

To: **Christopher Okafor, Director of Operations**

Department of Public Works
Town Building
195 Main Street
Maynard, MA 01754

From: Victor A. Olson, P.E.

Stantec
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File: 195112889

Date: December 8, 2015

**Reference: Hayes Street Drain Pipe Investigation Memorandum
Maynard, MA**

Abutters to the Hayes Street Drain Pipe have reported concerns with flooding along the easement areas where the drain pipe runs parallel to Hayes Street along private property. The Town of Maynard DPW moved forward with a drainage investigation to document the current condition of the drain. This memorandum provides a summary of the Hayes Street Drainage Investigation and recommendations for improvements to the operation of the drain line.

DRAIN CONFIGURATION

The drain pipe takes drainage from an open stream and wetland area adjacent to the Glenwood Cemetery, across Harrison Street to McKinley Street.



Open stream enters Hayes Street drain at the McKinley Street headwall.

The open stream then enters through a headwall into a cast in place concrete and masonry arch culvert under McKinley Street. This culvert appears to have originally been constructed to carry flow northerly from one side of McKinley Street to the other side. The stream was later culverted from this point to the Assabet River.

The culvert turns and enters into a 24 inch diameter vitrified clay tile culvert and runs northerly parallel to Hayes Street for approximately 100 feet through private property behind house number 22 Hayes Street Design with community in mind

Reference: **Hayes Street Drain Pipe Investigation Memorandum
Maynard, MA**

crossing under the garage to a drainage structure behind a shed at house number 20 Hayes street. This structure is raised and has a steel plate cover. Access to the location is difficult to access in private property. The drain increases in size to 30 inch diameter at this structure and runs approximately 175 feet northly crossing under Roosevelt Street to a drainage structure located behind house number 14 Hayes Steet.



Garage at house number 22 Hayes Street has encroached over the drain.



Drain Line runs cross country behind house number 22 and parallel to Hayes Street to drainage structure behind house number 20 Hayes Street.

Design with community in mind

Reference: **Hayes Street Drain Pipe Investigation Memorandum
Maynard, MA**

The structure at house number 14 Hayes Street has a larger 4'x8' steel plate cover that required machinery to remove to gain access to the drain and is also located on private property. The 30 inch drain continues to run northerly approximately 150 linear feet in private property crossing under two garages at 14 and 12 Hayes Street that also have been constructed over the top of the drain line to a drain manhole at Arthur street.



Drainage structure behind house number 14 Hayes Street.



Two garages have encroached over the drain line.

Design with community in mind

Reference: Hayes Street Drain Pipe Investigation Memorandum
Maynard, MA

The concrete block drain manhole (DMH) 1 at Arthur Street also takes in additional street drainage from an additional pipe connection. The 30 inch drain then continues to run approximately 35 linear feet northerly to DMH 2 with a grate behind house number 8 Arthur Street. The pipe increases to 36 inch diameter in size at this location and is constructed of corrugated metal pipe where it previously replaced the existing vitrified clay drain for approximately 125 linear feet to the DMH behind house number 2 Hayes Street. The Maynard Department of Public Works recently made additional repairs to this drain manhole in September 2015.



Drainage manhole 1 at Arthur St Looking north from Arthur Street towards DMH 2 behind 8 Arthur St.

The 36 inch drain then continues for another approximately 30 feet before discharging into a special transition drainage structure to a box culvert located on private property at the 49-51 Waltham Street condominium development. Drainage from the development ties into this special structure from the best management bioretention pond. The 5' x 4' reinforced concrete box culvert runs for approximately 70 linear feet and then into a 42 inch diameter cast iron drain before discharging into a drain manhole where into drops into a 48 inch diameter reinforced concrete drain at Waltham Street A copy of a site plan for the 49-51 Waltham Street Development Project was obtained from the Maynard Planning Board and shows the configuration of the drain in this area and is attached for your reference. This residential development project now completed was under construction during these investigations and demolition of a building structure over the drain had been completed. Foundations of the new residential buildings are directly adjacent to the existing drain and construction of new decks and patios are also constructed over the drain line.

