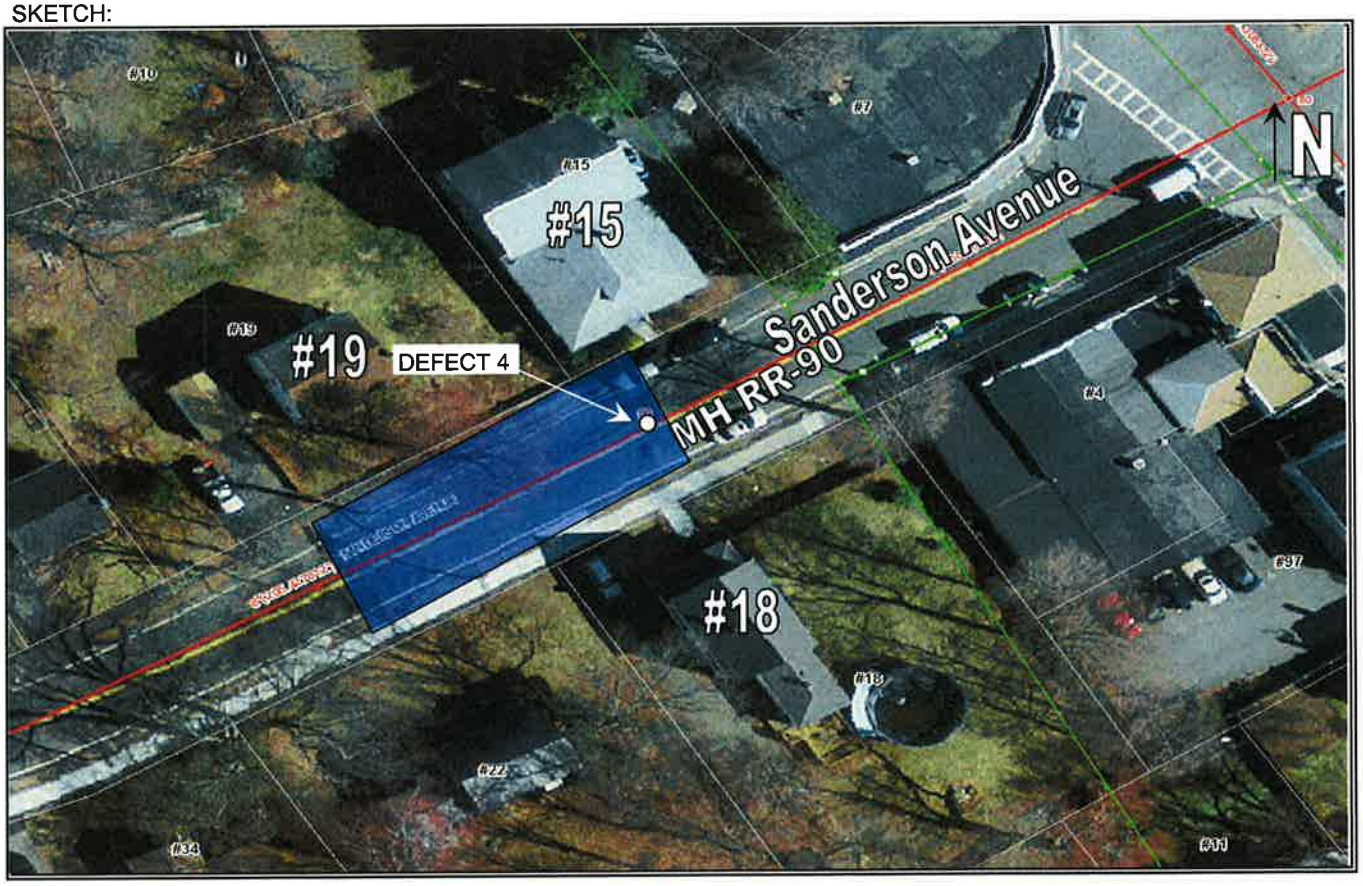

Weston&Sampson
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
0 3
SEWER

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson
DATE: 09/12/13
DEFECT: 4 thru 4
OWNER: Town of Dedham
SKETCH NO.: 4
MAP NO.: RR
PROJECT: Fall 2013 Smoke Testing
CREW: PMC, MJD, JC
LOCATION: 18 Sanderson Avenue

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
4	MH RR-90 - Holes in Cover	30' x 5'	Asphalt			X	4

SKETCH:



DEFECT SOURCE ○
DRAINAGE AREA ■


Weston&Sampson
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
04

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson
DATE: 09/16/13
DEFECT: 5 thru 5
OWNER: Town of Dedham
SKETCH NO.: 5
MAP NO.: RR
PROJECT: Fall 2013 Smoke Testing
CREW: NEM, MJD, JC
LOCATION: 82 Pratt Avenue

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
5	Sump hole in basement floor with suspected open cleanout below grade covered with crushed stone.	1020	Concrete		X		5

SKETCH:

DEFECT SOURCE ○
DRAINAGE AREA ■

DEFECT 5


Sump hole in basement floor with suspected open cleanout below grade covered with crushed stone.

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson | DATE: 09/16/13 | DEFECT: 6 thru 6

OWNER: Town of Dedham | SKETCH NO.: 6 | MAP NO.: RR

PROJECT: Fall 2013 Smoke Testing | CREW: NEM, MJD, JC

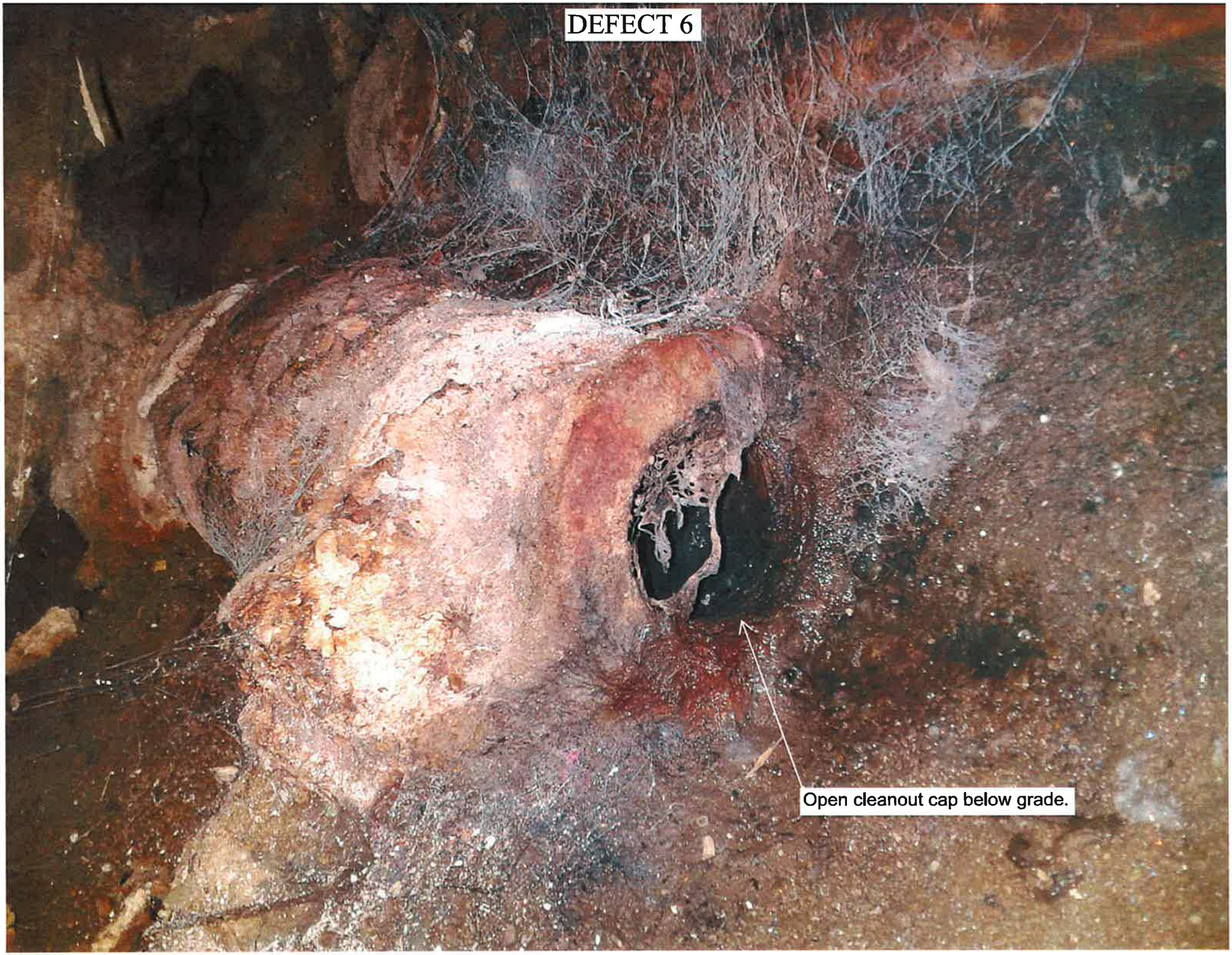
LOCATION: 73 Dale Street

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
6	Open cleanout cap below grade.	1,330	Concrete		X		6

SKETCH:

DEFECT SOURCE ○

DRAINAGE AREA ■


DEFECT 6
Open cleanout cap below grade.

