

September 16, 2011

Office of Community Development  
Homer Municipal Building  
19 Moore Street  
Belmont, Massachusetts 02478  
Attn: Mr. Glenn Clancy, Director

Subject: Belmont, Massachusetts  
2011 Illicit Connection Identification Program  
Outfall Areas 1, 2 & 10  
**Report of Findings**

Dear Mr. Clancy:

This Report of Findings (ROF) summarizes the results of building inspections and CCTV investigations of sewer and storm drain mainlines and sewer services recommended for further investigation in the "Evaluation of Sewers and Storm Drains to Identify Illicit Connections in Areas Tributary to Outfalls 1, 2 & 10", October 2010. This ROF includes a summary of continued investigations performed tributary to Unity Ave. (Outfall Area 1), Huron Ave. (Outfall Area 2) and Winn's Brook (Outfall Area 10) and provides recommendations for rehabilitation and/or further investigations.

## **METHODOLOGY**

In accordance with the recommendations of the October 2010 report, areas that showed fluctuating sample results around 5,000 E. Coli colonies per 100mL were the targets of these investigations. Building inspections, dyed-water testing and CCTV inspection were used to identify direct (sewer service connected to storm drain) and indirect (defect in sewer service or mainline exfiltrating to the storm drain) illicit connections. In addition to the new target areas, buildings that were not successfully inspected during the 2010 investigations were included. Sewer services identified in the October 2010 report as "indirect" or "undetermined" were subjected to CCTV inspection. Additional sewer services determined to be indirect connections as part of these investigations were also CCTV inspected.

## **Building Inspections & Dyed-Water Testing**

Building inspections consist of a thorough inspection of basement sewer plumbing to identify all discharge locations from the house. The dyed-water test involves introducing dyed-water into a plumbing fixture, typically a sink or toilet. An inspector then monitors the downstream sewer

and storm drain manholes in the vicinity of the building to determine the discharge location. For buildings with multiple sewer stacks or buildings where the main sewer stack could not be located (i.e. finished basement), a separate dyed-water test was conducted for each stack or plumbing fixture. Observation of dyed-water in only the storm drain system is indicative of a direct connection. Observation of dyed-water in both the sanitary sewer and the storm drain is indicative of an indirect connection.

### **CCTV Inspection of Mainlines & Services**

CCTV inspections, in both mainline and services, establishes the condition of the pipe and identifies the locations of exfiltration point sources in the sewer (i.e. holes or cracks). CCTV inspection of a sewer service is achieved by deploying a secondary spring-assisted camera up the service lateral from the main camera. However, the secondary camera is limited to inline inspection (i.e. no rotation of the camera head for perpendicular inspection).

### **RESULTS AND RECOMMENDATIONS**

The results and recommendations for each tributary area are discussed below. The results of building inspections & dyed-water testing, mainline CCTV inspection and service lateral CCTV inspection are provided in Tables 1, 2 and 3, respectively. In Figures 1 and 2, target areas are identified by sample numbers, which are provided along with the highest sample result recorded (E. Coli). For each individual sanitary sewer and storm drain section, Table 2 provides a detailed description of the recommended rehabilitation.

#### **OUTFALL AREA 2 (Figure 1)**

38 - Houses Targeted for Dyed-Water Testing

30 - Negative (to sewer)

1 - Positive (direct to storm drain)

3 - Positive (indirect)

4 - No Inspection

#### **Bacon Road to Audrey Road (Sample 4E2)**

Three sewer sections (595') and three storm drain sections (593') were CCTV inspected upstream of Sample 4E2. All three sewer sections were found to be in poor condition. Several exfiltration point sources were identified throughout the sewer sections that included severe broken pipe, longitudinal cracks and poor services connections. The storm drain was found to be in good structural condition with some minor roots and offset joints found throughout. Active infiltration was also identified in section 09D079-09D091. Infiltration into the storm drain is typically not an immediate concern. However, in this location the sewer is installed above the storm drain and, with several exfiltration point sources identified, contamination is probable.

All sewer services within this area were successfully dyed-water tested. Potential indirect sources were identified from 9 Audrey Rd. and 10 Bacon Rd. 10 Bacon Rd. was initially dyed-

water tested with no dye observed in the storm drain. Approximately one hour later, 9 Audrey Rd. was dyed-water tested with indirect dyed-water observed emanating from storm drain section 09D091-Stub, adjacent to 10 Bacon Rd. Both sewer services were subjected to CCTV inspection and contain minor/moderate defects. Sewer section 09S053-09S052, adjacent to 09D091-Stub, was dyed-water flooded for 40 minutes with no dye observed in the storm drain.

*We recommend lining of the three 8-inch sewer sections upstream of Sample 4E2 (595') and 2 services at 10 Bacon Rd. and 9 Audrey Rd. Three additional services are recommended for lining and 2 point repairs are required prior to lining. The Town may also consider installation of a drain manhole on Bacon Road at the capped drain line upstream of 09D091 for future access and maintenance.*

#### **Audrey Road (Sample 6H1)**

The area tributary to Sample 6H1 has undergone previous rehabilitation which included full-length pipe replacement or cured-in-place lining of the three sewer sections. Therefore, CCTV inspection of the mainline was not conducted in this area. All sewer services within this area were successfully dyed-water tested with indirect dyed-water observed at 47 Audrey Rd. This house was dyed-water tested in 2001/2002 with no dye observed in the storm drain. The sewer service at 47 Audrey Rd. was CCTV inspected and contains a separated joint and minor cracks.

*We recommend lining of the service at 47 Audrey Road.*

#### **2010 Investigations Carryover**

Eight buildings were successfully dyed-water tested as carryover from the 2010 investigations. At seven locations dyed-water was observed only in the sewer. At 30 Shaw Rd. 100% of the dyed-water was observed in the storm drain system, indicating a direct connection. However, 2001/2002 dyed-water testing determined 30 Shaw Rd. to be an indirect connection with 90% of the flow still going into the sewer. It is likely that the service lateral has now completely failed. Four houses remain uninspected and will continue to be incorporated into future investigations.