Reference: **Hayes Street Drain Pipe Investigation Memorandum
Maynard, MA**



View of 49 -51 Waltham Street development under construction from Hayes Street. Drain Line runs under corner of concrete slab that has since been removed. The corner of the special transition structure can be seen in center of photograph where the 36 inch diameter drain discharges into the box culvert shown..



View looking down DMH 4 at Waltham Street where the 42 inch diameter cast iron drain drops into the 48 inch diameter RCP drain before crossing under Waltham Street. Additional drainage from Waltham Street also discharges into this manhole.

Design with community in mind

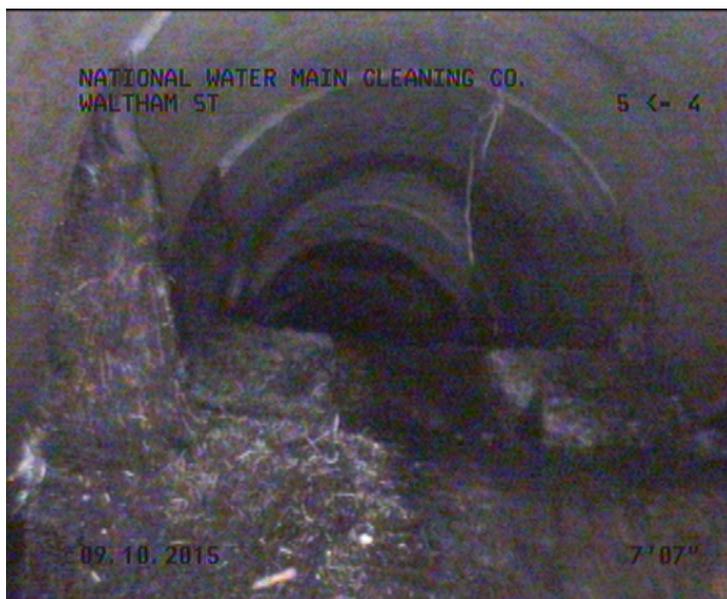
Reference: Hayes Street Drain Pipe Investigation Memorandum
Maynard, MA

The 48 inch diameter drain crosses under Waltham Street for approximately 50 linear feet and then runs from Waltham Street to Douglas Avenue for approximately 240 linear feet through private property out to Douglas Street from there it turns and runs westerly down Douglas Avenue to Powder Mill Road for approximately 1,050 linear feet. The drain pipe then turns and runs northerly down Powder Mill Road for approximately 250 linear feet near the intersection with Butler Avenue where it turns westerly approximately 100 linear feet to where it discharges into the Assabet River.

DRAINAGE INVESTIGATION

Stantec originally performed a site visit on July 9, 2015 of the project area to assess physical surface conditions and context of drainage configuration and conditions and reviewed closed circuit television inspection report prepared by Wayne's Drains and associated video files for a portion of the drain pipe provided by the DPW and determined the entire length of the Hayes Street drain be fully inspected by CCTV to fully address the Town of Maynard's concerns. The Town authorized inspection of the Drain line from McKinley Street headwall to Waltham Street as part of the scope of this investigation. A section of the 24 inch drain between the arch culvert and the structure behind house number 20 could not be CCTV'd due to access and bend in pipeline. The cross country section of drain between Waltham Street and Douglas Street was CCTV'd. The drain was CCTV'd as part of this evaluation on September 10th and 18th, 2015.

In general the drain is very shallow and runs across a low lying area behind the homes along Hayes Street. The groundwater is also very high in this area. The drain line will not relieve the level of groundwater in the area however it does provide a location for discharge of sump pumps. The drains current configuration has little cover and runs under a low lying elevation area that when the upstream wetland and the downstream Assabet River are at flood stage during extreme wet weather events the drain line can become surcharged from backwater and full flow conditions. The elevation of the rear yards are such that this type of flooding may not be relieved by increasing the capacity of pipe. The investigations did identify a couple of locations where the pipe diameter is reduced in size from previous pipe repairs and that a section of drain is severely constricted due to roots taking up more than half of the pipe capacity in the 48 inch Diameter line under Waltham Street.



48 inch diameter drain under Waltham Street is severely constricted with roots.
Design with community in mind

Reference: Hayes Street Drain Pipe Investigation Memorandum
Maynard, MA

The results of the drain investigation are summarized as follows. An overview figure of the Hayes Street Drain investigation is provided in figure attached in Appendix pocket for your reference in reviewing this report.

