

Mass DEP I/I Analysis

Wed 9/20/2017 7:10 AM

From: "Mike Carter"

To: "'Jim McKay'", "'Mike Guzinski'"

Cc: "'Jim Coe'"



Jim and Mike, Attached you will find three documents related to DEP requirements for an I/I analysis which is required to be completed by 12/31/2017. When we met with the DEP in May, we indicated we would be asking for an extension of time to complete the requirement. The following is a description of what is contained in the letter.

- One letter is a request of extension of time for one year to 12/31/2018.
- The summary letter would also be submitted documenting how much work the Town has done since 2008.
- The third letter is a proposal to comply with the requirements of the DEP Analysis/Plan which would need funding at your fall town meeting. We have minimized the scope of work to the maximum extent possible to comply with the requirement.

Once you have had a chance to review, I am available to meet with you to discuss the scope of work. I would recommend we submit the extension letter as soon as possible. If you recall, at our meeting they indicated they would prefer we do not wait to the last moment to submit the request.

Mike

Michael J. Carter, PE, PLS

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September 18, 2017

Att: David Boyer
Massachusetts Department of Environmental Protection
Surface Water Discharge Permit Program
8 New Bond Street
Worcester, MA 01606

RE: I/I Analysis/Plan Extension Request
Town of Millis – Wastewater Collection System

Dear Sir:

On behalf of the Town of Millis, GCG Associates is requesting an extension on the December 31, 2017 deadline to submit an I/I Analysis/Plan to MassDEP. This request contains information on sewer sanitary overflows and past I/I studies, and a schedule for completing the I/I analysis/plan by December 31, 2018, including:

- A plan and schedule to undertake the work to comply with the requirements for an I/I Analysis in accordance with 314 CMR 12.04(2) by December 31, 2018.
- A summary of past I/I or sewer system studies/reports (See attached detailed summary letter to James McKay, dated September 12, 2017)
- A summary of the municipality's I/I abatement efforts over the last 5-10 years (funding, work performed), including dates, locations, and an estimate of SSO volumes
- A summary of the authority's historical wet weather SSO events (for at least the past 10 years)
- Where required under 314 CMR 12.04(2)(d), for CSO permittees and tributary communities, a description of the municipality's program to provide for 4:1 I/I removal for any new connections for which design flows exceed 15,000 gpd. (Not applicable for the Town of Millis wastewater collection system)

I/I Analysis/Plan 2008 – 2016

In 2008, GCG Associates performed a I/I analysis for the year 2007 and divided the Town's sewer system into 4 study Subbasins based upon information collected from meter and pump station flow data, groundwater data and precipitation data. From July to December of 2007 near drought conditions with minimal rainfall and groundwater levels were recorded. This provided a conservative base sanitary flow to compare to the wet season wastewater flow from January to

June of 2007 and allowing an estimation of the amount of infiltration and inflow by comparing the wet and dry season flows. Based upon budgeting constraints of approximately \$125,000 annually, the Town and GCG decided to perform further investigations and repairs on a Subbasin by Subbasin approach for the sewers. The investigations consisted of night manhole flow isolation, manhole inspections, and CCTV inspections. The results of the investigations were summarized with peak infiltration and inflow rates, recommended repair method and estimated cost of repair. At present, the Town is scheduled to complete the final phases V/VI of the sewer system repair projects in 2018 and 2019, which consist of the open excavation repairs/replacements of sewer services, mains and castings. The total estimated peak I/I removed due to all repair work to date is 141,170 gpd and the total estimated peak I/I for all remaining repair work is 37,660 gpd. The following tables summarize the Town's I/I abatement efforts and the historical wet weather Sanitary Overflow Sewer (SSO) events for the past 10 years.

Town of Millis
Wastewater Collection System I/I Abatement Efforts
April 2008 thru September 2017

YEAR	APPROPRIATED ENGINEERING AND CONSTRUCTION FUNDS	PROJECT
2008 - 2009	\$125,000	I/I Flow Analysis, Flow Isolation, CCTV and Manhole Investigations
2010	\$125,000	Phase I Sewer Investigation and Rehabilitation Project
2011 – 2012	\$125,000	Phase II Sewer Investigation and Rehabilitation Project
2013 – 2014	\$125,000	Phase III Sewer Investigation and Rehabilitation Project
2015 – 2016	\$125,000	Phase IV Sewer Rehabilitation Project
Total to 2016	\$625,000	
2017-2018	\$125,000	Phase IV Sewer Rehabilitation Project
2018-2019	\$125,000	Phase IV Sewer Rehabilitation Project
Anticipated Total to 2019	\$875,000	Completion of Sewer Investigations and Rehabilitation beginning in 2008
Additional Reports and Projects		
2012	\$25,000	Town Pump Station Inspection and Maintenance Plan

2014	\$800,000	Water Street Pump Station Replacement Project
2015	\$50,000	Prepared a Capacity, Management, Operation and Maintenance Plan and GIS Manhole Location
Total	\$875,000	

Sanitary Sewer Overflow History

Millis has experienced 3 sanitary sewer overflows (SSOs) since 2007. The following table describes the overflow dates, locations, quantities and causes. The Town has not experienced any sanitary sewer overflows in the last 10 years that were related to capacity and/or related to infiltration and inflow.