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson
DATE: 09/16/13
DEFECT: 7 thru 7

OWNER: Town of Dedham
SKETCH NO.: 7
MAP NO.: RR

PROJECT: Fall 2013 Smoke Testing
CREW: NEM, MJD, JC

LOCATION: 31 Cedar Street

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
7	Open cleanout cap below grade found by Ron Lawrence. No photo taken.	340	Concrete		X		-

SKETCH:

DEFECT SOURCE ○
DRAINAGE AREA

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson | DATE: 09/17/13 | DEFECT: 8 thru 8

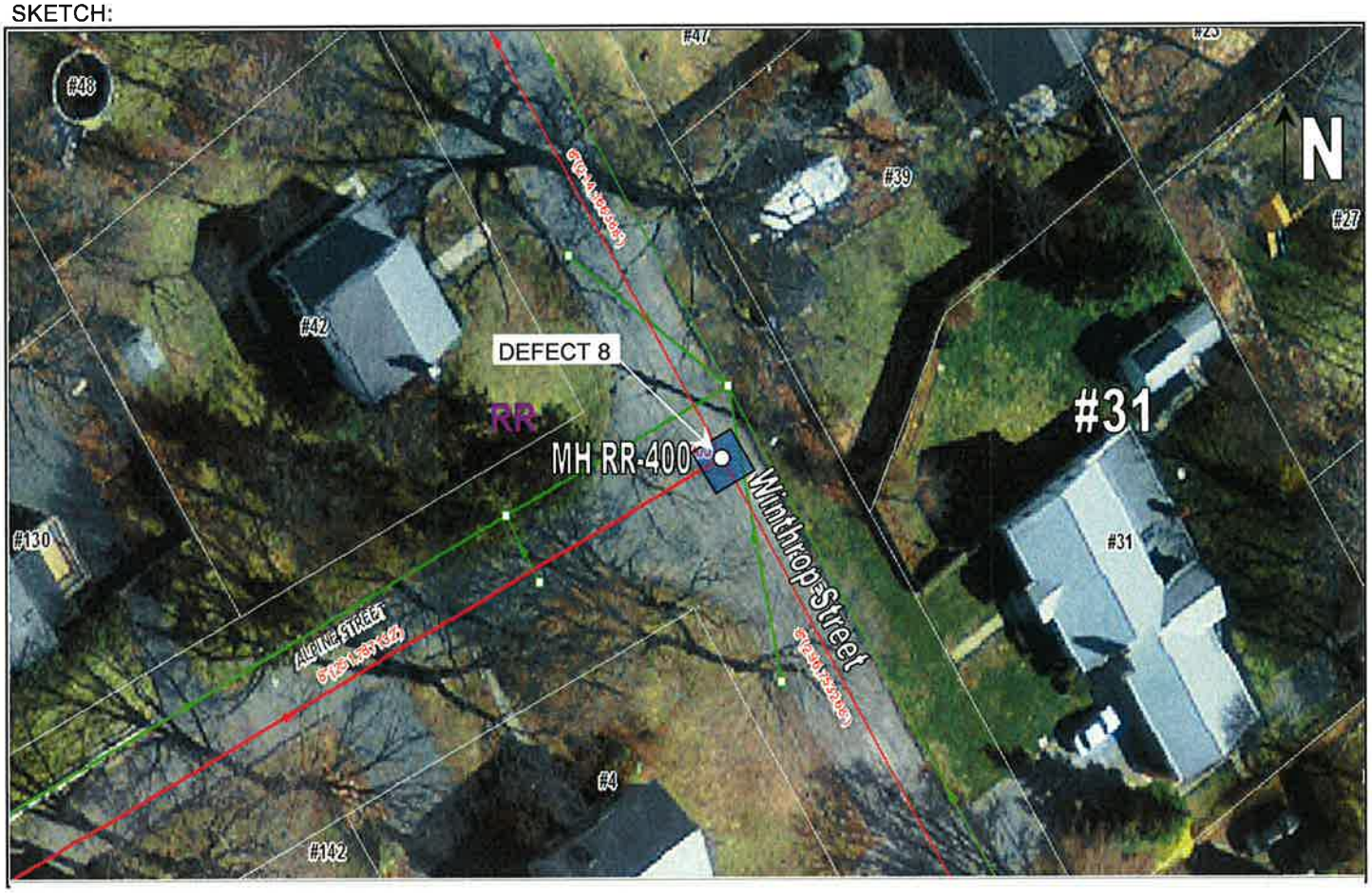
OWNER: Town of Dedham | SKETCH NO.: 8 | MAP NO.: RR

PROJECT: Fall 2013 Smoke Testing | CREW: NEM, MJD, JC

LOCATION: Winthrop Street

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
8	Manhole RR-400 with one vent hole.	25	Asphalt			X	8, 8A

SKETCH:



DEFECT SOURCE ○

DRAINAGE AREA


Weston&Sampson
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
0 8


08
1902

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson | DATE: 09/17/13 | DEFECT: 9 thru 9

OWNER: Town of Dedham | SKETCH NO.: 9 | MAP NO.: QQ

PROJECT: Fall 2013 Smoke Testing | CREW: NEM, MJD, JC

LOCATION: Ashcroft Street

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
9	Manhole QQ-500 with vent holes.	50	Asphalt			X	9

SKETCH:

DEFECT SOURCE ○
DRAINAGE AREA ■


Weston&Sampson
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
0 9

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson
DATE: 09/18/13
DEFECT: 10 thru 11
OWNER: Town of Dedham
SKETCH NO.: 10
MAP NO.: QQ
PROJECT: Fall 2013 Smoke Testing
CREW: NEM, MJD, JC
LOCATION: Quincy Avenue

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
10	Driveway Drain.	748	Asphalt	X			10
11	Driveway Drain.	2381	Asphalt	X			11

SKETCH:

DEFECT SOURCE ○
DRAINAGE AREA ■


Weston&Sampson
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
10


Weston&Sampson
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
1 1

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson | DATE: 09/18/13 | DEFECT: 12 thru 12

OWNER: Town of Dedham | SKETCH NO.: 11 | MAP NO.: QQ

PROJECT: Fall 2013 Smoke Testing | CREW: NEM, MJD, JC

LOCATION: 31 Flanagan Place

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
12	Indirect Public Catch Basin - 6" service connection between end manhole and 28 Flanagan Place.	925	Asphalt	X			12

SKETCH:

DEFECT SOURCE ○
DRAINAGE AREA ■


Weston&Sampson
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
1 2

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson
DATE: 09/19/13
DEFECT: 13 thru 13
OWNER: Town of Dedham
SKETCH NO.: 12
MAP NO.: LL
PROJECT: Fall 2013 Smoke Testing
CREW: NEM, MJD, JC
LOCATION: 6 Liberty Street

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
13	Broken Service Connection.	100	Grass		X		13

SKETCH:

DEFECT SOURCE ○
DRAINAGE AREA ■


Weston&Sampson
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
1 3

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson
DATE: 09/19/13
DEFECT: 14 thru 14
OWNER: Town of Dedham
SKETCH NO.: 13
MAP NO.: LL
PROJECT: Fall 2013 Smoke Testing
CREW: NEM, MJD, JC
LOCATION: 61 Bussey Street

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
14	Broken Service Connection.	576	Asphalt		X		14

SKETCH:

DEFECT SOURCE ○
DRAINAGE AREA ■


Weston&Sampson
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
14

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson | DATE: 09/20/13 | DEFECT: 15 thru 15

OWNER: Town of Dedham | SKETCH NO.: 14 | MAP NO.: GG

PROJECT: Fall 2013 Smoke Testing | CREW: LD, MJD, JC

LOCATION: 157 Robert Road

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
15	Driveway Drain with Sump Pump.	880	Asphalt	X			15

SKETCH:

DEFECT SOURCE ○
DRAINAGE AREA ■


Weston&Sampson
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
15

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson | DATE: 09/20/13 | DEFECT: 16 thru 16

OWNER: Town of Dedham | SKETCH NO.: 15 | MAP NO.: GG

PROJECT: Fall 2013 Smoke Testing | CREW: LD, MJD, JC

LOCATION: 100 Robert Road

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
16	Drainage Outfall with light smoke.	0	Grass			X	16