Arch Culvert

Visual inspection of this arch culvert shows it is structurally sound and functioning adequately. Periodic inspection should be done to monitor conditions over time and complete minor masonry repairs to they don't progress into major repairs. The original grate over the culvert has corroded away and a replacement grate was reported to be available but was not in place during inspection. The grate will prevent large debris washing into culvert during high flows and will keep trespassers from entering culvert .

24" VC Drain

We were unable to inspect approximately 100 feet of this drain because we could not gain access through the backyard without impacting fences and rutting lawn area. In addition the bend in pipe prevented access from the upstream arch culvert. It is recommended that this be inspected when follow-up construction recommendations are completed to verify condition and sizes throughout length. The garage at house number 22 Hayes St. encroaches over the drain.

30" VC Section #7 (Drainage structure at house number 20 to drainage structure house number 14)

This section of drain was in poorest condition. There were three previous repairs made to this line that included excavated spot repairs. A 40 foot section of the 30 inch VC line was replaced with 24 inch diameter HDPE truss pipe to repair a collapsed section. A 20 foot section of the VC line was replaced with 30 inch corrugated metal pipe (CMP) to replace another collapsed section. An excavated spot repair was also identified that patched a hole in the pipe with a section of VC pipe and masonry.

This line exhibited longitudinal cracking and medium root intrusion. In addition, this line has another section that is beginning to collapse.

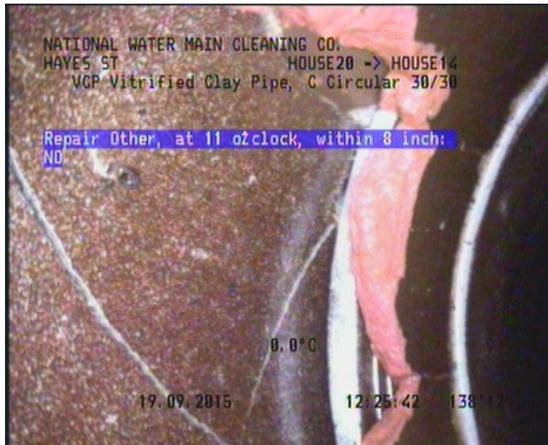


Medium root intrusion

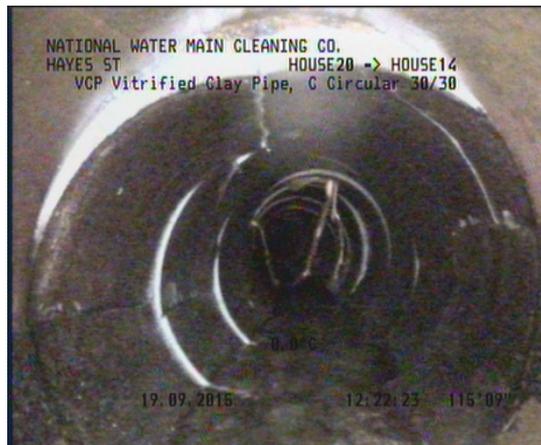
Previous spot repair and adjacent longitudinal pipe crack

Design with community in mind

Reference: Hayes Street Drain Pipe Investigation Memorandum
Maynard, MA



Previous hole repair



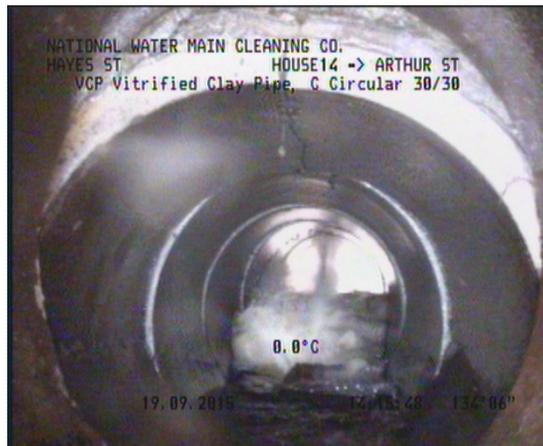
Partial collapse of Drain

30" VC Section #8 (Drainage structure at house number 14 to DMH 1 at Arthur Street)

This section of drain also has a section that is beginning to collapse just before it connects to DMH 1 under Arthur Street. In addition there is a hole in the pipe where soil is visible just before Arthur Street. The remainder of the line is intact with some medium roots but the two garages at House numbers 14 and 12 encroach over the drain.