SSO date	Location	Volume released	Cause of release
2/11/2014	Union Street	500 gal.	10" Ductile Iron Force Main Pipe broke due to a leaking pipe joint causing corrosion of the pipe wall and resulting in a break discharging sewer when pumping.
3/30/2014	Union Street	500 gal.	10" Ductile Iron Force Main Pipe broke close to first break/pipe corrosion of the pipe wall and resulting in a break discharging sewer when pumping.
4/5/2014	Union Street	500 gal.	10" Ductile Iron Force Main Pipe broke close to first/second break/pipe corrosion of the pipe wall and resulting in a break discharging sewer when pumping. Approximately 25 feet of pipe exposed, inspected and replaced. No further breaks to date.

For a more detailed in-depth review of work completed, see attached letter dated September 12, 2017.

I/I Analysis/Plan Scope 2017 – 2018

The I/I plan which is intended to be used for the Town of Millis is in accordance with the MassDEP Guidelines for Performing Infiltration/Inflow Analyses and Sewer System Evaluation Surveys (latest revision dated May 2017). The I/I plan shall begin in the spring of 2018 according to the following guidelines. This plan will be subject to funding at the Millis's November Town Meeting.

TASK 1 – March through June of 2018

- Continuous flow metering to begin March or April 2018 by utilizing the data from the town's SDADA system and three (3) existing permanent flow meters and three (3) additional temporary flow meters deployed within the (6) Subbasins established in the previous I/I study.

- Rainfall shall be monitored for the 10-week period. A rain gauge shall be located at the Millis DPW to measure local precipitation.
- Groundwater data shall be utilized from a USGS monitoring site located in Norfolk and located approximately 6 miles from downtown Millis.
- After 4 weeks of flow metering data is collected the method recognized by MassDEP as the "Single Season Two Phase Gauging and TV Inspection Approach" shall be utilized. If sufficient dry high groundwater data is collected during this time, then a preliminary analysis shall be performed to select those Subbasins requiring further flow isolation gauging based upon the 4,000 gpd/idm rule. Metering shall continue regardless in all Subbasins for the entire 10-week monitoring period to supplement the flow data. This approach will save one year's time and allow progressing into a Sewer System Evaluation Survey (SSES) in the same season and will eliminate the problems with comparing I/I flow data in one season and SSES data collected in a second season.
- Extensive Manhole and TV Inspections shall be conducted based upon the flow isolation gauging results within areas with high infiltration rates and in the same season. All inspections shall be performed according to the National Association for Sewer Service Companies (NASSCO) guidelines. The measured flow isolation rate shall be compared to the estimated rates during TV inspections and adjusted using best engineering judgment.
- An analysis of the flow data shall be conducted to determine the sanitary, infiltration and inflow components of the wastewater flow.
- Prepare an I/I Analysis Report summarizing the results of the field investigations and data analysis and shall consist of the following:
 - Executive Summary highlighting all tasks performed, conclusions, and recommendations, approximate costs and schedule for further work with tables and estimated quantities of extraneous flows.
 - Description of the wastewater Collection System.
 - Description of problems with the system.
 - Sewer Map delineating pipe sizes, Subbasins and gauging locations.
 - Summary and Tables for gauging results flow determinations.
 - Cost effective Analysis
 - An assessment of the SSO risk from the five-year design storm based on findings, system historical data, performance data during similar or larger storms or based upon a calibrated sewer system model.
 - Appendices – Manhole Inspections, flow hydro graphs for each Subbasin, dry weather flow graphs, model calibration data, and pertinent information.

TASK 2 – July through November 2018

- After completion of the I/I Analysis, complete a Sewer System Evaluation Study within Subbasins exhibiting high infiltration and high inflow to determine specific infiltration/inflow sources in the sewer system and select the appropriate rehabilitation method.
- Review flow isolation data, rainfall data groundwater data and extensive Manhole and TV Inspections for infiltration and inflow collected previously in Spring of 2018.
- Perform Smoke Testing to identify areas where stormwater/groundwater are entering the sanitary sewer system.
- Perform Dyed Water Testing to identify and confirm sources of inflow to the sanitary sewer system for direct and indirect stormwater connections.