*We recommend replacement of the sewer service at 30 Shaw Road.*

#### **OUTFALL AREA 10 (Figure 2)**

24 - Houses Targeted for Dyed-Water Testing

17 - Negative (to sewer)

1 - Positive (direct to storm drain)

1 - Positive (indirect)

1 - Undetermined (not in sewer or storm drain)

4 - No Inspection

### **Brighton Street (Sample 1E)**

Approximately 1241' of sewer and 1016' of storm drain were CCTV inspected on Brighton St. upstream of Sample 1E (from Hoitt Rd. to Albert Ave.), including one perpendicular section of sewer on Coolidge St. The sewer varied from good to poor condition with defects consisting of cracks, broken pipe, active infiltration and several broken services. The sewer on Coolidge St. transitions to ductile iron and passes through drain manhole 42D048. The storm drain was in poor condition with lengthy longitudinal cracks at the top and spring lines of the pipe. The elevation of the storm drain is level with or below the sewer, with a varying horizontal offset of 3'-10'. Sewer services on the Northwest side of Brighton Street cross over the storm drain.

All buildings upstream of Sample 1E (Hoitt Rd.) to Albert Avenue were targeted for dyed-water testing. Direct dyed-water was observed from 210 Brighton St. and the CCTV video shows no sanitary connection in the vicinity. Indirect dyed-water was observed from 188 Brighton St. with CCTV of the lateral revealing a sag and minor cracking.

Attempts at four buildings were unsuccessful, including two along section 44D046-41D046. Notably, portions of the CCTV video of this section show what appears to be toilet paper visible in the flow. However, it can not be determined from the video if the source is from within section 44D046-41D046 or upstream.

No dyed-water was observed from 170 Brighton St. (corner of Hoitt Rd.) in either the sewer or the storm drain. CCTV inspection was expanded to include sewer section 09S041-37S026 on Hoitt Rd., however, the only sewer service identified was at 173' from 09S041, which is past the property line of 170 Brighton St. Section 41S042-37S025 on Brighton St. contains two services in the direction of house 170. Upon subsequent lateral CCTV inspection, one sewer service located at 110' from 41S042 was capped. A second service located at 139' from 41S042, contained a severe blockage at 22' due to an apparent root ball.

*We recommend lining three sections of 15-inch sewer (604'), three sections of 24-inch storm drain (1,016') and 2 services at 170 and 188 Brighton Street. Two additional services are recommended for lining and 2 service replacements are required prior to lining. The sewer service for 210 Brighton Street must be disconnected from the storm drain and connected to the sewer. The storm drain is level with the sewer so that complete relaying of the service and internal plumbing modifications may be necessary for a gravity service to be maintained.*

### **2010 Investigations Carryover**

Two buildings on Pleasant St. were successfully dyed-water tested as carryover from the 2010 investigations with dye observed only in the sewer. One house on Waterhouse Rd. remains uninspected and will continue to be incorporated into future investigations.

## **SERVICE LATERAL CCTV INSPECTIONS**

A total of 32 sewer service laterals and 2 drain service laterals were subjected to CCTV inspection. This includes 18 (of 19) laterals recommend from the 2010 investigations and 14 laterals as of result of the 2011 investigations.

Table 3 shows that in approximately half of the laterals the camera was able to proceed to the internal plumbing transition point or cleanout. In the remaining laterals, the camera was obstructed at some point due to a defect such as broken pipe, root ball, pipe sag (camera under water) or capped pipe. The service lateral CCTV inspections are grouped and summarized below. *In total, 17 services are recommended to be lined and 6 services replaced.*

### **Direct Connection**

64 Betts Rd. showed a direct dyed-water testing result as dyed-water placed in the sewer reentered the house through the drain service. The sewer service was successfully CCTV inspected 43' to the plumbing transition point, ruling out direct connection of the sewer service to the storm drain. The inspection revealed an offset joint and large sag in the line, which appear to be the source of sewage exfiltration. *We recommend lining rehabilitation of this service.*

### **Indirect Connections**

Nineteen (19) services were CCTV inspected upon showing indirect dyed-water testing results. Fourteen (14) services are suitable for trenchless rehabilitation via lining. Five (5) services require service replacements including 64 Livermore Rd., 192 & 253 Washington St., 99 Sherman St. and 70 Waterhouse Rd. Most notable is 192 Washington due to recent roadway reconstruction (service from 253 Washington goes to Dalton Rd.). The service at 192 Washington is offset approximately 80% with a large void below, leaving excavation replacement as the only viable repair alternative.

As noted in the 2010 report, 58 Van Ness Rd. could not be inspected, as a preceding point repair is required. However, the service lateral camera was utilized to partially inspect the 10-inch drain that emanates from the vicinity of 58 Van Ness and tees into the 24-inch storm drain on Fairview Ave. The drain was inspected to 55 feet with clear water flowing and no significant defects and no connections observed. Although the origin of the drain remains unknown, it does not appear to be an illicit connection source and, therefore, focus remains on the service to 58 Van Ness.