Hole in pipe, soil is visible

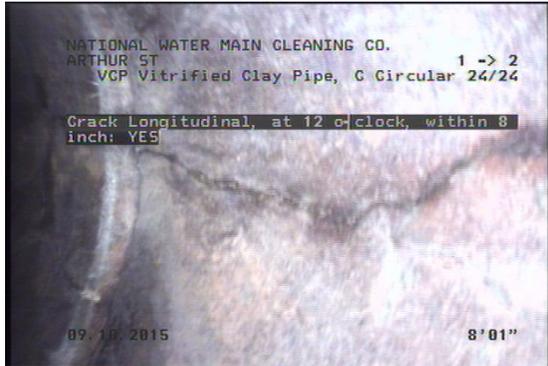


Partial collapse of Drain

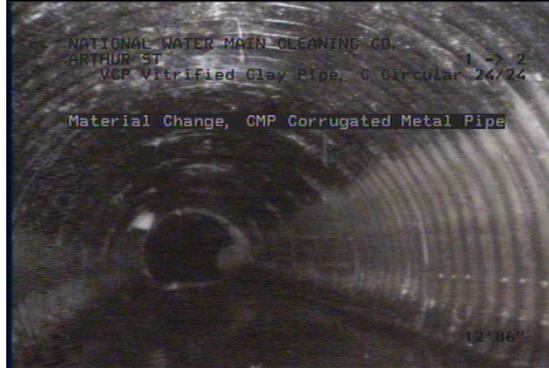
24" VC Section #1 (DMH 1 at Arthur Street to DMH 2 behind House Number 8 Hayes Street)

There is a 12.5 foot section of 24 inch VC pipe that leaves DMH 1 and transitions to a 30 inch CMP where 22 foot section all the way to DMH 2 was replaced. It is functioning but the decrease in size constricts the flow .

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Maynard, MA



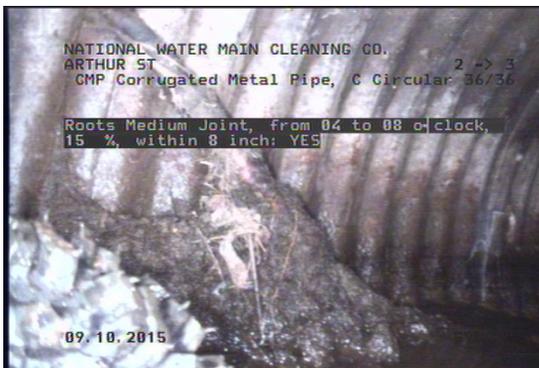
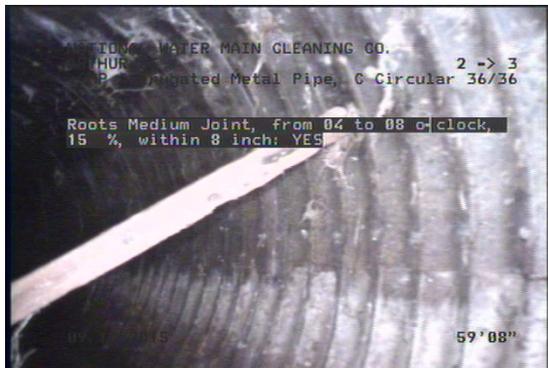
Longitudinal crack in VC pipe



Section of drain was replaced with CMP

30" CMP Section #2 (DMH 2 behind House Number 8 to DMH 3 behind House Number 2 Hayes Street)

This section of drain was previously replaced with corrugated metal pipe. It has some medium root intrusion but is functioning. The drainage structure at DMH 3 sits in low elevation and can be subject to ponding. As previously stated, DPW made repairs to concrete block DMH 3.