- Perform property inspections and house-to-house inspections to visually identify inflow sources on private property.
- Perform a Cost-Effectiveness Analysis for I/I to determine whether the I/I is excessive.
- Develop rehabilitation methods and costs for infiltration and inflow sources.
- Prepare a SSES Report summarizing the results of the field investigations and data analysis and shall consist of the following:
 - Executive Summary highlighting all tasks performed, conclusions, and recommendations, approximate costs and schedule for further work with tables and estimated quantities of I/I components.
 - Description of the wastewater Collection System.
 - Description of problems with the system.
 - Sewer Map delineating pipe sizes, Subbasins and gauging locations.
 - Summary and Tables for gauging results and flow determinations.
 - Results of inspections and recommendation for rehabilitation.
 - Cost effective Analysis.
 - Proposed recommendations including cost and schedule for repairs and follow up post construction flow metering.
 - Appendices – Detailed manhole and TV inspections, smoke and dye test logs, property inspections, dry weather flow graphs, model calibration data, and pertinent information.

If you have any questions or additional information is required please contact Mike Carter at GCG Associates (978-657-9714) or Jim McKay, Millis Assistant DPW Director (508-376-5424). We look forward to hearing from you regarding our request for extension of time.

Respectfully submitted,

GCG ASSOCIATES, INC.

Michael J. Carter

Michael J. Carter, P.E., P.L.S.
President

GCG ASSOCIATES, INC.

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September 12, 2017

Mr. James McKay
Town Hall
900 Main Street
Millis, MA 02054

RE: Sewer System I/I Study
(2008 to 2017 Overview)

Dear Mr. McKay:

This letter is in response to your request for an overview of the sewer system infiltration and inflow investigations and repair work conducted by this office beginning in 2008 through the present. The following is a list of the reports prepared by this office with an accompanying summary.

October 14, 2008 – Sewer System I/I Study – Status Report 1

- Updated the Overall Sewer System Map and divided into four study areas or subbasins based upon the locations of meter and pump stations and there contributing sewers, allowing sanitary flows to be isolated.
- Performed a I/I analysis for the year 2007 for each sub basin from collected meter and pump station flow data, groundwater data and precipitation data. From July to December of 2007 near drought conditions with minimal rainfall and groundwater levels were recorded. This provided a conservative base sanitary flow to compare to the wet season wastewater flow from January to June of 2007 and allowing an estimation of the amount of infiltration and inflow by comparing the wet and dry season flows.

Average Daily Flow by Week (gpd/week)		Sub Basin 1	Sub Basin 2	Sub Basin 3	Sub Basin 4	Sub Basin 1-4
Average Daily Dry Season Flow (July to December 2007)		104,302	134,659	9,316	1,665	249,942
Average Daily Wet Season Flow (Jan to June 2007)		178,041	168,706	10,600	1,963	359,310
Average Daily I/I Flow (Wet - Dry Season Flow)		73,739	34,047	1,284	298	109,368
% Average Daily I/I Flow		41%	20%	12%	15%	30%

Peak Week Average Daily Wet Season Flow					
(Week of the 23rd of April 2007)	309,429	287,286	18,957	2,514	618,186
Peak Week Average Daily I/I Flow					
(Peak Week Wet -Dry Season Flow)	205,126	152,626	9,641	849	368,243
% Peak Average Daily I/I Flow		66%	53%	51%	34%
					60%

- Performed night manhole inspections throughout Subbasin 2 during off peak hours in April 2008 to determine sewer mains that would require further investigations.
- Subbasin 2 consists of approximately 45,000 linear feet of 8" to 18" diameter, vitrified clay, asbestos concrete, cast iron and PVC gravity sewer mains, four sewerage pump stations located on Water Street, Dover Road, Heritage Path and the condominiums off Clark Road, 8,500 linear feet of force mains and 225 manholes. Most of the sewer mains are vitrified clay and with manholes constructed entirely of brick and mortar.
- After a review of the night inspections and observed flow data, GCG Associates hired Northeast Pipeworks to clean and CCTV inspect approximately 20,000 linear feet of sewer mains and GCG completed 180 manhole inspections within Subbasin 2.
- Reviewed the CCTV and manhole inspections and prepared detailed tables which identified the I/I location and source, repair recommendation, observed I/I, repair cost and cost per gallon of removal. The tables were further summarized in the following table.