### **Undetermined Connections**

Three services produced no dyed-water in either the sanitary sewer or the storm drain. The sewer service a 22 Sharpe Rd. was successfully CCTV inspected to the cleanout (48') and appears active with only minor defects. *We recommend a second dyed-water test of the sewer service. If dyed-water is still not observed, then rehabilitation via lining is recommended.*

The sewer service from 215 Washington St. runs through an intermediate manhole on the private property prior to connecting to the main in the street. Dyed-water was observed in the intermediate manhole but not in the mainline. The service was CCTV inspected 61' from the

main (total length approximately 95') and was observed to be in relatively good condition. The service contains several sags, which account for the dyed-water not reaching the main during the time allowed. *No rehabilitation of this service is recommended.*

The sewer service for 21 Livermore Rd. was found to be capped at 40 feet. Review of the mainline CCTV video for this area revealed no other sewer services in front of 21 Livermore Rd. or on adjacent Shaw Rd. The initial attempt to inspect the drain service to 21 Livermore was obstructed by a large root ball at 2 feet and a later attempt to remove the root ball failed. Although not verified by CCTV dyed-water testing, investigations to date indicate a direct connection to the storm drain. *We recommend the sewer service for 21 Livermore Road be disconnected from the storm drain and connected to the sewer. The storm drain is below the sewer so that complete relaying of the service and internal plumbing modifications may be necessary for a gravity service to be maintained.*

#### **Newcastle Road**

At the Town's request, two sewer services in the vicinity of 9 Newcastle Rd. were CCTV inspected. The homeowner had reported groundwater seepage into the basement and was concerned recent sewer work in the area (Winn's Brook Sewer Overflow Mitigation Facilities) may have damaged the service lateral. Prior to the Winn's Brook project, existing conditions had one service from 9 Newcastle and a second unknown service connected directly to the terminal manhole. Both services were connected to the new local sewer on Newcastle Rd. and replaced to the edge of pavement. Upon CCTV inspection, both services appear to emanate from 9 Newcastle. The service previously connected the manhole was inspected 51' to the plumbing connection and appears PVC and in good condition the entire length. The other service transitions to VCP at 18' and is obstructed with roots (end of CCTV at 18'). It could not be determined if the VCP service is sewer or drain. No damage to the services as a result of the Winn's Brook project was observed.

#### **Miscellaneous**

175 Brighton St. was CCTV inspected to 55' with moderate root intrusion observed. 70 Betts Rd. as obstructed at 15' due to a large root ball. We recommend the Town inform the homeowners of these conditions and the need to clean their services. *No rehabilitation is recommended at this time.*

#### **ADDITIONAL INFLOW SOURCES**

Building inspections identified numerous sump pumps illegally connected to the sewer system. Seven (7) of the illicit sump pumps identified in Table 4 are not currently included in recommended SSES work. In addition, one (1) open clean and four (4) sump pumps to undetermined discharge locations were identified. FST recommends these locations be added to any future sump pump removal program conducted by the Town.

### **SUMMARY OF RECOMMENDED WORK & OPINION OF PROBABLE COST**

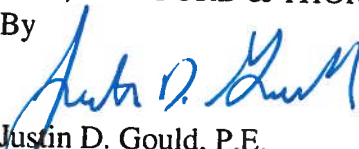
The design and construction Opinion of Probable Cost (OPC) is based on inclusion of the recommended work into a larger sewer rehabilitation contract. The cost for some of the work discussed herein is already accounted for in the 2010 cost estimate (\$752,000). For the additional work, including contractor's overhead & profit, engineering services, contingencies and police details, the OPC is approximately **\$537,000**. A detailed breakdown is presented in Table 5 and summarized below:

- 1,200 ft sewer lining
- 1,020 ft storm drain lining
- 2 point repairs
- 2 service replacements (main to edge of roadway)
- 8 service replacements (main to house)
- 5 service lining
- 1 new drain manhole

Based on the 2010 and 2011 investigations, the total cost of recommended illicit connection related rehabilitation is **\$1,289,000**. To realize construction cost savings due to economy of scale, we recommend combining the illicit connection rehabilitation work into one construction contract with I/I removal related sewer rehabilitation.

We are available to meet with you to discuss the findings of this report at any time upon your request.