Section of drain replaced with 36" CMP Medium roots at joint

30" CMP Section #3 (DMH 3 behind House Number 2 to Special transition structure at rear of 49-51 Waltham Street development)

This approximately 30 foot long section of drain was also previously replaced with corrugated metal pipe. It has a couple of intruding connections at approximately 25.5 and 26.5 feet respectively that could be trimmed back to remove obstructions but is functioning well.

Reference: **Hayes Street Drain Pipe Investigation Memorandum
Maynard, MA**



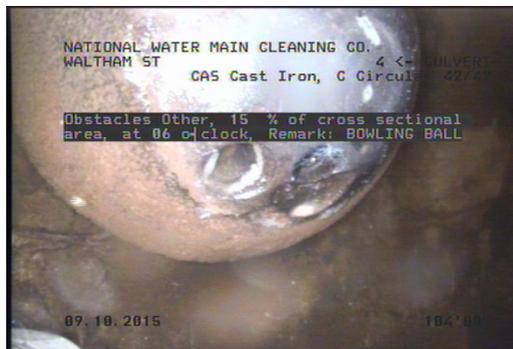
Protruding connection



Protruding drainage connection

42" CI and 5'x4' reinforced concrete box culvert Section #4 (Special transition structure at rear of 49-51 Waltham Street development to DMH 4 on Waltham Street

The RCP box culvert is in excellent condition with some minor debris including a cinder block and bowling ball that should be removed. The 42 inch diameter cast iron portion section of this drain is also in very good condition



Box culvert with minor debris

48" RCP Section #5 (DMH 4 on Waltham Street to DMH 5 on other side of Waltham St at edge of driveway at #

This 48 inch diameter RCP drain is severely restricted with root intrusion with more than half the pipe obstructed by roots, grit and debris.

Reference: Hayes Street Drain Pipe Investigation Memorandum
Maynard, MA



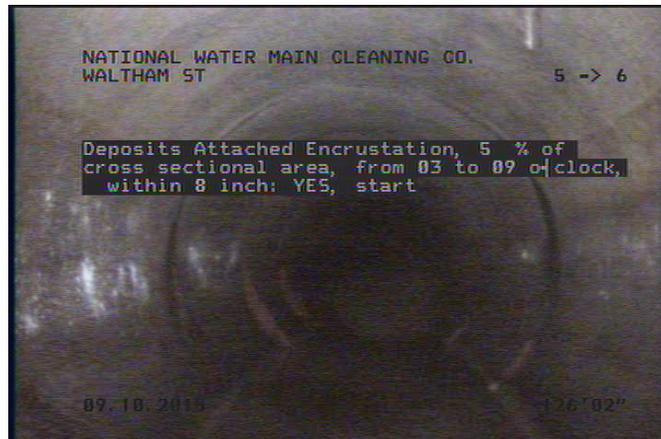
Sewer root balls and intrusion

48" RCP Section #6 (DMH 5 at edge of driveway at # Waltham Street to DMH 6 on Douglas Street

This 48 inch diameter RCP is in good condition with a previous repair noted at the 70 foot mark and some minor encrustation and fine roots noted