Summary Table
Subbasin 2

Table No.	Total Observed I/I (Gpd)	Total Estimated Repair Cost (\$)	Total Cost per Gallon per Day of Removal (\$/gpd)
No. 1 - Identified I/I Sources within Sewer Mains	15,840	32,000.00	1.97
No. 2 - Identified I/I Sources within Sewer Services	12,960	10,600.00	0.97
No. 3 - Identified I/I Sources within Sewer Manholes	44,110	38,950.00	2.64
Subtotal No.1-3 - Identified I/I	72,910	81,550.00	1.86
No. 4 - Future Clear Flow Sewer Service Investigations	40,320	14,500.00	0.73
Subtotal No.4 - Clear Flow Investigations	40,320	14,500.00	0.73
No. 5 - Sewer Pipeline - Maintenance	0	45,320.00	N/A
No. 6 - Manhole - Maintenance	0	18,900.00	N/A

Subtotal No.5-6 - Maintenance	0	64,220.00	N/A
Total No. 1-6		160,270.00	

May 19, 2009 – Sewer System I/I Study – Status Report 2

- Performed night manhole inspections throughout Subbasin 1 during off peak hours in March 2009 to determine sewer mains that would require further investigations.
- Subbasin 1 consists of approximately 70,000 linear feet of 8" to 18" diameter, vitrified clay, asbestos concrete, cast and ductile iron and PVC gravity sewer mains, five sewerage pump stations located on Middlesex Street, Norfolk Road, Timberline Road and the condominiums off Key Street and Clarke Road, 9,500 linear feet of force mains and 360 manholes. The length of sewers within Subbasin 1 is approximately twice as large as the length of sewers in Subbasin 2. Most of the sewer mains are PVC with manholes constructed of precast concrete.
- After a review of the night manhole inspections and observed flow, GCG Associates decided to divide Subbasin I into three sub-areas of study. Subbasin 1-A and 1-B consist of primarily 8" to 12" sewers and are considered tributary subbasins to Subbasin 1-C, which consists primarily of the larger 15" to 18" trunk line sewers. During manhole inspections conducted within Subbasin 1-C, most of the trunk lines were observed to be flowing half full and flow from possible I/I could not be determined accurately by visual inspection.
- GCG Associates decided to investigate possible sources of I/I observed within the tributary Subbasins 1-A and 1-B further, and retained National Water Main Cleaning Company to clean and CCTV inspect approximately 20,000 linear feet of sewer mains within Subbasins 1-A and 1-B. GCG associates completed 104 manhole inspections along the sewer lines investigated within the Subbasins 1-A and 1-B.
- Reviewed the CCTV and manhole inspections and prepared detailed tables which identified the I/I location and source, repair recommendation, observed I/I, repair cost and cost per gallon of removal. The tables were further summarized and combined with the 2008 results from Subbasin 2 in the following table.

Summary Table

Subbasins 1-A, 1-B and 2

Table No.	Total Observed I/I (Gpd)	Total Estimated Repair Cost (\$)	Total Cost per Gallon per Day of Removal (\$/gpd)
No. 1 - Identified I/I Sources within Sewer Mains	30,960	40,000.00	1.28
No. 2 - Identified I/I Sources within Sewer Services	23,760	14,600.00	0.80
No. 3 - Identified I/I Sources within Sewer Manholes	66,410	50,600.00	1.95
Subtotal No.1-3 - Identified I/I	121,130	105,200.00	1.34

No. 4 - Future Clear Flow Sewer Service Investigations	87,120	31,000.00	0.42
Subtotal No.4 - Clear Flow Investigations	87,120	31,000.00	0.42
No. 5 - Sewer Pipeline - Maintenance	0	64,370.00	N/A
No. 6 - Manhole - Maintenance	0	21,800.00	N/A
Subtotal No.5-6 - Maintenance	0	86,170.00	N/A
Total No. 1-3/5-6 - Repairs		191,370.00	
Total No. 1-6 – Repairs and Investigations		222,370.00	

October 25, 2010–Phase I–Sewer System Rehabilitation Project–Construction Summary Report

- On March 12, 2010, the town of Millis received bids for the Phase I – Sewer System Rehabilitation Project and awarded the project to National Water Main and Cleaning Company.
- The repairs and investigations were completed by National Water Main Cleaning Company and consisted of the following major work items:
 - a. Twenty-seven (27) sewer manholes rehabilitated by leak sealing and patching with an estimated removal of 37,640 gpd of peak infiltration.
 - b. Twenty-three (23) sewer manholes rehabilitated by cementitious coating with an estimated removal of 15,180 gpd of peak infiltration.
 - c. Three (3) sewer manholes rehabilitated by epoxy coating to prevent structural failure and to prevent damage from hydrogen sulfide.
 - d. Sixty-nine (69) sewer services with clear flows investigated by closed circuit television inspection with 30,960 gpd of confirmed peak infiltration, 27,000 gpd of remaining clear flow to investigate and 28,800 gpd of clear flow omitted.
 - e. Twenty (24) sewer service connections tested, resulting in thirteen (13) connections rehabilitated by testing and sealing with an estimated removal of 12,600 gpd of peak infiltration and eleven (11) connections testing and passing not requiring rehabilitation.
- The total estimated peak I/I removed due to the repair work is 65,420 gpd. An additional 30,960gpd peak I/I was confirmed during the clear flow investigations.