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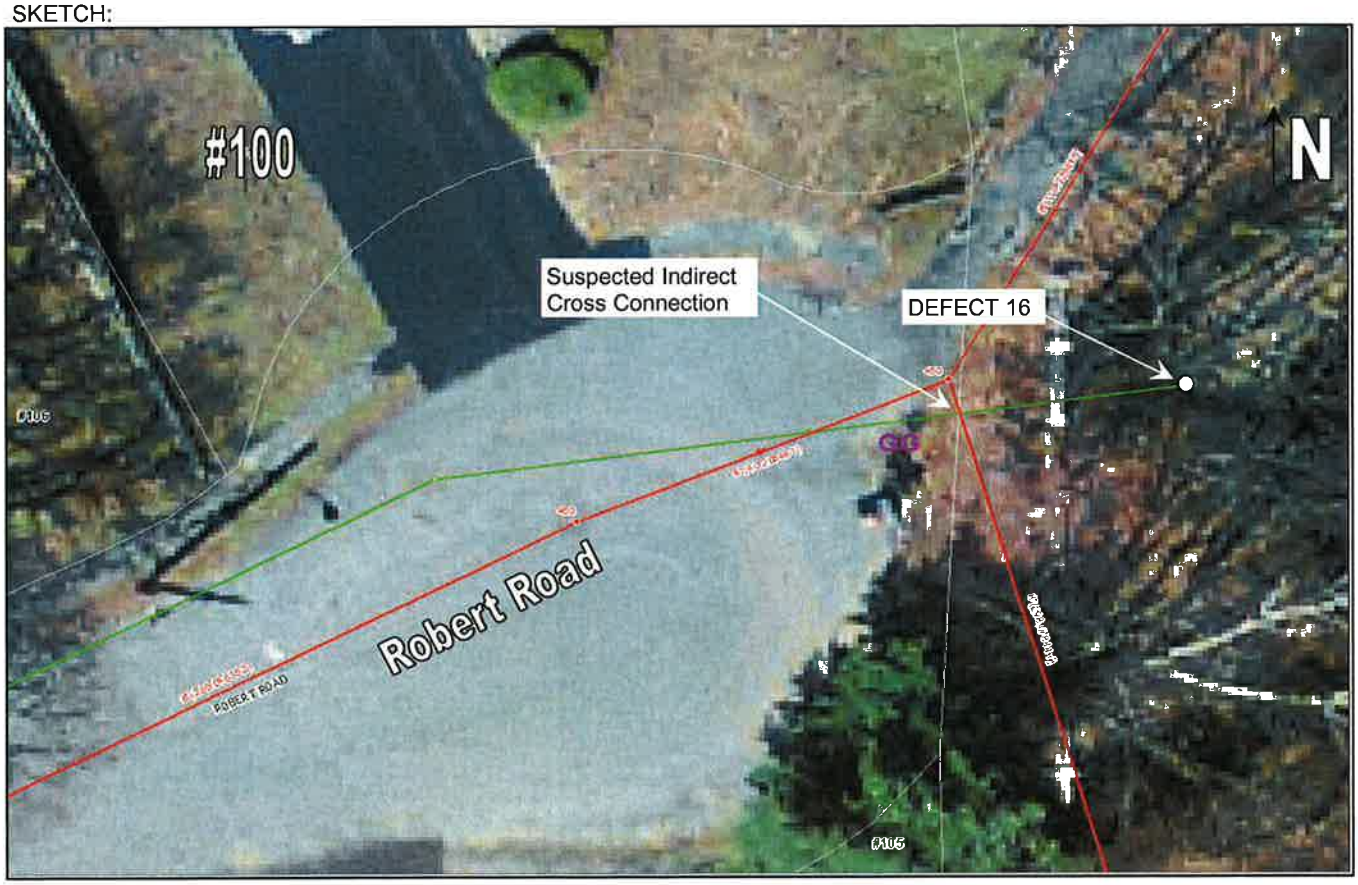

DEFECT SOURCE ○

DRAINAGE AREA

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson | DATE: 09/20/13 | DEFECT: 17 thru 18,27

OWNER: Town of Dedham | SKETCH NO.: 16 | MAP NO.: GG

PROJECT: Fall 2013 Smoke Testing | CREW: LD, MJD, JC

LOCATION: 1 Newcourt Lane

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
17	Catch Basin directly connected to sewer 5.5' deep by 4' wide to invert of overflow pipe.	648	Asphalt	X			17,17A
18	Catch Basin directly connected to sewer 5.5' deep by 4' wide to invert of overflow pipe.	360	Asphalt	X			18
27	Catch Basin directly connected to sewer 5.5' deep by 4' wide to invert of overflow pipe. (No Photo)	600	Asphalt	X			

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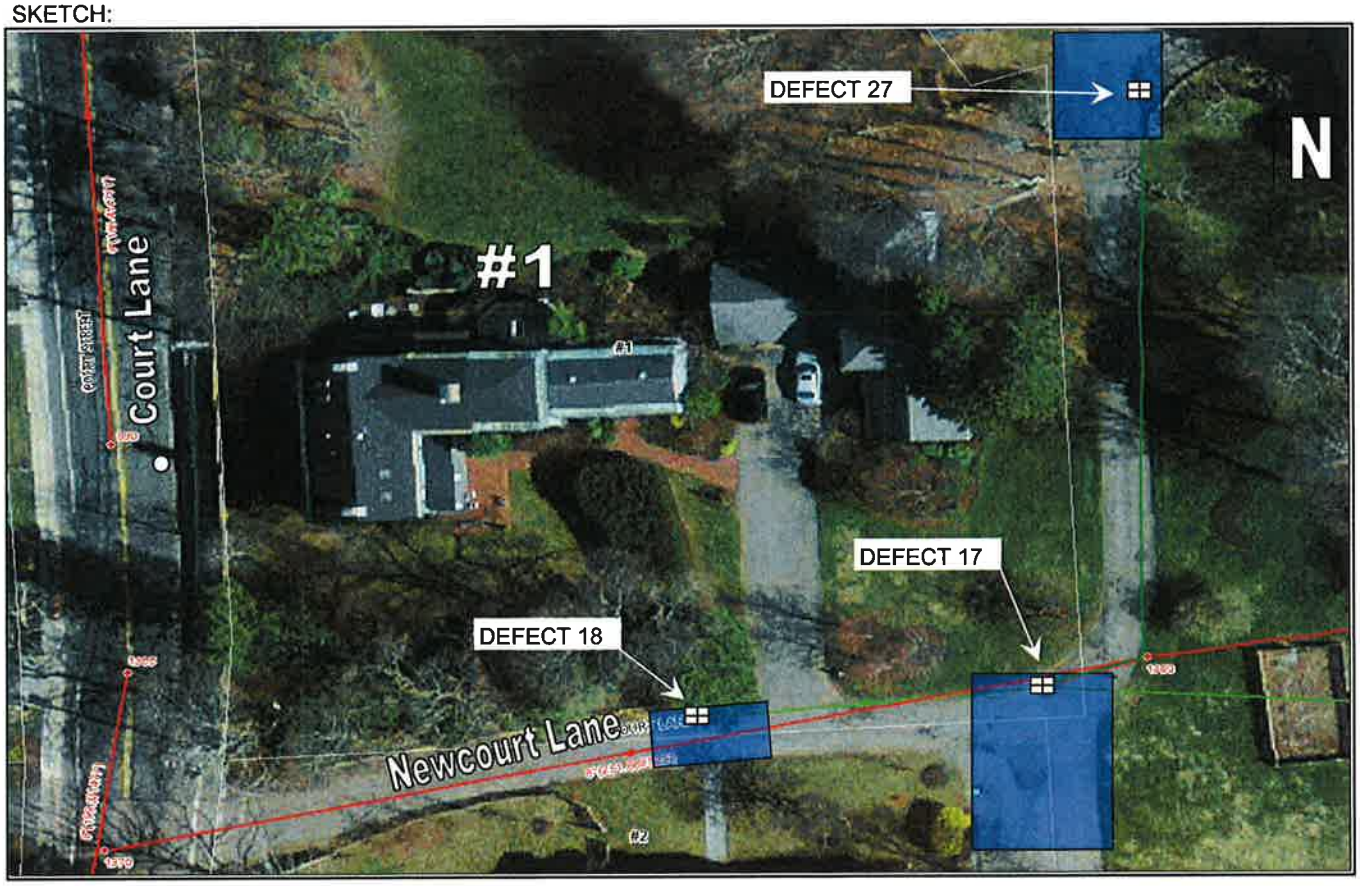


DEFECT SOURCE ○
DRAINAGE AREA ■


Weston&Sampson
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
17

DEFECT 17
(Photo 2)