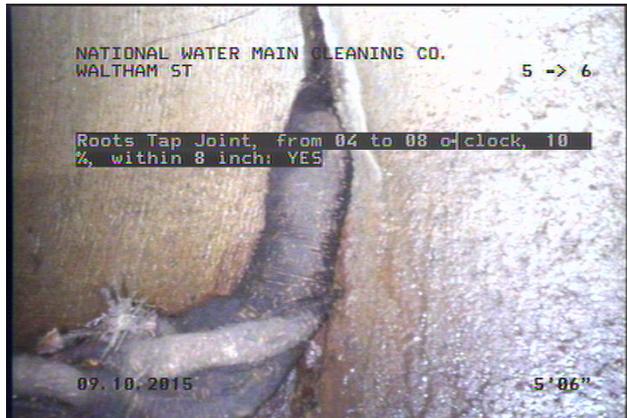


Previous pipe repair

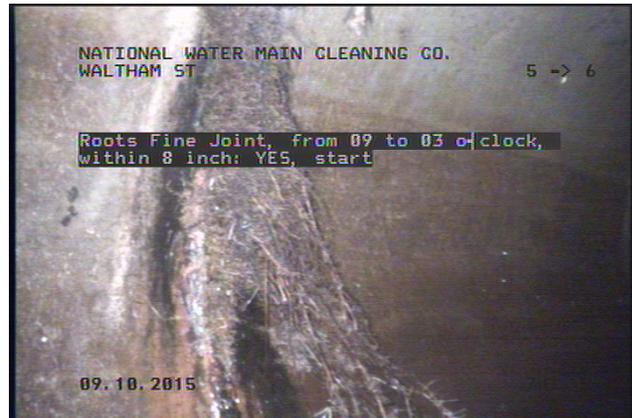


Minor Encrustation

Reference: Hayes Street Drain Pipe Investigation Memorandum
Maynard, MA



Tap root



Fine roots at joint

DRAINAGE RECOMMENDATIONS

We have included flooding considerations and prepared recommendations to improve the performance of the existing drain and to restore the structural capacity of failing sections of the drain line. An overview figure of the Hayes Street Drainage Recommendations is provided in figure attached in Appendix pocket for your reference in reviewing this report

Flooding Considerations

The Hayes Street drain is very shallow and has little cover over the top of the pipe. Therefore, when the pipe is flowing full it has little freeboard to surcharge during extreme wet weather events. The elevation of the water levels of the upstream wetland area it drains and the Assabet River to where the drain discharges have an impact on how the drain performs during extreme wet weather events. Increasing the pipe size may not have an impact on local ponding when the waterways connected by the drain are at flood stage. Replacement of the drain with a larger drain along the existing layout may not be feasible without adding fill over the drain located between McKinley Street and Arthur Street. This is not practical without major disruption of private property and due to encroachment of structures over the top of the drain.

The Town could consider disconnecting the upstream wetland stream connection from the existing Hayes Street Drain. This would require installation of a new 36 inch drain along the Hayes Street roadway right of way from McKinley Street to Waltham Street to relieve backyard flooding. The existing drain would still be subject to backwater flooding in the most severe flooding elevations along the Assabet River. The elevation grades along Hayes Street roadway are higher than the backyards where the existing drain flows which would allow the upstream wetland drainage to flow through the pipe without adding to localized ponding. The existing drain would remain to serve the local neighborhood drainage connections.

The existing Hayes Street Drain however was noted as having a few restrictions in pipe size and roots that should be addressed to restore the original pipe flow capacity and structural and operation issues that should be addressed sooner to restore capacity to relieve flooding; maintain the current service level and restore structural integrity of the drain.

Reference: Hayes Street Drain Pipe Investigation Memorandum
Maynard, MA

Recommendations for Existing Hayes Street Drain

The drain is general is located on private property however if could not be determined at this time if a formal easement exists for the entire drain other than a small portion on the 49-51 Waltham Street property. The Town should determine if a formal easement exists otherwise a right of entry to gain access to perform drainage repairs will need to be negotiated.

Any excavations will require restoration of surfaces including roadways, sidewalks, driveways, walkways, lawn and landscaped areas and fences. Proper documentation of these preconstruction conditions would be required to ensure restoration to equal or better conditions.

Monitor Arch Culvert

Periodic inspection should be done to monitor conditions over time and complete minor masonry repairs so they don't progress into major repairs. The original grate over the culvert has corroded away and a replacement grate was reported to be available but was not in place during inspection. The grate will prevent large debris washing into culvert during high flows and will keep trespassers from entering culvert. Consider adding an access manhole just beyond the downstream end of the culvert to improve operations access.

Inspect, Clean and Line 24" VC Drain and line

It is recommended that this be inspected when follow-up construction recommendations are completed to verify condition and sizes throughout length. The garage at house number 22 Hayes St. encroaches over the drain. Line pipe with cured in place liner if line is to remain in service.

Replace 30" VC Section #7 (Drainage structure at house number 20 to drainage structure house number 14)

It is recommended that this section be completely replaced from drainage structure to drainage structure. There have been a few repairs on the line already including a section that reduces the capacity from a 30 inch down to a 24 inch diameter line and the sections between repairs that are cracked, with root obstructions and beginning to collapse.

Replace existing pipe with a 36 inch class IV reinforced concrete pipe and gasketed joints. The drainage structure at House number 20 will need to be reconstructed along with the invert at drainage structure at house number 14. There is a drainage connection on Roosevelt Street at the 123 foot position at which a new drain manhole is recommended to be constructed to accommodate the connection and to provide access. A private connection to the new drain at the 113 foot position is also required.