Very truly yours,  
FAY, SPOFFORD & THORNDIKE, LLC.  
By

  
Justin D. Gould, P.E.  
Senior Principal Engineer

cc: Ms. Lisa Dallaire, MADEP

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BELMONT, MASSACHUSETTS  
2011 PRELIMINARY DESIGN REPORT

TABLE 1  
OUTFALL AREAS 1, 2 & 10  
BUILDING INSPECTION AND DYED-WATER TRACING RESULTS

Address		Outfall Area	No. of Tests Conducted	Date	Dye Test Entry	Sewer Connection Contamination Source	Dye Discharge		Sump Pumps	Sump Pump Discharge	Other Pipes	Sump Pit	Flow in Storm Drain	Comments
No.	Street						% Sewer	% Storm Drain						
9	Audrey Road	2	1	2/21/2011	Basement Sink	Indirect	95	5	None		None		Yes	All sewer plumbing was identified to one sewer stack. Contamination may be in conflict with 10 Bacon Rd.
47	Audrey Road	2	1	3/1/2011	First Floor Toilet	Indirect	95	5	None		Separate Drain Pipe		Yes	All sewer plumbing to main sewer stack. Separate drain pipe in cleanout pit under sewer service
15	Audrey Road	2	1	2/21/2011	Basement Sink		100	0	None		None		Yes	All sewer plumbing confirmed to main sewer stack.
16	Audrey Road	2	1	2/21/2011	First Floor Toilet		100	0	1	Ground Surface	None	1	Yes	Sump pump in back corner of house. Cleanout pit in front of house. Finished basement. Could not completely confirm sewer plumbing behind walls.
19	Audrey Road	2	2	2/21/2011	Basement Toilet & Sink		100	0	None		None		Yes	May install sump pump in future. New construction (2010). Photo provided by owner
48	Audrey Road	2	2	2/22/2011	Basement Toilet & Sink		100	0	None		None		Yes	Finished Basement. Possibly 2 separate sewer stacks. Both Dye-tested. 2" Cl by washing machine and cleanout for sewer stack behind bathroom wall
22	Audrey Road	2	2	2/22/2011	Basement Toilet & First Floor Kitchen Sink		100	0	None		Separate Drain Pipe	1	Yes	Separate Drain pipe identified appears to be directly to DMH in front of house. Sewer service to SMH in front of house
42	Audrey Road	2	1	2/22/2011	Basement Toilet		100	0	1	Sanitary Sewer	None	1	Yes	Sump Pump plumbing directly to sewer plumbing. Finished basement. Sewer stack behind wall. See photo for exposed plumbing
35	Audrey Road	2	1	5/14/2011	Basement Sink		100	0	0		None		Yes	All plumbing confirmed to main sewer stack. Partially finished basement. Sewer service was replaced from edge of roadway to 09S044.
36	Audrey Road	2	1	2/23/2011	Basement Sink		100	0	None		None		Yes	All sewer plumbing identified to main sewer stack
31	Audrey Road	2	1	2/23/2011	Basement Sink		100	0	1	Ground Surface	None	1	Yes	Perimeter foundation drain to sump pump (new). All sewer plumbing identified to main sewer stack
10	Audrey Road	2	1	2/24/2011	Basement Sink		100	0	None		Separate Drain Pipe	1	Yes	Only portable sump pump when needed. Separate drain pipe with flap valve. All sewer piping connected to main sewer.
32	Audrey Road	2	1	2/24/2011	Basement Sink		100	0	None		None		Yes	2 sewer stacks confirmed connected.
25	Audrey Road	2	1	2/24/2011	Basement Sink		100	0	1	Ground Surface	None	1	Yes	Possible sag in sewer service. Dye was more diluted in mainline than typical. All sewer plumbing confirmed to one sewer stack. 2nd sewer stack was confirmed connected to main sewer stack
26	Audrey Road	2	1	3/1/2011	Basement Sink		100	0	None		Open Cleanout		Yes	Valve on sewer cleanout in cleanout pit for possible drainage. All sewer plumbing to main sewer stack. Sewer service directly connected to SMH 09S045
10	Bacon Road	2	1	2/21/2011	Basement Sink	Indirect	95	5	None		None	1	Yes	Sewer service connects to SMH 09S053. One sewer stack collects all sewer plumbing. Contamination may be in conflict with 9 Audrey Rd.
19	Bacon Road	2	1	2/21/2011	Basement Toilet		100	0	None		None		Yes	All sewer plumbing connected to main sewer stack.
31	Bacon Road	2	2	2/23/2011	Basement Sink & First Floor Toilet		100	0	1	Ground Surface	None	1	Yes	Two pipes identified into floor. Two dye-tests conducted.
25	Bacon Road	2	1	2/23/2011	Basement Sink		100	0	1	Unknown	None	1	Yes	Sump pump is portable, when needed, not often. Not a permanent sump pump. All plumbing to one sewer stack.
30	Bacon Road	2	2	2/24/2011	Basement Toilet & Sink		100	0	None		Separate Drain Pipe		Yes	Separate pipe (capped) adjacent to sewer cleanout in pit. Finished basement. Partially exposed sewer stack.
39	Bacon Road	2	2	2/24/2011	Basement Toilet & Sink		100	0	None		Separate Drain Pipe		Yes	Separate pipe probable drain in separate pit. All sewer plumbing identified to same system.
15	Bacon Road	2	1	3/3/2011	Basement Sink		100	0	None		None		Yes	All sewer plumbing to main sewer stack. Inspected over 30 mins, then came back to inspect after 1 hour.
22	Bacon Road	2	2	3/4/2011	Basement Toilet & First Floor Kitchen Sink		100	0	None		None		Yes	2 sewer stacks identified and both were dye tested
	Bacon Rd (09S052 - 09S053)	2	1	3/8/2011	09S053		100	0						Dye-Flooded sewer section for 40 minutes. No dye was observed in Storm Drain
94	Baile Road	2	3	2/23/2011	Basement Toilet, Basement Sink & First Floor Kitchen Sink		100	0	1	Ground Surface	Basement Drain & Open Pipe		Yes	Separate drain pipe in sump pit. Basement drain in basement floor. See photo. 3 separate pipes. 3 separate tests.
21	Baile Road	2	1	3/4/2011	Basement Sink		100	0	2	Ground Surface (2)	None	2	Yes	All sewer plumbing to main sewer stack
82	Baile Road	2	1	3/1/2011	First Floor Toilet		100	0	1	Sanitary Sewer	None	1	Yes	All sewer plumbing to main sewer stack. Partially finished basement. Sewer service to Baile Rd. Sump pump hard piped to Sewer
139	Dallon Road	2	1	3/1/2011	Basement Sink		100	0	1	Ground Surface	Separate Drain Pipe	1	Yes	Foundation drain to sump pump. 1 sewer stack all plumbing to stack. Separate drain pipe in cleanout pit below sewer service. Town services sewer service for roots issue.
130	Dallon Road	2	1	3/1/2011	Basement Sink		100	0	None		Separate Drain Pipe		Yes	Dye-tested separate drain pipe after sewer was dye tested. Drain pipe to storm drain. All sewer plumbing to main sewer stack. Separate drain pipe perpendicular to sewer service cleanout in cleanout pit draining groundwater.
133	Dallon Road	2	1	3/3/2011	Basement Sink		100	0	None		None		Yes	All sewer plumbing to main sewer stack. Sewer cleanout under rug.
205	Dallon Road	2	2	3/4/2011	Basement Sink & First Floor Sink		100	0	2	Ground Surface (2)	Basement Drain (to sump pit)	2	Yes	Basement drain to sump pit. Sewer service to Shaw Rd. 2 sewer stacks tested
200	Dallon Road	2	1	3/8/2011	Basement Sink		100	0	None		None		Yes	2 sewer stacks into floor slab and was confirmed connected
18	Shaw Road	2	1	2/21/2011	Basement Sink		100	0	None		None		Yes	All sewer plumbing identified
30	Shaw Road	2	1	5/14/2011	Basement Sink	Direct to Drain	0	100	None		None		Yes	All Plumbing to main sewer stack. Direct connection to storm drain.
106	Shaw Road	2	2	3/3/2011	Basement Toilet & Sink		100	0	None		None		Yes	All sewer plumbing confirmed connected.