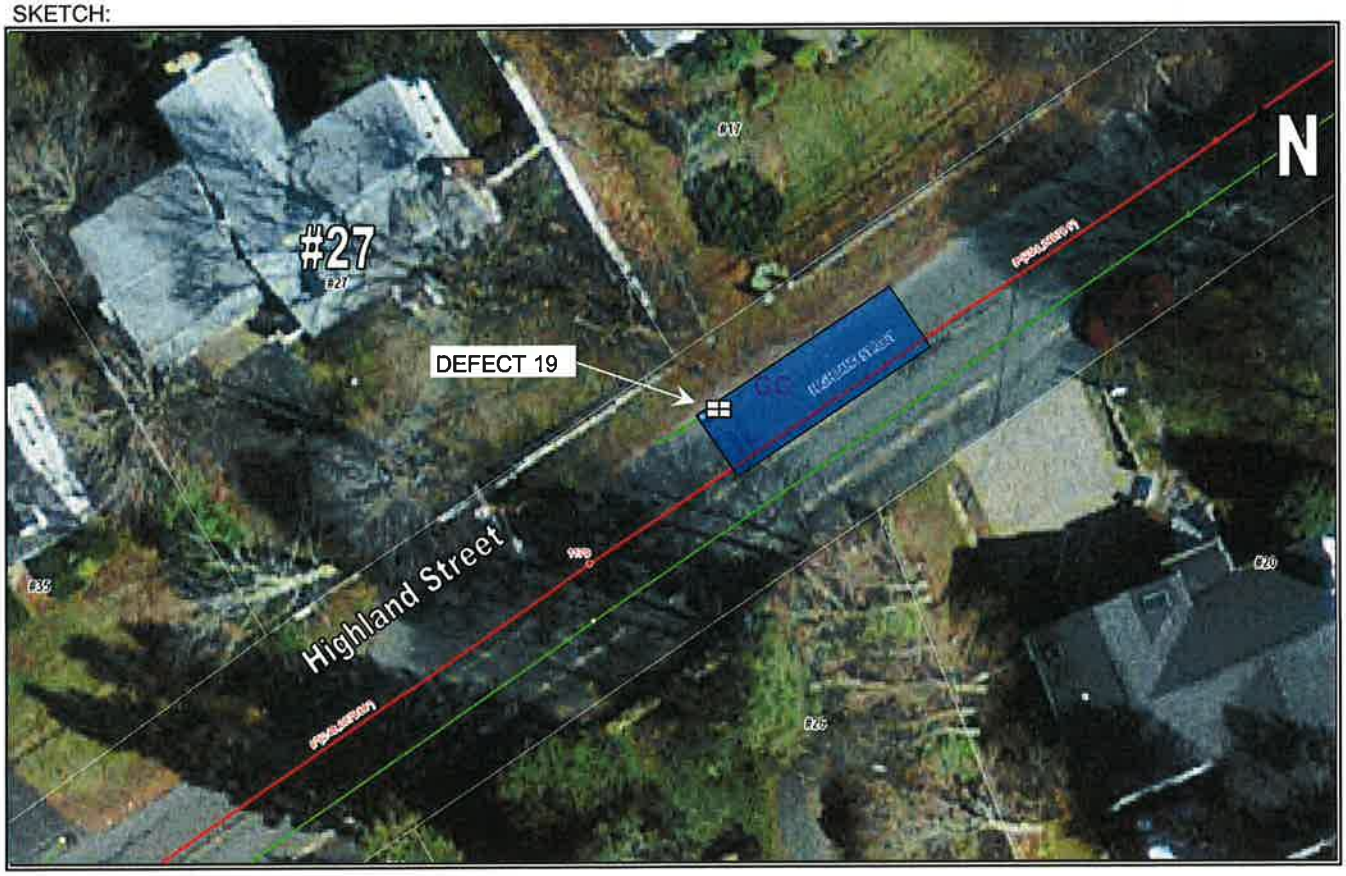

Weston&Samposn
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
18

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson
DATE: 09/20/13
DEFECT: 19 thru 19
OWNER: Town of Dedham
SKETCH NO.: 17
MAP NO.: GG
PROJECT: Fall 2013 Smoke Testing
CREW: LD, MJD, JC
LOCATION: 27 Highland Street

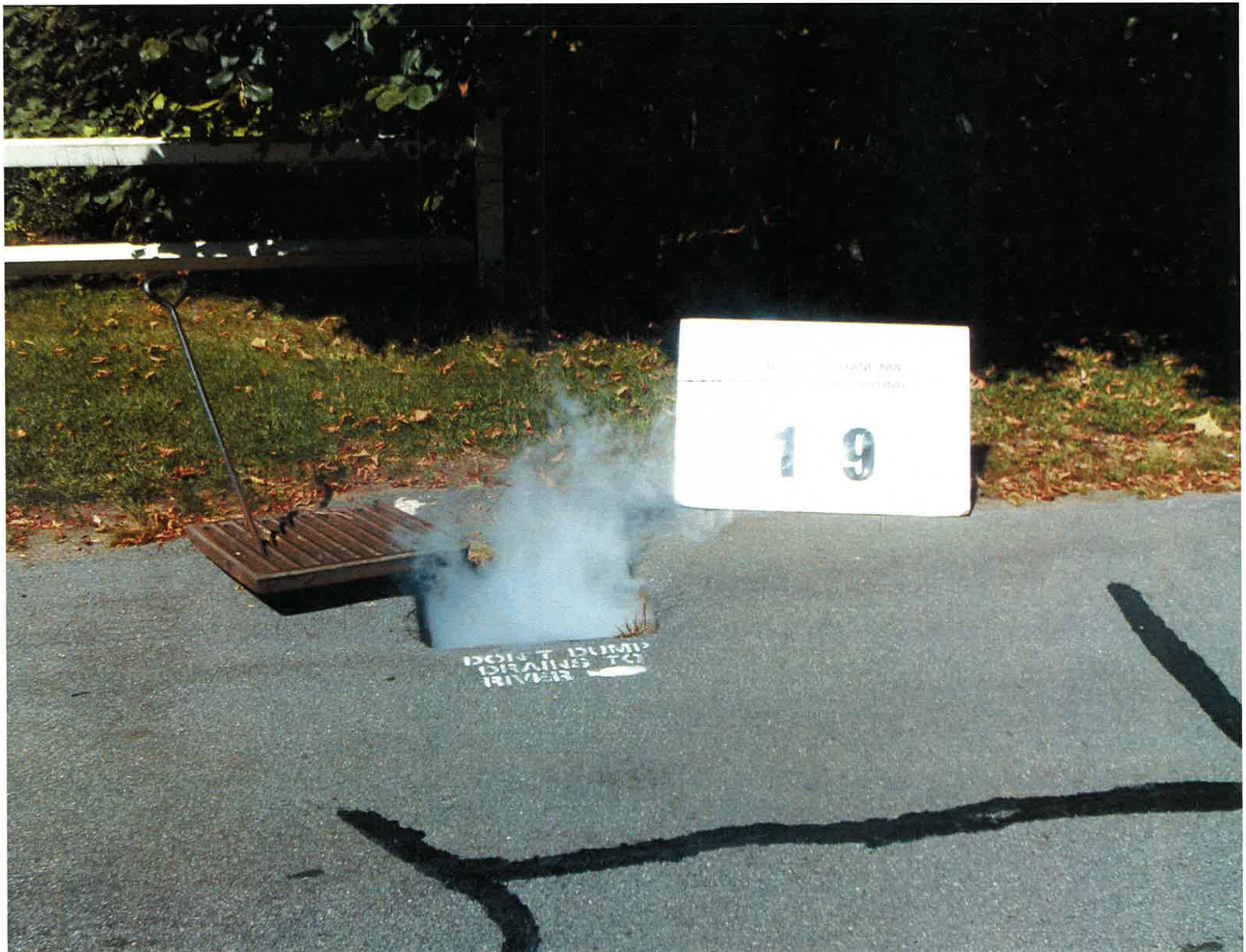
DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
19	Catch Basin Indirectly connected to sewer. Smoke leaking in from brick walls.	480	Asphalt		X		19

SKETCH:



DEFECT SOURCE ○
DRAINAGE AREA ■

O:\Dedham MA\2130225 - Year One Inflow Investigations\Field Notes\Smoke Testing Sketches\[Dedham 2013 Smoke Testing - Defect 19 Sketch Log.xlsx]Defect 1 (Sketch 1)


19
DON'T DUMP
DRAINS TO
RIVER

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson DATE: 09/24/13 DEFECT: 20 thru 21

OWNER: Town of Dedham SKETCH NO.: 18 MAP NO.: GG

PROJECT: Fall 2013 Smoke Testing CREW: PMC, MJD

LOCATION: 832 High Street & 19 Guild Road

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
20	MH GG 170 with loose frame and vent holes in cover.		Grass		X		20
21	MH GG 160 with loose frame and vent holes in cover.		Grass		X		21

SKETCH:

DEFECT SOURCE ○
DRAINAGE AREA ■


Weston&Sampson
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
2 0


Weston&Sampson
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
2 1

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson | DATE: 09/24/13 | DEFECT: 22 thru 22

OWNER: Town of Dedham | SKETCH NO.: 19 | MAP NO.: KK

PROJECT: Fall 2013 Smoke Testing | CREW: PMC, MJD

LOCATION: 57 Leonard Street

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
22	Driveway Drain.	243	Asphalt	X			22

SKETCH:

DEFECT SOURCE ○
DRAINAGE AREA ■

Weston&Sampson
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
2
2

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson | DATE: 09/24/13 | DEFECT: 23 thru 23

OWNER: Town of Dedham | SKETCH NO.: 20 | MAP NO.: KK

PROJECT: Fall 2013 Smoke Testing | CREW: PMC, MJD

LOCATION: 38 Leonard Street

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
23	Driveway Drain.	261	Asphalt	X			23

SKETCH:

DEFECT SOURCE ○
DRAINAGE AREA ■


Weston&Sampson
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
23

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson
DATE: 09/24/13
DEFECT: 24 thru 24
OWNER: Town of Dedham
SKETCH NO.: 21
MAP NO.: KK
PROJECT: Fall 2013 Smoke Testing
CREW: PMC, MJD
LOCATION: 81 Berlin Street

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
24	Driveway Drain.	252	Asphalt	X			24

SKETCH:

DEFECT SOURCE ○
DRAINAGE AREA ■


Weston&Sampson
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
2 4

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson
DATE: 09/24/13
DEFECT: 25 thru 25