May 19, 2011 – Phase II – Sewer System I/I Investigations Report

- GCG Associates decided to investigate possible sources of I/I previously observed within Subbasin 1-C during night inspections., GCG retained National Water Main Cleaning Company to clean and CCTV inspect approximately 9,000 linear feet of sewer mains within Subbasin 1-C. GCG associates completed 43 manhole inspections along the sewer lines investigated within the Subbasin 1-C. These inspections completed the investigations of the sewers which are tributary to the main trunk sewer line which flows to the treatment plant from Auburn Road along Main Street for the remainder of Subbasin 1-C.
- The findings and repair costs were summarized within the tables attached to the report. The total peak I/I identified for repair is 19,900 gpd and the total clear flows requiring further investigation is 11,700 gpd.

May 19, 2011 – Phase II – Sewer System I/I Summary Report

- Summary of all work completed to date and summary of outstanding repair work. The cost of repairs was updated and all repair work within the subbasins was combined. The repair work was further divided into tables for each type of repair expected with an estimated cost and estimate of I/I removal.

September 14, 2012 – Phase II – Sewer System Rehabilitation Project – Construction Summary Report

- On October 28, 2011, the town of Millis received bids for the Phase II – Sewer System Rehabilitation Project and awarded the project to National Water Main and Cleaning Company.
- The repairs were completed by National Water Main Cleaning Company and consisted of the following major work items:
 - a. Twenty (20) sewer manholes rehabilitated by leak sealing and patching with an estimated removal of 17,340 gpd of peak infiltration.
 - b. Three hundred seventy-four (374) joints tested and one hundred thirty four (134) joints sealed on 8" clay sewer mains with an estimated removal of 3,240 gpd of peak infiltration.
 - c. Ten (10) sewer service connections tested and sealed, resulting in thirteen (13) connections rehabilitated by testing and sealing with an estimated removal of 10,080 gpd of peak infiltration.
 - d. A total of sixty-four (64) feet of 8" diameter cured in place short liner installed at fourteen (14) repair locations with an estimated removal of 25,560 gpd of peak infiltration.
 - e. A total of twenty-eight (28) feet of 10" diameter cured in place short liner installed at one (1) location after cleaning by chain flail/cutter to remove heavy rust deposits from an unlined cast iron pipe which did not result in the removal of infiltration but was completed to prevent future blockages or pipe failure.

- f. A total of one hundred twenty-six (126) feet of 10" diameter cured in place manhole to manhole long liner installed at two (2) locations after cleaning by chain flail/cutter to remove heavy rust deposits from an unlined cast iron pipe and defective clay pipe which did not result in the removal of infiltration but was completed to prevent future blockages or pipe failure.
 - g. A total of four (4) feet of 12" diameter cured in place short liner at one (1) repair location not installed because of future connection resulting in 360 gpd of peak infiltration omitted.
- The total estimated peak I/I removed due to the repair work is 56,220 gpd.

February 27, 2013 – Phase III – Sewer System I/I Investigations Summary Report 1

Summary of the investigation work completed this in spring of 2012 within the main trunk sewers in Sub basin 1-C. Previously, I/I could not be determined by night manhole inspections due to half full - large diameter pipes of the main trunk sewers which flow from Exchange Street along the railroad tracks and Main Street to the Medway treatment plant. GCG retained Inland Waters to CCTV inspect approximately 8,500 linear feet of 12" to 18" diameter sewer main and perform 36 manhole inspections during the off peak – night flows.) The following is a summary of the findings.

- a. Six (6) sewer manholes requiring rehabilitation by leak sealing and patching with an estimated removal of 2,880 gpd of peak infiltration.
- b. One (1) sewer manhole frame and cover broken and requiring replacement.
- c. Seventeen (17) sewer services requiring additional CCTV inspections to determine the source of observed clear flows of an estimated 20,160 gpd.
- d. One thousand (1,000) linear feet of sewer main within an easement to #1575 Main Street to at the Medway town line to determine the source of observed clear flows of an estimated 2,880 gpd.
- e. Elimination of 1,440 gpd clear flow sewer service building inspections by confirming that Phase II - repair work had removed all observed clear flow from three (3) sewer service connections.
- f. Identified approximately 1,650 linear feet of 18" ductile iron sewer main along the railroad tracks from Auburn Road to Main Street in which the asphaltic lining is delaminating from the cement lining and pipe wall. Most likely due to hydrogen sulfide damage originating from the Water Street pump station upstream as identified in previous reports. GCG recommends an annual cleaning and monitoring of this section of sewer main. If an annual cleaning is performed in combination with the recommended cleaning and maintenance at the Water Street pump station, then there poses no problem to the exposed cement lining and damage will not continue to occur.