TABLE 1  
OUTFALL AREAS 1, 2 & 10  
BUILDING INSPECTION AND DYED-WATER TRACING RESULTS

Address				Dye Discharge				Comments						
No.	Street	Outfall Area	No. of Tests Conducted	Date	Dye Test Entry	Sewer Connection Contamination Source	% Sewer	% Storm Drain	Sump Pumps	Sump Pump Discharge	Other Pipes	Sump Pit	Flow in Storm Drain	
246	Cross St	10	1	5/14/2011	First Floor Toilet		100	0	None		None		No Drain	All plumbing to main sewer stack. Sewer service to Cross St (44S027). Out of scope of target work.
210	Brighton Street	10	1	3/2/2011	Basement Sink	Direct to Drain	0	100	1	Ground Surface	Separate Drain Pipe	1	Yes	All sewer plumbing to main sewer stack. Direct connection to storm drain. Separate drain pipe in cleanout pit beneath sewer service.
170	Brighton Street	10	2	3/4/2011	First Floor Toilet & Second Floor Toilet		0	0	1	Unknown (Pipe into Ground)	Separate Drain System	1	Yes	Possible separate drain system. 2 sewer stacks identified and both were dye tested. Dye was not identified in either sewer or storm drain. Unknown sewer service location.
188	Brighton Street	10	1	2/24/2011	Basement Sink	Indirect	85	15	None		None		Yes	All sewer plumbing identified to main sewer stack
227	Brighton Street	10	1	2/24/2011	Basement Sink		100	0	None		Separate Drain Pipe		Yes	Pipe in pit separate from sewer stack. All sewer plumbing to main sewer stack. (Home owner concerned about water usage)
184	Brighton Street	10	2	3/1/2011	Basement Sink & First Floor Sink		100	0	None		None		Yes	2 sewer stacks both dyed-water tested
181	Brighton Street	10	1	3/1/2011	First Floor Toilet		100	0	2	Storm Drain	Separate Drain Pipe	1	Yes	All sewer plumbing to main sewer stack. Sump pumps consistently run. Sump pumps piped to roof leader and hard piped to CIB at end of driveway. Separate drain pipe in pit separate from sewer cleanout.
175	Brighton Street	10	2	3/2/2011	Basement Sink & First Floor Sink		100	0	1	Ground Surface	Separate Drain Pipe	1	Yes	2 sewer stacks into floor slab. Both dyed water tested. Separate drain pipe in separate pit.
207	Brighton Street	10	2	3/2/2011	Basement Toilet & First Floor Toilet		100	0	1	Sanitary Sewer	None	1	Yes	Partially finished basement. Identified sewer stack but 2 tests were conducted due to basement bathroom. Sump pump hard piped to sewer. Bought home in 2009.
201	Brighton Street	10	2	3/3/2011	Basement Toilet & First Floor Toilet		100	0	2	Unknown (Out Foundation), Sanitary Sewer	None	1	Yes	Partially finished basement. 2 tests were conducted. 2 sump pumps, one to sink pipe and second into wall possibly to ground surface (could not identify due to snow)
216	Brighton Street	10	2	3/4/2011	Basement Toilet & First Floor Toilet		100	0	None		None		Yes	Finished basement. Sewer stack behind wall. 2 dye tests were conducted
232	Brighton Street	10	2	3/4/2011	Basement Sink & First Floor Toilet		100	0	None		Separate Drain Pipe		Yes	French drain system to loosely capped separate drain pipe. 2 sewer stacks were identified and tested
215	Brighton Street	10	1	3/6/2011	First Floor Toilet		100	0	1	Sanitary Sewer	None	1	Yes	All sewer plumbing to main sewer stack. Sump pump hard piped to sewer stack.
219	Brighton Street	10	1	3/6/2011	First Floor Toilet		100	0	1	Storm Drain	Separate Drain Pipe (for sump pump only)	1	Yes	All sewer plumbing was confirmed to main sewer stack. Separate drain pipe 4 ft above sewer service, only sump pump was connected to pipe (labeled Storm Drain).
237	Brighton Street	10	1	3/1/2011	First Floor Toilet		100	0	1	Separate Drain Pipe	Separate Drain Pipe (for sump pump only)	1	Yes	All sewer plumbing to main sewer stack. Finished basement. Separate Drain pipe approximately 2' below grade.
3	Coolidge Road	10	1	2/24/2011	Basement Sink		100	0	None		None		Yes	All sewer plumbing to main sewer stack. French drain possibly piped to sewer cleanout buried on concrete floor.
4	Coolidge Road	10	1	3/1/2011	Basement Sink		100	0	1	Other (Out Foundation into Ground)	None	1	Yes	Sump pump to probable drywell in garden. Sump pump beneath washing machine. All sewer plumbing to main sewer stack. Sewer service connected on Brighton St.
5	Oliver Road	10	1	3/1/2011	Basement Sink		100	0	1	Sanitary Sewer	None	1	Yes	All sewer plumbing to main sewer stack. Sump pump hard piped to sewer. Sewer service to Brighton St.
409	Pleasant Street	10	1	3/2/2011	Basement Sink		100	0	1	Sanitary Sewer	None	1	Yes	All sewer plumbing to main sewer stack. Sump pump hard piped to sewer.
429	Pleasant Street	10	2	3/1/2011	First Floor Toilet & Second Floor Toilet		100	0	1	Sanitary Sewer	None	1	Yes	2 sewer stacks identified and both were dye tested. Owner stated basement sink was connected to sump pump. FST could not confirm. Owner stated pump is rarely used, only once in 10 years.