Partial Replace, Root Treatment Clean and Line 30" VC Section #8 (Drainage structure at house number 14 to DMH 1 at Arthur Street)

This section of drain also has a section of it that is beginning to collapse just before it connects to DMH 1 under Arthur Street. In addition, there is a hole in the pipe where soil is visible just before Arthur Street. There is a section of 8 inch sewer in Arthur Street that has also collapsed near where the sewer crosses under the drain. This section of drain should be replaced when the sewer is replaced because it will completely collapse when the sewer is reconstructed. The sewer work is currently under design and replacement of this section of drain should be accommodated at the same time.

Reference: Hayes Street Drain Pipe Investigation Memorandum
Maynard, MA

Replace existing pipe with a 36 inch class IV reinforced concrete pipe and gasketed joints. The remainder of the line is intact with some medium roots. The two garages at House numbers 14 and 12 encroach over the drain which make replacement difficult and failure may produce collateral damage. It is recommended that the pipe be treated to remove roots and that the line be thoroughly cleaned and a cured in place liner be installed through this section to protect the structural integrity of the pipe and extend its design life.

Replace 24" VC Section #1 (DMH 1 at Arthur Street to DMH 2 behind House Number 8 Hayes Street)

There is a section of 24 inch VC pipe that leaves DMH 1 and transitions to a 30 inch CMP. It is recommended to replace this line with a 36 inch class IV reinforced concrete pipe and gasketed joints to improve pipe capacity and restore structural integrity. In addition, it is recommended that drain manhole 1 be replaced and drain manhole 2 be reconstructed to accommodate replacement pipe.

Monitor and Root Treatment 30" CMP Section #2 (DMH 2 behind House Number 8 to DMH 3 behind House Number 2 Hayes Street)

Periodically monitor this line for roots and provide root treatment as needed.

Monitor and Trim Protruding Connections 30" CMP Section #3 (DMH 3 behind House Number 2 to Special transition structure at rear of 49-51 Waltham Street development)

Periodically monitor this line for roots and condition. Consider trimming two protruding connections at approximately 25.5 and 26.5 feet respectively.

Remove Minor Debris 42" CI and 5'x4' reinforced concrete box culvert Section #4 (Special transition structure at rear of 49-51 Waltham Street development to DMH 4 on Waltham Street)

Manned entry is required to remove minor debris including a cinder block and bowling ball. It is recommended that this debris be removed when manned entry is performed to remove roots from next section.

Remove Roots Grit and Debris 48" RCP Section #5 (DMH 4 on Waltham Street to DMH 5 on other side Waltham St at edge of driveway at #

Manned entry is required to remove roots, grit and debris in this 48 inch diameter RCP drain to restore full flow capacity. Dewatering of upstream DMH 4 will be required to safely remove roots. The Town should consider removal of roots as soon as possible in this severely restricted pipe to restore flow capacity. It is also recommended that the pipe be treated for roots and periodically monitored to ensure full capacity is maintained and that root intrusion is controlled. This effort will require specialty firms to complete the work.

Remove Minor Roots 48" RCP Section #6 (DMH 5 at edge of driveway at # Waltham Street to DMH 6 on Douglas Street)

Remove some minor fine roots and perform spot root treatment when upstream manned entry root removal is completed upstream. Inject grout at previous spot repair and areas where encrustation noted.

Reference: Hayes Street Drain Pipe Investigation Memorandum
Maynard, MA

CCTV Remainder of Drain Pipe System on Douglas Street to outfall at the Assabet River

It is recommended that the remaining 1,400 l.f. of the drainage system downstream of the Hayes Street drain from Douglas Street to the outfall at the Assabet River be inspected by CCTV to completely assess the condition of this drainage system.

BUDGET COST ESTIMATE

A summary of budget costs to implement the recommendations described above for rehabilitation of the Hayes Street Drainage Pipe are summarized in table below.