March 3, 2015 – Phase III – Sewer System I/I Investigation and Repair Summary Report 2

- March 14, 2014, the town of Millis received bids for the Phase III – Sewer System Rehabilitation Project and awarded the project to Inland Waters, Inc.
- The investigation and repair work was completed by Inland Waters, Inc and consisted of the following major work items:
 - a. Five (5) sewer manholes rehabilitated by leak sealing and patching with an estimated removal of 5,040 gpd of peak infiltration.
 - b. Twenty (20) sewer manholes rehabilitated by repairing brick masonry under frame and cover with an estimated removal of 450 gpd of inflow.
 - c. Removed two (2) miscellaneous obstructions within sewer pipes resulting in no I/I removal.
 - d. CCTV inspected forty (40) sewer services from the sewer main to investigate 39,780 gpd of unidentified clear flows, ruled out 4,500 gpd clear flow and confirmed 11,520 gpd of repairable peak infiltration within four (4) sewer services requiring repair by open excavation and the complete replacement of the 6" clay sewer service to the Clyde Brown School which is approximately 300 feet in length. Section of the old service should be properly abandoned at building. One service with a clear flow of 360 gpd that is not in use was obstructed needs to be cleaned before continuing CCTV inspection. Found that twenty-three (23) of the sewer services require CCTV inspection from the building cleanout to determine the source 23,400 gpd of unidentified clear flows.
 - e. CCTV inspected 12 (twelve) sewer services from the building cleanouts to investigate 19,800 gpd of unidentified clear flows and was not able to confirm source of flow or the flow was identified normal usage or leakage.
 - f. Cleaned 3,200 feet of 8" through 15" diameter sewer main by removal of grease with chemical treatment on sewers previously identified that did not result in the removal of infiltration but was completed to prevent future blockages.
 - g. Cleaned 3,000 feet of 8" through 12" diameter sewer main by removal of roots with chemical treatment on sewers previously identified that did not result in the removal of infiltration but was completed to prevent future blockages.
 - h. Installed sixty (60) feet of 10" diameter cured in place short liner installed at one (1) location after cleaning by chain flail/cutter to remove heavy rust deposits from an unlined cast iron pipe that did not result in the removal of infiltration but was completed to prevent future blockages or pipe failure.
 - i. Cleared trees from the Farm Street cross country sewer easement. Cleaned and inspected approximately 2,100 feet of 8" and 12" diameter sewer pipe and found that the pipeline has some minor sags but is in good condition.
 - j. The unidentified clear flow of 2,880 gpd previously identified during night manhole inspections was not present when inspecting the 8" sewer service for 1575 Main Street. The service is in good condition.

- The total estimated peak I/I removed due to the repair work is 5,490 gpd. An additional 11,520 gpd peak I/I was confirmed during the clear flow investigations.

Present – Phase IV – Sewer System Rehabilitation Project

- July 7, 2016, the town of Millis received bids for the Phase IV – Sewer System Rehabilitation Project and awarded the project to Ponch Excavation, Inc.
- The repair work was completed by Ponch Excavation, Inc and consisted of the following major work items:
 - a. Thirteen (13) sewer services and two (2) sewer mains rehabilitated by open excavation through replacement and point repairs with an estimated removal of 14,040 gpd of peak infiltration.

I/I Study Summary
April 2008 thru September 2017

YEAR	REMOVED PEAK I/I TO DATE (GPD)	REMAINING PEAK I/I TO DATE (GPD)	REMAINING CLEAR FLOW INVESTIGATIONS (GPD)	TOTAL POSSIBLE PEAK I/I (GPD)
2008 – Investigations (Subbasin 2)	0	72,910	40,320	113,230
2009 – Investigations (Subbasin 1A & 1B)	0	48,220	46,800	95,020
Total to 2009		121,130	87,120	208,250
2010 – Phase I Investigations and Repairs	65,420	79,830	29,160	174,410
2011 – Phase II Investigations (Subbasin 1C)	0	19,900	11,700	31,600
Total to 2011	65,420	99,730	40,860	206,010
2012 - Phase II Repairs	56,220			
	121,640	43,510	40,860	206,010
2012 – Phase III Investigations (Subbasin 1C- Main Street Interceptor)		2,880	23,040	
Adjustments for omissions, etc.		-720	-1,440	
Total 2013	121,640	45,670	62,460	229,770