BELMONT, MASSACHUSETTS  
2011 PRELIMINARY DESIGN REPORT

TABLE 2  
OUTFALL AREAS 1, 2 & 10  
SANITARY SEWER AND STORM DRAIN RECOMMENDED REHABILITATION

Street	Outfall Area	Priority*	Manhole No.		Pipe Diameter (inches)	Distance (feet)	Joint Spacing (feet)	No. of Point Repairs	Point Repair Locations **	Recommended Rehabilitation		No. of Service Connections	No. of Service Connections Replaced	Location of Services Replaced **	No. of Service Connections Lined	Location of Services Lined **	Notes
			Direction	Start	End					Line	Replace						
Bacon Rd	2	4	Downstream	09S052	09S051	8	257	1	173'	257	NRR	6	0		1	244' (3:00)	Many sections with moderate to severe cracked and broken pipe (173'). Minor roots throughout.
Bacon Rd	2	4	Downstream	09S053	09S052	8	68	0		68.3	NRR	0	0		0		Several sections with moderate to severe cracked and broken pipe
Audrey Rd	2	4	Downstream	09S046	09S052	8	270	1	266'	270	NRR	5	0		2	22' (9:00), 101.4' (9:00)	Several severe broken pipe sections. Severe broken pipe at 266' large void in soil. Service not active at 28'. Inspection complete. One minor crack. Slight offset joints throughout and minor to moderate roots at a few joints.
Bacon Rd	2	2	Downstream	09D091	09D086	10	256	0		NRR	NRR	2	0		0		Minor offset joints and roots throughout. Capped pipe at 48'. Could not televise last 12' camera zoomed in. Inspection complete. Minor to moderate roots at joints throughout. Infiltration identified. Offset joints throughout.
Bacon Rd	2	2	Upstream	09D091	Stub	12	48	0		NRR	NRR	0	0		0		Minor offset joints and roots throughout. Capped pipe at 48'. Could not televise last 12' camera zoomed in. Inspection complete. Minor to moderate roots at joints throughout. Infiltration identified. Offset joints throughout.
Audrey Rd	2	2	Downstream	09D079	09D091	8	289	0		NRR	NRR	6	0		0		Several Sections of moderate to severe cracking. Infiltration evident. Service replacement could be delayed.
Brighton St	10	4	Downstream	45S028	41S045	15	252	0		252	NRR	5	0		1	72.9' (3:00)	Several Sections of moderate to severe cracking. Infiltration evident. Service replacement could be delayed.
Brighton St	10	4	Downstream	41S045	41S044	15	209	0		209	NRR	5	1	160.7' (9:00)	1	121' (3:00)	Several Sections of minor to severe cracking. Infiltration evident. Service replacements could be delayed.
Brighton St	10	2	Downstream	41S044	42S002	15	94	0		NRR	NRR	2	0		0		3 joints with minor circumferential cracks.
Brighton St	10	1	Upstream	41S043	42S002	15	110	0		NRR	NRR	1	0		0		Mineral deposits at several joints throughout
Brighton St	10	3	Downstream	41S043	41S042	15	143	0		143	NRR	4	1	110' (9:00)	0		One severely broken service and one moderate crack.
Brighton St	10	2	Downstream	41S042	37S025	15	162	0		NRR	NRR	5	0		0		Section in pretty good condition, one minor circumferential crack. Service at 107.6 has circumferential crack could be delayed.
Brighton St	10	1	Downstream	37S025	41S041	15	52	0		NRR	NRR	1	0		0		Pipe in good condition
Brighton St	10	3	Downstream	44D046	41D046	24	247	0		247	NRR	5	0		0		Minor to moderate longitudinal cracks throughout. Paper/debris identified in flow (13:36) POSSIBLE DIRECT CONNECTION UPSTREAM OF 41D046
Brighton St	10	4	Downstream	41D046	42D048	24	309	0		309	NRR	7	0		0		Minor to severe longitudinal crack throughout. Service at 208.8' is believed to be sewer service from 210 Brighton St.
Brighton St	10	3	Downstream	42D048	37D036	24	460	0		460	NRR	7	0		0		Minor to moderate longitudinal cracks throughout. Minor to moderate roots at joints throughout (1"-4" thick).
Coolidge Rd	10	2	Downstream	42S000	42S002	8	219	0		NRR	NRR	6	0		0		Slight offset joints throughout, several joints with mineral deposits. 1 minor crack at 55'
Holt Rd	10	2 - INC	Upstream	41S041	37S026	8	194	0		NRR	NRR	1	0		0		Inspection incomplete. A few minor offset joints. Mineral deposits identified at one joint. No services for 170 Brighton St
Livermore Rd	2	3	Downstream	09D029	09D038	12	233	0		NRR	NRR	8	0		0		Minor to moderate roots at joints throughout. Several minor longitudinal crack throughout. Several services with roots.
TOTALS						3,872		2		2,215	0	76	2		5		

\* 1 (Excellent Condition) - 5 (Severe Deterioration)  
\*\* Distance from Starting Manhole in feet (Orientation of Service Lateral)

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TABLE 3  
OUTFALL AREAS 1, 2 & 10  
SANITARY SEWER SERVICE TELEVISION INSPECTION & RECOMMENDATIONS