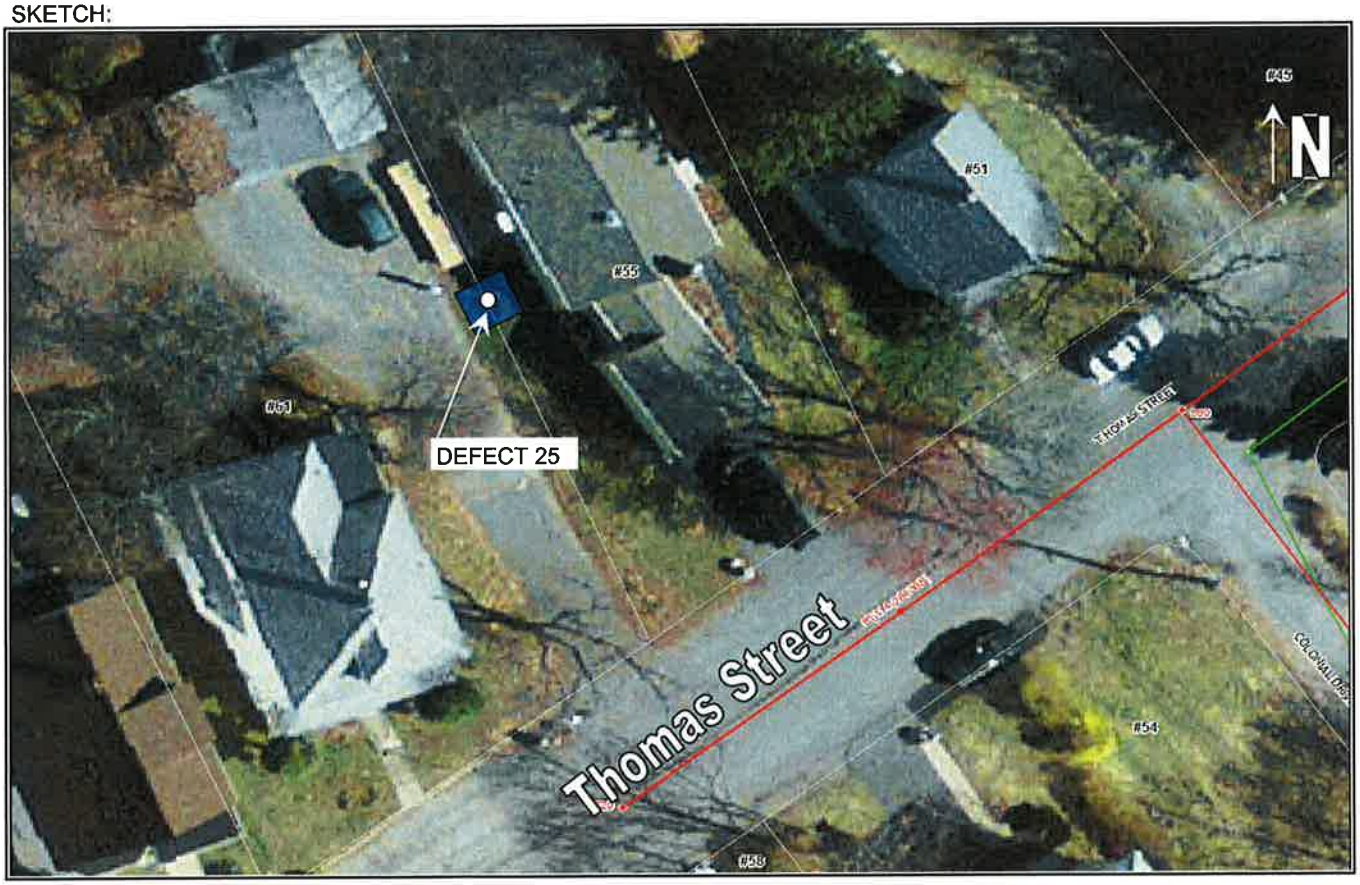
OWNER: Town of Dedham
SKETCH NO.: 22
MAP NO.: kk

PROJECT: Fall 2013 Smoke Testing
CREW: PMC, MJD

LOCATION: 55 Thomas Street

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
25	Missing Exterior Cleanout Cap.	25	Grass			X	25

SKETCH:



DEFECT SOURCE ○
DRAINAGE AREA ■


Weston&Sampson
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
25

WESTON & SAMPSON
SMOKE TESTING DEFECT LOG

ENGINEER: Weston & Sampson
DATE: 09/24/13
DEFECT: 26 thru 26
OWNER: Town of Dedham
SKETCH NO.: 23
MAP NO.: KK
PROJECT: Fall 2013 Smoke Testing
CREW: PMC, MJD
LOCATION: 99 Ware Street

DEFECT	DESCRIPTION	Drainage Area	Surface Type	Severity			Picture No.(s)
				Major	Mod	Minor	
26	MWRA MH in Subarea KK with vent hole.	600	Asphalt	X			26

SKETCH:

DEFECT SOURCE ○
DRAINAGE AREA ■


Weston&Sampson
TOWN OF DEDHAM, MA
YEAR 1 – SMOKE TESTING
26

APPENDIX B

DYE FLOODING DEFECT LOGS

WESTON AND SAMPSON
DYE FLOODING DEFECT REPORT

ENGINEER: Weston & Sampson

OWNER: Town of Dedham

PROJECT: Year One Inflow Investigations

LOCATION: 31 Flanagan Place

DEFECTS: 12 thru 12

SUBAREA: QQ

DYE FLOOD NO.: 1

CONTRACTOR: NEPCCO

Smoke Testing Results

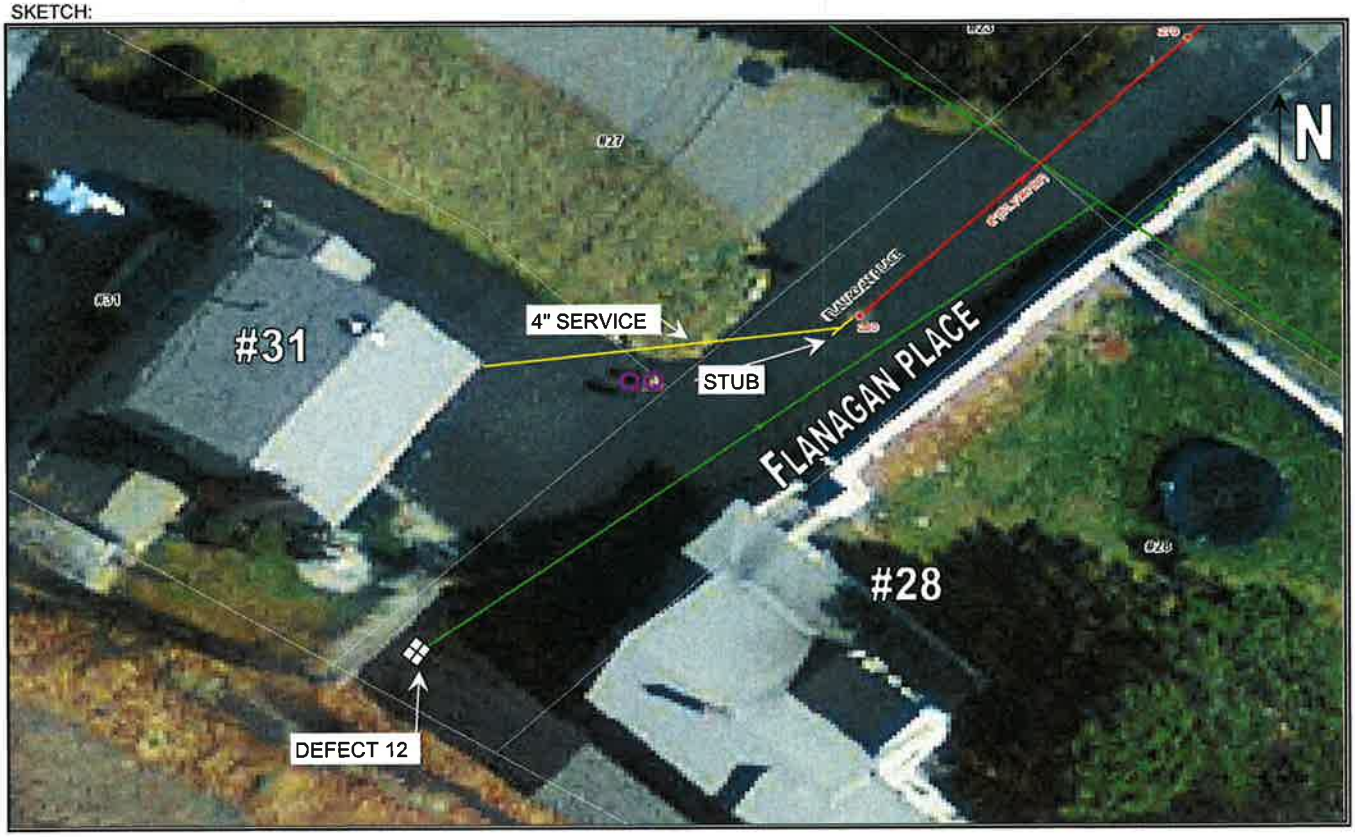
Leak No.	Description of Smoke Testing Defects	Drainage Area	Surface Type	Date
12	Catch Basin with light smoke.	925	Asphalt	9/18/13

Dye Flooding Results

Date of Test: 11/7/13 **Contractor:** New England Pipe Cleaning Co. **Result(s):** Negative

Description of test: Unable to dye flood drain line due to no access for plugging of downstream line. Unable to perform television inspection of drain line due to debris. Unable to perform television inspection of sewer service from manhole QQ-280 due to 4" pipe.