HAYES STREET DRAIN RECOMMENDATIONS BUDGET COSTS

REHABILITATION METHOD	QUANTITY	UNIT PRICE	ESTIMATED CONSTRUCTION BUDGET
Drain Defects			
Chemical Root Treatment of 24 -36 inch drain	350 l.f.	\$25.00/l.f.	8,725
Manned Entry Root Removal 48 inch drain	1 l.s.	\$15,000/l.s.	15,000
Clean and CCTV 24 inch Drain	100 l.f.	\$5,000/day	5,000
Manhole to Manhole Pipe Replacement – cut and cover (30" diameter RCP)	176 l.f.	\$250/l.f.	44,000
Manhole to Manhole Pipe Replacement – cut and cover (36" diameter RCP)	35 l.f.	\$250/ l.f.	8,750
Excavated Point Repairs Pipe Replacement – cut and cover (30" diameter RCP) (40' length)	40 l.f.	\$300/l.f.	12,000
Cut Protruding Laterals	2 each	\$750/each	1,500
Manhole to Manhole CIPP Lining of 30 inch pipe	150 l.f.	\$167/l.f.	25,050
Manhole to Manhole CIPP Lining of 24 inch pipe	100 l.f.	\$167/l.f.	16,700
Manholes			
Manholes Reconstructed	4 each	\$4,000/each	16,000
Manholes New Installed	1 each	\$6,000/each	6,000
CCTV			
Douglas Street Drain Pipe to Assabet River Outfall	1,400 l.f.	\$10.00/l.f.	\$14,000
Subtotal			\$172,725
30% Contingencies and Engineering			\$51,800
Total			\$225,000



Reference: Hayes Street Drain Pipe Investigation Memorandum
 Maynard, MA

A summary of additional budget costs to consider for installation of a new 36 inch drain along the Hayes Street roadway right of way from McKinley Street to Waltham Street to relieve backyard flooding by disconnecting the upstream wetland stream connection from the existing Hayes Street Drain.

CONSIDERATIONS OF HAYES STREET DRAINAGE RELIEF PIPE OPTION BUDGET COSTS

NEW DRAIN CONSIDERATION	QUANTITY	UNIT PRICE	ESTIMATED CONSTRUCTION BUDGET
Drain			
Manhole to Manhole Pipe Construction – cut and cover (36" diameter RCP)	900 l.f.	\$275/ l.f.	247,500
Manholes			
Manholes Reconstructed	1 each	\$4,000/each	4,000
Manholes New Installed	6 each	\$6,000/each	36,000
Subtotal			\$287,500
30% Contingencies and Engineering			\$86,250
Total			\$375,000

We are prepared to discuss the findings and recommendations included in this memorandum. Please let us know if you have any questions on this matter.

STANTEC CONSULTING SERVICES INC.

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c. G. McCarthy, Stantec

**Attachments: Hayes Street Drainage Investigation Plan
 Hayes Street Drainage Recommendations Plan**



CCTV 1,400 LF FROM DOUGLAS STREET TO ASSABET RIVER

REMOVE ROOTS (REQUIRES MAN ENTRY AND DEWATERING TO REMOVE ROOTS, GRIT AND DEBRIS)

RECONSTRUCT MANHOLE

REPLACE DRAIN WITH 30\"/>

RECONSTRUCT OR REPLACE DRAIN MANHOLE

SPOT REPAIR

TRANSITION COLLAR

30\"/>

REBUILD INVERT

ADD DRAIN MANHOLE TO ACCESS DRAIN FROM ROOSEVELT STREET

REPLACE SECTION #7 DRAIN WITH 30\"/>

40\"/>

19\"/>

RECONSTRUCT DRAIN MANHOLE

CCTV INSPECT LINE FROM MANHOLE AT HOUSE 20 WHEN ACCESS IS AVAILABLE THROUGH YARD. FOR CONSTRUCTION VERIFY SIZE AND CONDITION AND CONSIDER CURED-IN-PLACE LINER

CONSIDER ADDING NEW ACCESS MANHOLE

CONSIDER DISCONNECTING UP STREAM DRAINAGE FROM EXISTING PIPE AND RECONNECTING DRAINAGE AROUND TO RELIEVE BACKYARD FLOODING BY INSTALLING NEW 36\"/>

TRANSITION BETWEEN CULVERT AND 24\"/>

ARCH CULVERT

HEADWALL

OPEN STREAM