No.	Address	Outfall Area	NWMCC Section No.	NWMCC Disk No.	Start Manhole	Mainline Diameter (in)	Location of Service from Start MH	Service Diameter (in)	Length of Service Televised (ft)	Inspection End Location	Defects	Recommended Rehabilitation		Notes
	Street											Service Replacement	Line Service	
10	Bacon Rd	2	66	3	09S053		TO SMH	6	41	Cleanout	Moderate Roots and Slight offset joints throughout		YES	Minor to moderate Roots at joints throughout. Slight offset joints throughout.
9	Audrey Rd	2		1 of 2	09S046	8	174.5	6	35	Obstruction (rootball)	Offset joints and minor to severe rootballs throughout		YES (root control)	Service has slight offset joint from and minor to severe roots at joints throughout. Severe rootball at 35'.
47	Audrey Rd	2		1 of 2	09S043	8	95	6	46	Pipe Size Change 6'-4"	Separated joint at 3.5'(PVC-VCP connection); Minor cracks at 17.5'; minor rootball and pipe size change		YES	Separated joint at 3.5'(PVC-VCP connection); Minor cracks at 17.5'; minor rootball and pipe size change
35	Shaw Rd	2	21	2	09S039	8	96	6	53	Cleanout	Sag (2'-9'). Slight offset joints		YES	Sag 2'-9' from mainline, camera under water. Slight offset joints throughout.
56	Shaw Rd	2	22	2	09S020	8	175.5	6	46	Cleanout	Mineral Deposits/ Conc. at Slight offset joints throughout		YES	Mineral Deposits/ Concrete at joints throughout slightly offset joints 5'-10%
63	Shaw Rd	2	22	2	09S020	8	98.1	6	37	Pipe Size Change 6'-4"	Standing Water (0-20'), Offset Joints approx. (1')		YES	Standing water 0-20', televised when camera was removed. Minor to moderate offset joints throughout approx. 1'.
109	Shaw Rd	2	23	2	09S016	8	128.2	6	58	Beyond Cleanout	Severe Rootball at 0', Offset joints with moderate roots (25'-34')		YES (root control)	Camera under water 0-25'. Offset joints with moderate roots (25'-34'). Severe Rootball at wve connection.
21	Livermore Rd	2	24	2	09S016	8	123.9	6	40	Capped (bricked)	None		No Rehab	Service in good condition. Sewer service not connected to sewer.
64	Livermore Rd	2	25	2	09S036	8	75.5	6	10	Obstruction (unknown)	Possible collapsed pipe	To Edge of Roadway	NO (obstruction)	Standing sewage in pipe (Sag). Something obstructing camera, camera under water. Possible collapsed pipe.
22	Betts Rd	2	27	2	09S008	8	58.7	6	45	Cleanout	Separated Joint at 4'		YES	Service in good condition completely PVC. Possible separated joint at 4' possible exfiltration source.
64	Betts Rd	2		1 of 2	09S040	8	124.7	6	43	Pipe Size Change 6'-4"	Offset joint at 0.5'; sag from 2'-19' camera under water	YES (0-19')	YES	Offset joint at 0.5'; sag from 2'-19' camera under water
70	Betts Rd	2	26	2	09S040	8	44	6	15	Obstruction (rootball)	Severe rootball at 15'	No Rehab	No Rehab	Moderate roots at Joints severe rootball at 15' can not pass with camera.
186	Washington St	2	28	2	19S002	8	102.7	6	35	Obstruction (concrete)	Hole in pipe at 18', deposits		YES	Hole in pipe at 18'. concrete/ deposits at several locations 10-30% blockage
187	Washington St	2	63	2	07S022		TO SMH	6	2	Capped (VC cap)	None		No Rehab	Capped service.
187A	Washington St	2	63	2	07S022		TO SMH	6	41	Pipe Size Change 6'-4"	Offset joint, Roots		YES (root control)	Moderate offset at 5', moderate roots at joints throughout
192	Washington St	2	28	2	19S002	8	170	6	6	Severe Offset	Severe offset with soil exposed and empty void.	To Edge of Roadway	NO (severe offset joint)	2 Severe offset joints with infiltration and exposed soil.
215	Washington St	2	67	3	09S030	8	8.8	6	61	Middle of Section	Separated Joints - Soil visible w/ active infiltration. Minor Roots at 23'. Appears to be several sags.	No Rehab	No Rehab	Separated Joints with soil visible, active infiltration identified. Minor root at 23'. Appears to be several sags.
253	Washington St	2	64	2	20S034	10	75.8	6	3	45 deg. Bend up/Capped	None. Appears to be capped a few feet up the lateral		No Rehab	Appears not active and appears to be capped.
253A	Washington St	2	64	3	20S034	10	112.9	6	4	Rootball/blockage	100% blocked rootball	To Edge of Roadway	NO (rootball)	Severe Blockage Possible rootball, 100% blocked.
22	Sharpe Rd	2	65	3	20S036	8	78.9	6	48	Cleanout	Minor Root at 2', slight offset joints throughout		YES	Minor root at 2', slight offset joints throughout. Service is active.
22	Chilton St	10	20	1	44S006		TO SMH	6	48	Beyond Cleanout	Broken Pipe, Minor Roots	To Edge of Roadway	YES	Severe broken pipe at 4' and minor fine roots
23	Chilton St	10	20	1	44S006		TO SMH	6	34	Pipe Size Change 6'-4"	Moderate Roots		YES	Several Joints with minor to moderate roots
70	Waterhouse Rd	10	68	3	37S022	8	8	6	30	Obstruction (under water)	Standing Sewage 7'-30', moderate roots at joints	To Building	NO (under water)	Moderate roots at joints, sag/offset at 7' causing standing sewage. Camera under water 7'-30'.
99	Sherman St	10	69	3	37S020	8	43	6	41	Cleanout	Broken Pipe at 1', severe sag from 15' -26'. Standing sewage, moderate roots	To Building	NO (severe sag/broken pipe)	Moderate broken pipe at 1'. Severe sag/ broken pipe 15'-26' camera under water. Moderate roots.
55	Holt Rd	10	70	3	37S028	8	32.6	6	37	Pipe Size Change 6'-4"	Offset joints throughout 1'. Minor roots		YES	Offset joints throughout approx. 1'. Minor roots.
170	Brighton St	10		2 of 2	41S042	15	138.7	6	22	Obstruction (rootball)	Severe rootball & blockage at 22'		YES	Major rootball and blockage at 22' appears to be sewage in invert of service
170(A)	Brighton St	10		2 of 2	41S042	15	110	6	1	Capped	None		No Rehab	Capped at 1'
175	Brighton St	10		2 of 2	41S042	15	106	6	54	Unknown (Under water)	Moderate roots at 32', 35', 38'. Camera under water from 39'-54'		No Rehab	No rehab necessary. Moderate roots at 32', 35', 38'. Camera under water from 39'-54'
188	Brighton St	10	78	4	42S043	15	56.5	6	2	Capped	None. Appears to be capped a few feet up the lateral		No Rehab	Appears to be Capped
188A	Brighton St	10	78	4	42S043		TO SMH	6	45	Cleanout	Sag (10'-16'). Moderate cracks 29'-33', minor roots (27'-36')		YES (root control)	Sag with standing sewage at 10'-16'. moderate cracks at 30', minor roots at 27'-36'
9	Newcastle Rd	10		1 of 2	38S001A	8	8	6	51	Pipe Size Change 6'-4"	None		No Rehab	PVC service good
9(A)	Newcastle Rd	10		1 of 2	38S001A	8	15.1	6	18	Obstruction (rootball)	Moderate rootball at 18'		No Rehab	PVC service good to PVC - VCP connection at 18 with moderate rootball.
21	Livermore Rd		8/30/2011		09D029	12	104	6	0	Capped	None		No Rehab	Capped at 1'
21	Livermore Rd		8/30/2011		09D029	12	108.8	6	2	Rootball	Severe rootball at 1 5'	Disconnect from Drain & Connect to Sewer	NO	Severe Rootball at 1 5' incomplete inspection
DL	Fairview Ave	1		2 of 2	03D008	30	302.6	10	55	Obstruction (rootball)	Severe Rootball at 55'. Camera under water from 30'-50'		No Rehab	Severe Rootball at 55'. Camera under water from 30'-50'
TOTALS									930					