SKETCH:



WESTON AND SAMPSON
DYE FLOODING DEFECT REPORT

ENGINEER: Weston & Sampson
OWNER: Town of Dedham
PROJECT: Year One Inflow Investigations
LOCATION: 100 Robert Road

DEFECTS: 16 thru 16
SUBAREA: GG
DYE FLOOD NO.: 2
CONTRACTOR: NEPCCO

Smoke Testing Results

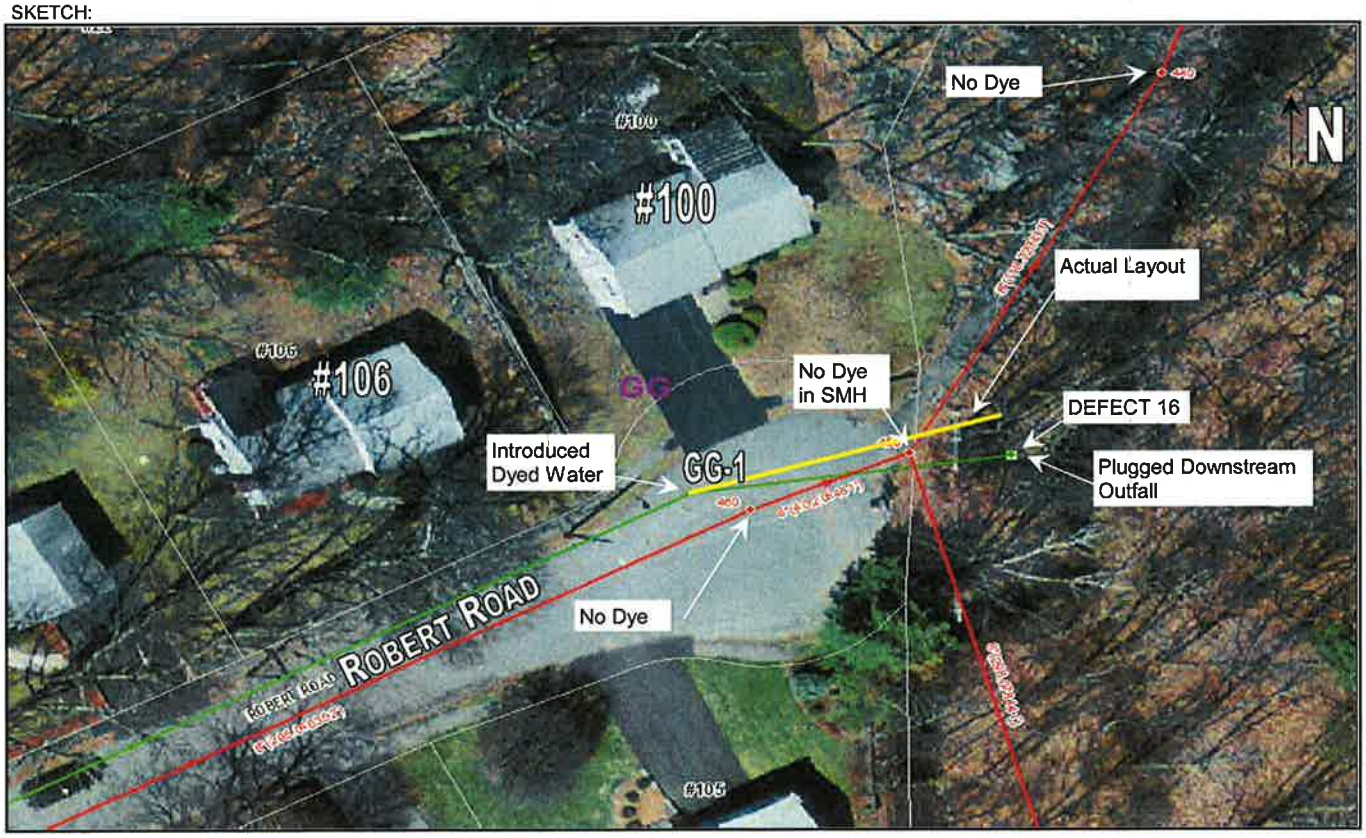
Defect No.	Description of Smoke Testing Defects	Drainage Area	Surface Type	Date
16	Drainage Outfall with Light Smoke.	0	-	9/20/13

Dye Flooding Results

Date of Test: 11/7/13 **Contractor:** New England Pipe Cleaning Co. **Result(s):** Negative

Description of test: Upon plugging and flooding of drain line, dyed water was not observed in the surrounding sewer manholes. Television inspection from DMH GG-1 towards the drain outfall revealed moderately open joints throughout the drain line.

SKETCH:



WESTON AND SAMPSON
DYE FLOODING DEFECT REPORT

ENGINEER: Weston & Sampson
OWNER: Town of Dedham
PROJECT: Year One Inflow Investigations
LOCATION: 27 Highland Street

DEFECTS: 19 thru 19
SUBAREA: GG
DYE FLOOD NO.: 3
CONTRACTOR: NEPCCO

Smoke Testing Results

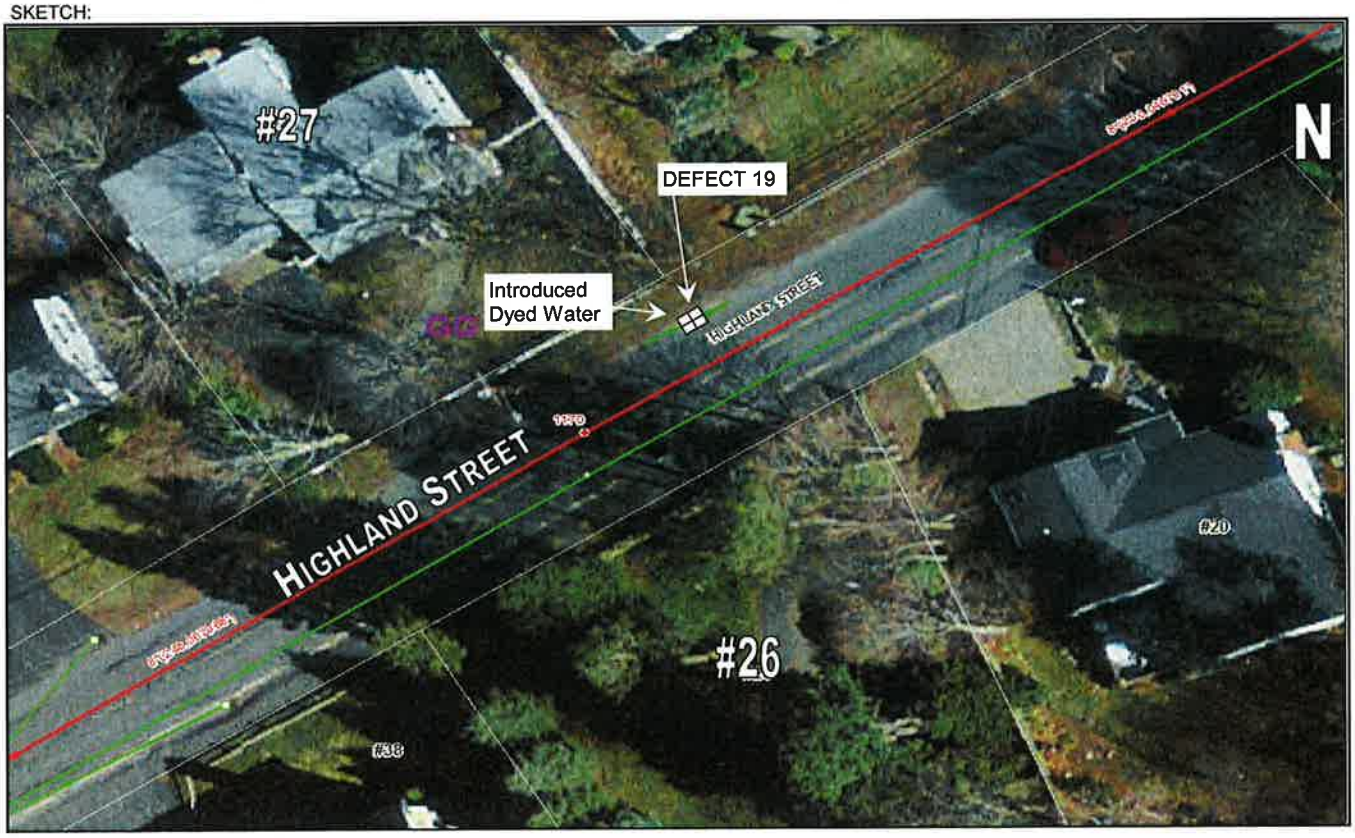
Leak No.	Description of Smoke Testing Defects	Drainage Area	Surface Type	Date
19	Moderate Smoke from Catch Basin Walls	480	Asphalt	9/20/13

Dye Flooding Results

Date of Test: 11/8/13 **Contractor:** New England Pipe Cleaning Co. **Result(s):** Negative

Description of test: Plugged incoming and outgoing stubs. Flooded catch basin. No Dye observed. Television Inspection of sewer line between manhole GG-1170 and GG-1180 was performed revealing no defects.