2014 - Phase III – Repairs/Investigations	5,490	11,520(New) 5,490(Removed)	27,180 (Discard) 11,520(confirmed)	
Total 2014	127,130	51,700	23,760	202,590
2015 - Phase IV – Repairs	14,040			
	141,170	37,660	23,760	202,590

2017 and 2018– Phase V and VI – Sewer System Rehabilitation Projects

- The town of Millis to plan on receiving bids for Phase V and VI – Sewer System Rehabilitation Projects in the 2017 and 2018 construction seasons.
- The repair work will consist of the following major work items:
 - a. Fifteen (15) sewer services and three (3) sewer mains rehabilitated by open excavation through replacement and point repairs with an estimated removal of 28,800 gpd of peak infiltration.
 - b. Thirty-Two (32) sewer manholes rehabilitated by removing and resetting frame and cover and adjusting to grade in low areas with an estimated removal of 2,130 gpd of inflow.
 - c. Fifteen (15) sewer manholes rehabilitated by removing and replacing frame and cover and adjusting to grade in low areas with an estimated removal of 6,730 gpd of inflow.
- Based upon the lack of results and the high cost associated with CCTV inspections of sewer services from the building which were conducted during the prior Phase IV repair project, GCG Associates does not recommend continuing the investigation of the remaining sewer services found with unidentified clear flow.

The total estimated peak I/I removed due to all repair work to date is 141,170 gpd. GCG Associates recommends that the remaining repair work be divided into two phases over the next two years as outlined above. The total estimated peak I/I for all remaining repair work is 37,660 gpd. Please don't hesitate to contact this office with questions.

Respectfully Submitted,
GCG ASSOCIATES, INC.

Michael J. Carter

Michael J. Carter, P.E.

Phone: (978) 657-9714
Fax: (978) 657-7915

September 19, 2017

Mr. James McKay
Deputy Director
Department of Public Works
Memorial Building
900 Main Street
Millis, MA 02054

RE: Millis, Massachusetts
Proposal for Engineering Services
I/I Analysis and Plan

Dear Mr. McKay,

We are pleased to submit for your approval, this letter of agreement for the performance of engineering services for the Infiltration and Inflow (I/I) Analysis/Plan required to be completed by December 31, 2018 as required by MassDEP for the operation of Millis's sanitary sewer collection system.

SCOPE OF SERVICES

The I/I plan developed for the Town of Millis is in accordance with the MassDEP Guidelines for Performing Infiltration/Inflow (I/I) Analysis and Sewer System Evaluation Surveys (SSES) (latest revision dated May 2017). The I/I plan shall begin in the spring of 2018 according to the following guidelines:

TASK 1 – I/I Analysis and Report - March through June of 2018

- Continuous flow metering to begin March or April 2018 by utilizing the data from the town's SDADA system and three (3) existing permanent flow meters and three (3) additional temporary flow meters deployed within the (6) Subbasins established in the previous I/I study.
- Rainfall shall be monitored for the 10-week period. A rain gauge shall be located at the Millis DPW to measure local precipitation.
- Groundwater data shall be utilized from a USGS monitoring site located in Norfolk and located approximately 6 miles from downtown Millis.
- After 4 weeks of flow metering data is collected the method recognized by MassDEP as the "Single Season Two Phase Gauging and TV Inspection Approach" shall be utilized. If sufficient dry high groundwater data is collected during this time, then a preliminary analysis shall be performed to select those Subbasins requiring further flow isolation gauging based upon the 4,000 gpd/idm rule. Metering shall continue regardless in all Subbasins for the entire 10-week monitoring period to supplement the flow data. This approach will save one year's time and allow progressing into a Sewer System Evaluation Survey (SSES) in the same season and will eliminate the problems with comparing I/I flow data in one season and SSES data collected in a second season.
- Extensive Manhole and TV Inspections shall be conducted based upon the flow isolation gauging results within areas with high infiltration rates and in the same season. All inspections shall be performed according to the National Association for Sewer Service Companies (NASSCO)

guidelines. The measured flow isolation rate shall be compared to the estimated rates during TV inspections and adjusted using best engineering judgment.

- An analysis of the flow data shall be conducted to determine the sanitary, infiltration and inflow components of the wastewater flow.
- Prepare an I/I Analysis Report summarizing the results of the field investigations and data analysis and shall consist of the following:
 - Executive Summary highlighting all tasks performed, conclusions, and recommendations, approximate costs and schedule for further work with tables and estimated quantities of extraneous flows.
 - Description of the wastewater Collection System.
 - Description of problems with the system.
 - Sewer Map delineating pipe sizes, Subbasins and gauging locations.
 - Summary and Tables for gauging results flow determinations.
 - Cost effective Analysis
 - An assessment of the SSO risk from the five-year design storm based on findings, system historical data, performance data during similar or larger storms or based upon a calibrated sewer system model.
 - Appendices – Manhole Inspections, flow hydro graphs for each Subbasin, dry weather flow graphs, model calibration data, and pertinent information.