DL = Drain Lateral

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**TABLE 4  
ILLCIT SUMP PUMP CONNECTIONS**

Address		No. of Sump Pumps	Sump Pump Discharge	Other Pipes	Sump Pits	Comments
No.	Street					
42	Audrey Road	1	Sanitary Sewer	None	1	Sump Pump plumbing directly to sewer plumbing. Finished basement. Sewer stack behind wall. See photo for exposed plumbing
82	Betts Road	1	Sanitary Sewer	None	1	All sewer plumbing to main sewer stack. Partially finished basement. Sewer service to Betts Rd. Sump pump hard piped to Sewer.
207	Brighton Street	1	Sanitary Sewer	None	1	Partially finished basement. Identified sewer stack but 2 tests were conducted due to basement bathroom. Sump pump hard piped to sewer. Bought home in 2009.
215	Brighton Street	1	Sanitary Sewer	None	1	All sewer plumbing to main sewer stack. Sump pump hard piped to sewer stack.
5	Oliver Road	1	Sanitary Sewer	None	1	All sewer plumbing to main sewer stack. Sump pump hard piped to sewer. Sewer service to Brighton St.
409	Pleasant Street	1	Sanitary Sewer	None	1	All sewer plumbing to main sewer stack. Sump pump hard piped to sewer.
429	Pleasant Street	1	Sanitary Sewer	None	1	2 sewer stacks identified and both were dye tested. Owner stated basement sink was connected to sump pump. FST could not confirm. Owner stated pump is rarely used, only once in 10 years.
<b>TOTAL</b>		<b>7</b>				
<b>UNDETERMINED DISCHARGE LOCATIONS - SUMP PUMPS/OPEN CLEANOUT</b>						
26	Audrey Road	None		Open Cleanout		Valve on sewer cleanout in cleanout pit for possible drainage. All sewer plumbing to main sewer stack. Sewer service directly connected to SMH 09S045
25	Bacon Road	1	Unknown	None	1	Sump pump is portable, when needed, not often. Not a permanent sump pump. All plumbing to one sewer stack.
170	Brighton Street	1	Unknown (Pipe into Ground)	Separate Drain System	1	Possible separate drain system. 2 sewer stacks identified and both were dye tested. Dye was not identified in either sewer or storm drain. Unknown sewer service location.
201	Brighton Street	2	Unknown (Out Foundation). Sanitary Sewer	None	1	Partially finished basement. 2 tests were conducted. 2 sump pumps, one to sink pipe and second into wall possibly to ground surface (could not identify due to snow)
4	Coolidge Road	1	Other (Out Foundation into Ground)	None	1	Sump pump to probable drywell in garden. Sump pump beneath washing machine. All sewer plumbing to main sewer stack. Sewer service connected on Brighton St
<b>TOTAL</b>		<b>5</b>				

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**TABLE 5  
RECOMMENDED REHABILITATION  
OPINION OF PROBABLE COST**

ITEM NO.	ITEM OF WORK	ESTIMATED QUANTITIES	UNITS	UNIT COST	AMOUNTS
2	8-INCH SEWER - FULL LENGTH LINING	595	LF	\$45	\$26,775
3	15-INCH DRAIN - FULL LENGTH LINING	605	LF	\$65	\$39,325
4	24-INCH DRAIN - FULL LENGTH LINING	1020	LF	\$110	\$112,200
5	REINSTATEMENT OF SERVICE CONNECTIONS	35	EACH	\$150	\$5,250
6	SEWER OR DRAIN POINT REPAIR REPLACEMENT (6-10 INCH)	2	EACH	\$7,500	\$15,000
9	SERVICE REPLACEMENT (main to edge of roadway)	2	EACH	\$7,500	\$15,000
10	SERVICE REPLACEMENT (main to house)	8	EACH	\$10,000	\$80,000
11	SERVICE LINING	5	EACH	\$5,000	\$25,000
13	NEW DRAIN MANHOLE	1	EACH	\$12,000	\$12,000
14	TEMPORARY PAVING (trench)	217	SY	\$15	\$3,250
15	PERMANENT PAVING (trench)	260	SY	\$40	\$10,400
16	MOBILIZATION	1	LS	5% of Total	\$17,210
SUBTOTAL					<b>\$361,410</b>
CONTRACTOR OVERHEAD & PROFIT @ 20%					\$72,282
ENGINEERING & CONTINGENCIES @ 25%					\$90,353
TRAFFIC POLICE 320 HOURS @ \$40					\$12,800
<b>TOTAL</b>					<b>\$536,845</b>