SKETCH:



WESTON AND SAMPSON
DYE FLOODING DEFECT REPORT

ENGINEER: Weston & Sampson

OWNER: Town of Dedham

PROJECT: Year One Inflow Investigations

LOCATION: Monroe Street at East Street

DEFECTS: S10 thru S10

SUBAREA: SS

DYE FLOOD NO.: 4

CONTRACTOR: NEPCCO

Smoke Testing Results

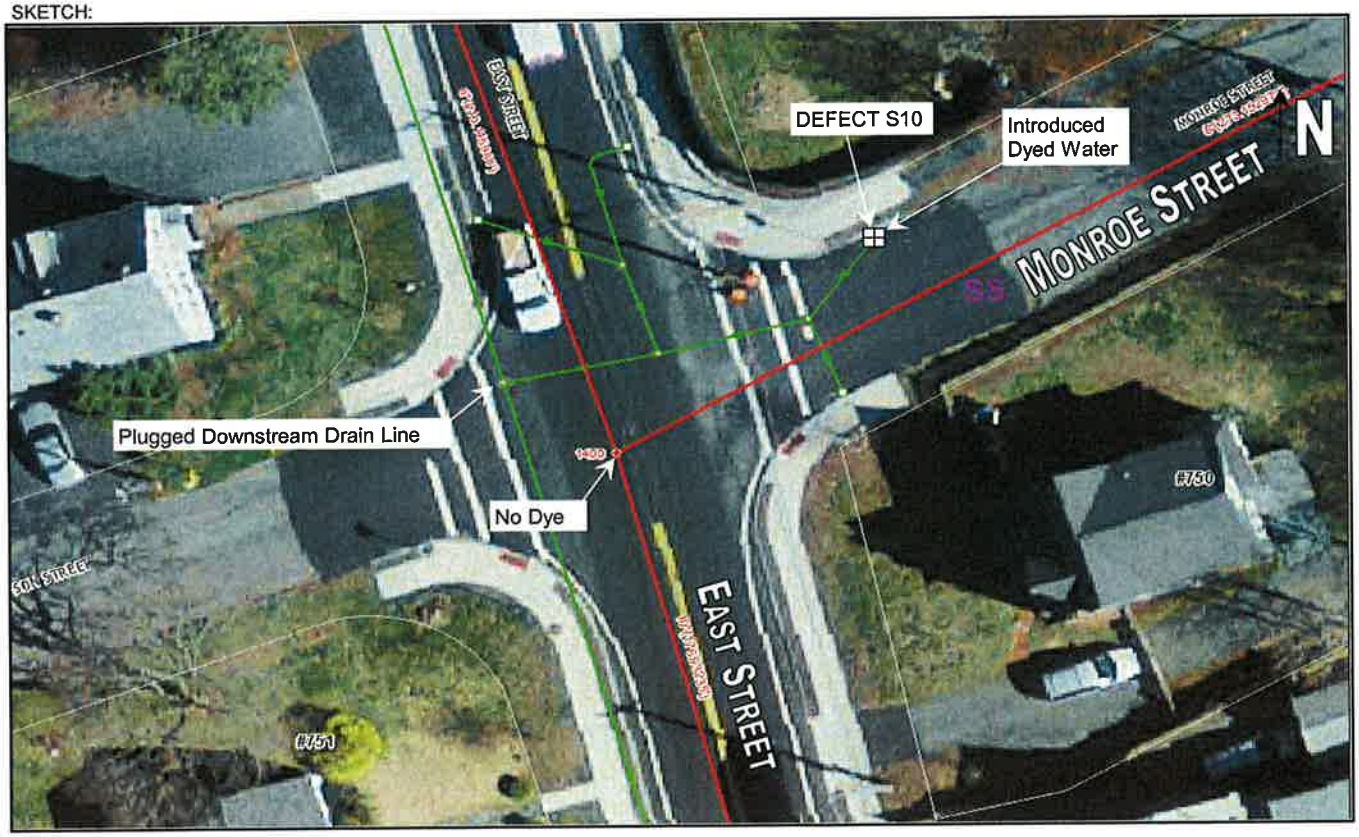
Leak No.	Description of Smoke Testing Defects	Drainage Area	Surface Type	Date
S10	Catch Basin with Hood	1,500	Asphalt	

Dye Flooding Results

Date of Test: 11/8/13 **Contractor:** New England Pipe Cleaning Co. **Result(s):** Negative

Description of test: Upon flooding and plugging, no dyed water was observed.

SKETCH:



WESTON AND SAMPSON
DYE FLOODING DEFECT REPORT

ENGINEER: Weston & Sampson

OWNER: Town of Dedham

PROJECT: Year One Inflow Investigations

LOCATION: 86 Lincoln Street

DEFECTS: S19 thru S19

SUBAREA: RR

DYE FLOOD NO.: 5

CONTRACTOR: NEPCCO

Smoke Testing Results

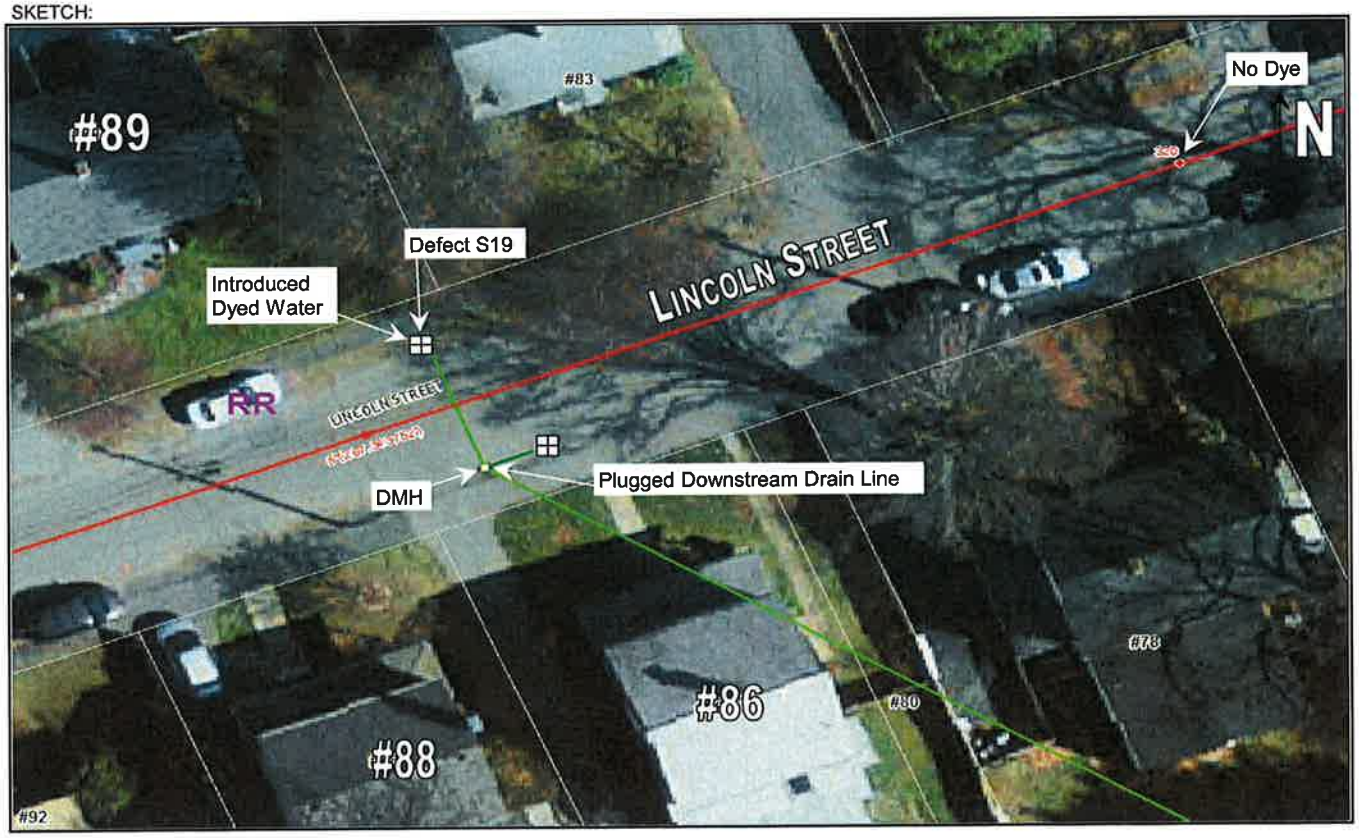
Leak No.	Description of Smoke Testing Defects	Drainage Area	Surface Type	Date
S19	Two (2) Catch Basins with Hoods	2,160	Asphalt	

Dye Flooding Results

Date of Test: 11/7/13 **Contractor:** New England Pipe Cleaning Co. **Result(s):** Negative

Description of test: Upon Flooding and plugging, no dyed water was observed at the downstream sewer manhole.