TASK 2 – SSES Study and Report- July through November 2018

- After completion of the I/I Analysis, complete a Sewer System Evaluation Study within Subbasins exhibiting high infiltration and high inflow to determine specific infiltration/inflow sources in the sewer system and select the appropriate rehabilitation method.
- Review flow isolation data, rainfall data groundwater data and extensive Manhole and TV Inspections for infiltration and inflow collected previously in Spring of 2018.
- Perform Smoke Testing to identify areas where stormwater/groundwater are entering the sanitary sewer system.
- Perform Dyed Water Testing to identify and confirm sources of inflow to the sanitary sewer system for direct and indirect stormwater connections.
- Perform property inspections and house-to-house inspections to visually identify inflow sources on private property.
- Perform a Cost-Effectiveness Analysis for I/I to determine whether the I/I is excessive.
- Develop rehabilitation methods and costs for infiltration and inflow sources.
- Prepare a SSES Report summarizing the results of the field investigations and data analysis and shall consist of the following:
 - Executive Summary highlighting all tasks performed, conclusions, and recommendations, approximate costs and schedule for further work with tables and estimated quantities of I/I components.
 - Description of the wastewater Collection System.
 - Description of problems with the system.
 - Sewer Map delineating pipe sizes, Subbasins and gauging locations.
 - Summary and Tables for gauging results and flow determinations.
 - Results of inspections and recommendation for rehabilitation.
 - Cost effective Analysis.
 - Proposed recommendations including cost and schedule for repairs and follow up post construction flow metering.
 - Appendices – Detailed manhole and TV inspections, smoke and dye test logs, property inspections, dry weather flow graphs, model calibration data, and pertinent information.

Fee schedule

The not to exceed fee for providing the above scope of services would be \$218,290. See attached breakdown of man-hours for estimated cost. The subcontractor work would be invoiced as a reimbursable expense. See attached estimated contract.

The total fees for the above listed Scope of Services will not be exceeded without formal agreement between the parties of this agreement. A change in the Scope of Services will be considered cause to modify this agreement. Changes, other than minor revisions, requested by the Owners, or any review boards; will be considered as a change in the Scope of Services.

If you have any questions or require additional information, please call.

Sincerely,
GCG ASSOCIATES, INC.

Michael J. Carter

Michael Carter, P.E.
President

BUDGET ESTIMATE FOR INFILTRATIN/INFLOW INVESTIGATION					
Project Task			Estimated Manhour Effort		
Personnel	Project Manager	Senior Project Eng	Project Engineer	Subcontractor ****	Estimated Fees
Hourly Rates	\$125	\$105	\$80		
TASK 1 - I/I STUDY AND REPORT					
a. Data collection/analysis	4	40	40	\$25,000.00	
b. Flow Isolation Gauging/Inspections	4	40	40		
c.Manhole Inspection and Camera lines*	2	40	120	\$75,000.00	
d. Prepare Report	12	80	80		
SUBTOTAL	22	200	280	\$100,000.00	\$146,150.00
TASK 2 - SSES STUDY AND REPORT					
a. Review investigations for I/I Sources	4	40	40		
b. Coordinate and perform Smoke Testing**	4	4	20	\$5,000.00	
c. Coordinate and perform Dyed Water Testing**	4	4	20	\$5,000.00	
d. Coordinate and inspect homes sump pump***	4	40	40	\$25,000.00	
e. Prepare Report	12	80	80		
SUBTOTAL	28	168	200	\$35,000.00	\$72,140.00
			Engineering Total		\$83,290.00
			Subcontractor Total		\$135,000.00
			Total Estimated Budget Cost		\$218,290.00
SUBCONTRACTOR COST ARE BASED UPON PERFORMING WORK ON THE ENTIRE SEWER SYSTEM					
THE ACTUAL WORK WILL BE LESS AND CANNOT BE DETERMINED UNTIL INVESTIGATIONS ARE COMPLETED.					
* Current price for camera of sewer lines is \$2.00/ft to camera, \$0.50/ft to \$2.00/ft to clean lines : Average price \$3/ft to clean and camera lines.					
	Maximum cost of camera work: \$3/ft x 25,000 feet = \$75,000.00				
** Smoke and Dyed Water Testing maximum of 5 days total testing					
	Estimated cost : 5 days of testing x \$2,000 per day testing crew cost = \$10,000				
*** Sump pump inspection: \$50/house and \$25/house to revisit.					
	Estimated cost : 500 homes @ \$50/ home = \$25,000				
**** Budget numbers					