SKETCH:



WESTON AND SAMPSON
DYE FLOODING DEFECT REPORT

ENGINEER: Weston & Sampson

OWNER: Town of Dedham

PROJECT: Year One Inflow Investigations

LOCATION: 408 Whiting Avenue

DEFECTS: S24 thru S24

SUBAREA: QQ

DYE FLOOD NO.: 6

CONTRACTOR: NEPCCO

Smoke Testing Results

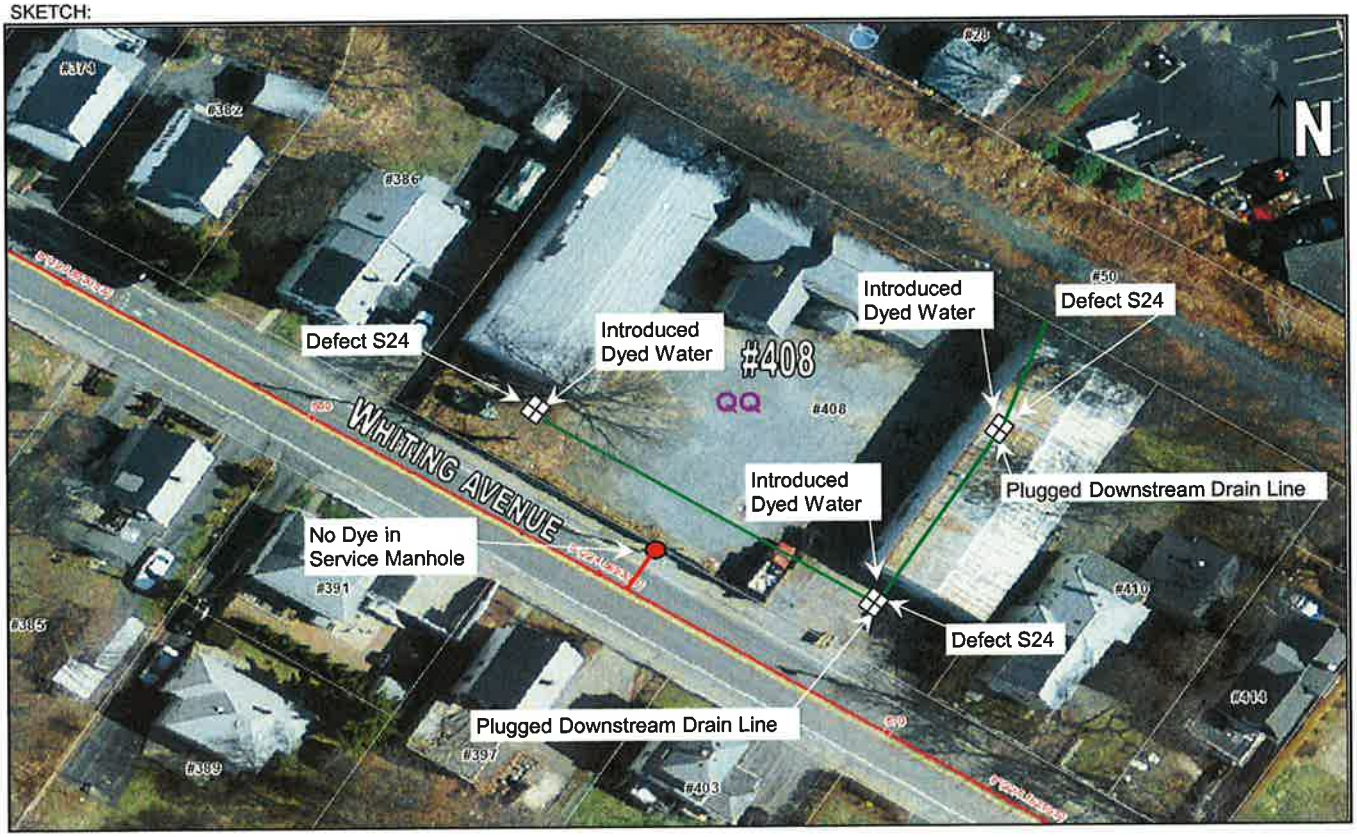
Leak No.	Description of Smoke Testing Defects	Drainage Area	Surface Type	Date
S24	Three (3) Catch Basins	25,000	Asphalt	

Dye Flooding Results

Date of Test: 11/7/13 **Contractor:** New England Pipe Cleaning Co. **Result(s):** Negative

Description of test: Upon dye flooding and plugging, no dyed water was observed in the service manhole. Lot is under construction, shown buildings no longer exist. Was informed by owner catch basins flow to a leaching field behind the new building.

SKETCH:



\\peabody2003\project\Dedham MA\2130225 - Year One Inflow Investigations\Field Notes\Dye Flood Sketches\[Dye Flood 6 Sketch.xls]DYE FLOOD 1

APPENDIX C

MWRA T&T COSTS

RATIONAL EQUATION CONVERSION

CONSTRUCTION UNIT COSTS

MEMORANDUM

DATE: December 13, 2013

FROM: Patrick Yeo

TO: File 2130225.A

SUBJECT: T&T costs for Dedham, Massachusetts using MWRA methodology

Fiscal year 2014 Transportation & Treatment (T&T) costs for sewerage in the Town of Dedham can be calculated using both the MWRA Operation & Maintenance (O & M) and Capital charges, and the town's O & M and Capital costs. Therefore, MWRA charges are based mainly on sewage flow exiting the Town of Dedham. MWRA's FY14 sewerage charges to the Town of Dedham are shown in Table A, and Table B shows Dedham's FY14 O & M and Capital costs.

TABLE A - MWRA CHARGES TO THE TOWN OF DEDHAM

ITEM	FLOW (gallons/year)	FLOW (gallons/day)	MWRA CHARGE	COST ($/GPD)
Average Strength Flow*				
Annual Wastewater Volume	1,331,867,000	3,648,950	$1,153,760	$0.3162
Total Suspended Solids (O & M and Capital)	1,331,867,000	3,648,950	$379,483	$0.1040
Biochemical Oxygen Demand (O & M and Capital)	1,331,867,000	3,648,950	$304,523	$0.0835
Maximum Monthly Flow	N/A	6,680,000	$822,351	$0.1231
Population **	1,331,867,000	3,648,950	$2,265,361	N/A
TOTAL			**$4,925,478**	**$0.6268**

NOTE:
*MWRA's charges only apply to average strength flow.
**MWRA's population charges are not flow based, so it is not to be included in T & T cost.

TABLE B – TOWN OF DEDHAM SEWERAGE COSTS

ITEM	FLOW (gallons/year)	FLOW (gallons/day)	DEDHAM COST	COST ($/GPD)
Debt Service (Capital Costs)	1,331,867,000	3,648,950	$166,970	$0.0458
O & M	1,331,867,000	3,648,950	$1,400,000	$0.3837
TOTAL			**$1,566,970**	**$0.4295**

Therefore, the total FY14 T&T cost for both the MWRA charges and the Town of Dedham's costs are $1.0563 /GPD ($0.6268 + $0.4295).

According to the Department of Environmental Protection's (DEP) Guidelines for Performing I/I Analyses and SSES this cost of $1.0563/GPD needs to be extended throughout the life of a rehabilitative measure. The life cycle for a rehabilitative measure can be set by good engineering judgement as well as backup documentation, depending on the type of rehabilitation. For this study, Weston & Sampson will use a life cycle of twenty years.

To find the present worth of a rehabilitative measure over a twenty-year period, a discount rate, or annual percentage rate, is required. According to the DEP, the discount rate for FY13 is 4.125%. To calculate the T&T cost in order to account for this twenty-year period, a present worth analysis must be done. The following formula will calculate the present worth of the T&T cost for the next twenty years:

PRESENT WORTH ANALYSIS:

Discount Rate = 4.125% (DEP FY13 Information)

Present Worth Factor:

$$\frac{(1+i)^n - 1}{i\,(1+i)^n}$$ where: i = discount rate, or interest rate
n = number of years

$$\frac{(1 + 0.04125)^{20} - 1}{0.04125\,(1 + 0.04125)^{20}} = 13.44$$

Present Worth T&T Cost:

(Present Worth Factor) x (FY13 T & T cost)

13.44 x $1.0563/GPD = $14.20/GPD

Therefore, the T&T cost for the Town of Dedham, utilizing a present worth of the rehabilitation for a twenty-year period, with a discount rate of 4.125%, is $14.20/GPD.

Town of Dedham T&T costs were derived using MWRA sewerage costs.

ESTIMATED UNIT COSTS FOR REHABILITATION
Dedham, MA - Year One Inflow Investigations

RECOMMENDED REHABILITATION METHOD	ESTIMATED COST
CLEAN, INSPECT, TEST & SEAL	
Clean, inspect, test & seal (8")	$8.00 / lf
CHEMICAL ROOT TREATMENT	
Chemical root treatment (8")	$1.90 / lf
MANHOLE REHABILITATION	
Build bench & invert	$650.00 / mh
Cementitious lining (precast/brick/block)	$130.00 / vf
Install inflow dish	$200.00 / mh
Repair bench & invert	$200.00 / mh
Repair chimney	$200.00 / mh
Repair cone	$200.00 / mh
Replace cover	$250.00 / mh
Replace frame	$750.00 / mh
Replace/Raise/Reset frame & cover	$1,000.00 / mh
Install Watertight Frame and Cover	$1,250.00 / mh
Root treatment	$310.00 / mh
Seal Invert	$230.00 / mh
CLEAN & TELEVISION INSPECTION	
Clean & TV (6" to 36")	$2.00 / lf
Heavy Cleaning (6" to 36")	$15.00 / lf
TV service connection from mainline to house	$10.00 / lf

RECOMMENDED REHABILITATION METHOD	ESTIMATED COST
CURED-IN-PLACE PIPE	
Reline pipe (8") liner from MH to MH	$50.00 / lf
CURED-IN-PLACE PIPE (STRUCTURAL)	
Reline pipe (8") liner from MH to MH	$55.00 / lf
SHORT LINER	
Short liner (8")	$375.00 / lf
Structural short liner (8")	$400.00 / lf
SERVICE CONNECTION REHABILITATION	
Replacement of wye connection (6" to 36")	$800.00 / wye
Cut protruding service	$650.00 / each
Grout service at connection with main	$600.00 / each
EXCAVATE & REPLACE PIPE	
Replace pipe (8")	$700.00 / lf
DIRECT CONNECTIONS	
Redirect Roof Leader	$2,500.00 /each
Redirect Catch Basin	$15,000.00 /each
Redirect Area or Driveway Drain	$7,500.00 /each
Redirect Sump Pump	$5,000.00 /each
Install Cleanout Cap	$200.00 /each
Install Cleanout Cap & Install Sump Pump	$7,500.00 /each