Haverhill

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Environmental Protection Agency
Water Technical Unit (SEW)
PO Box 8127
Boston, Massachusetts 02114

Massachusetts Department of Environmental Protection
Northeast Regional Office
Bureau of resource Protection
205B Lowell Street
Wilmington, MA 01887

Subject: City of Haverhill NPDES Permit # MA0101621
Infiltration Inflow Report 2007

Dear EPA & DEP:

In accordance with the City of Haverhill's NPDES Permit # **MA0101621**, we are providing this status report as required by item 3 Infiltration/Inflow Plan page 14 of 18. Please note the items in *italic* are taken directly from the NPDES permit followed by a response.

The permittee shall implement a plan to control infiltration and inflow (I/I) to the separate sewer system. The plan shall be kept onsite and shall be made available upon request by EPA or MassDEP. The plan shall describe the permittee's program for preventing infiltration/inflow related effluent limit violations, and all unauthorized discharges of wastewater, including overflows and by-passes due to infiltration/inflow.

The plan shall include:

- *An ongoing program to identify and remove sources of infiltration and inflow. The program shall include the necessary funding level and the source(s) of funding.*

- *An inflow identification and control program that focuses on the disconnection and redirection of illegal sump pumps and roof down spouts. Priority should be given to removal of public and private inflow sources that are upstream from, and potentially contribute to, known areas of sewer system backups and/or overflows.*

- *Identification and prioritization of areas that will provide increase aquifer recharge as the results of reduction/elimination of infiltration and inflow to the system.*

- *An educational outreach program for all aspects of I/I control, particularly private inflow.*

Reporting Requirements:

A summary report of all actions taken to minimize I/I during the previous calendar year shall be submitted to EPA and the MassDEP annually, by April 30th of each year. The summary report shall, at a minimum, include:

- *A map and a description of inspection and maintenance activities conducted and corrective actions taken during the previous year.*
- *Expenditures for any infiltration/inflow related maintenance activities and corrective actions taken during the previous year.*
- *A map with areas identified for I/I-related investigation/action in the coming year.*
- *A report of any infiltration/inflow related corrective actions taken as a result of unauthorized discharges reported pursuant to 314 CMR 3.19(20) and reported pursuant to the Unauthorized Discharges section of this permit.*

Please be advise the attached analysis shall demonstrate the non-existence of excessive infiltration/inflow for the City of Haverhill collection system flow.

If you require additional information, please call me at 978-374-2382.

Sincerely,

Paul J. Jessel

Paul J. Jessel
Collection System Supervisor

cc: Mike Stankovich, DPW Director
Robert Ward, Deputy DPW Water/Wastewater
Fred Haffty WWTP Facility Manager
Don Freeman, CDM
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EXECUTIVE SUMMARY

The City of Haverhill calculated the City Wide Annual Infiltration/Inflow rates using two methods. Method 1 was to breakout the wet days and dry days to arrive at I/I rate of **3,243** gpdidm for the wet weather days and **846 gpdidm** for dry days. Method 2 was a calculation for the entire year with a City wide annual Infiltration/Inflow rates **1,373** gpdidm.

Furthermore, the minimum rehabilitation cost is $48.4 Million and the maximum rehabilitation is $186 Million. The loan payment for 20 years at 2% interest on $48 Million is $2,962,040 per year. This far exceeds the annual $86,889 transportation and treatment costs.

Analysis of the City of Haverhill collection system flows 2007 clearly indicates the non-existence of excessive infiltration/inflow. All design literature and case studies show that Haverhill's collection system to be operating within acceptable quantities for infiltration/inflow.

The findings of the analysis clearly demonstrate that excessive infiltration/inflow does not exist in the City of Haverhill's collection system. Minimum rehabilitation costs are greater than transportation and treatment costs. Therefore, the evaluation phase of the study has not been undertaken.

SECTION 1: COLLECTION SYSTEM DESCRIPTION

1.1. Description of Wastewater Collection System

The City of Haverhill owns and operates a wastewater collection system that conveys wastewater to the City's wastewater treatment plant, which is located on the southern shore of the Merrimack River. Portions of this collection system have been in service since the late 1800s and portions convey both stormwater and wastewater.

The piping network consists of gravity pipe ranging in size from 8 to 72-inches in diameter and force mains ranging in size from 4 to 42-inches. Approximately 37 percent of the service area has combined sewers. The majority of the combined portion of the collection system is located in the older, more densely populated downtown area, along the Merrimack River. Areas further north or south of the Merrimack River tend to be newer and generally include separate sanitary and storm sewers.

1.2. Wastewater Treatment Plant

1.2.1. CSO Phase I Upgrades

Completed in June 2006 comprise the following major components:

- **Main Wastewater Pump Station Upgrades Now Capable of Pumping 60 Mgd.**

A pump station conveys all flow from the terminus of the Bradford interceptor to the treatment plant. This station is designed for a peak flow of 60 mgd with 3 pumps in operation and a fourth pump is available as a standby pump. Connecting the pump station to the WWTP is a 42-inch force main with a length of approximately 3000 feet.

- **Modulating Influent Gate to Control Flow to the Main Wastewater Pump Station**

The potential exist during extreme high flow and river elevations that the main pump station could become flooded. This modulating gate prevents the possibility.

- **Supervisory Control And Data Acquisition, (SCADA)**

SCADA is the computer monitoring and control for critical wastewater systems from the main control room and computer terminals through out the treatment plant. System components are monitored and can be queried through Microsoft Excel Historian. Treatment plant influent flows are monitored at the parshall flume and were queried for this Infiltration/Inflow report.

- **CSO Wet Weather Upgrades**

Throughout the mid 1990's to 2007, the City of Haverhill embark on raising CSO weirs through out the City, which captured 92 percent of the wet weather events.

Phase I CSO required the City to further treat CSO by upgrading the treatment plant main pumping station to pump 60 million gallon a day, (MGD); Wet weather by-pass for 40 MGD maximum; Aerated grit facility to capture excessive grit and protect treatment plant equipment;

Modified five CSO regulator along the South side of the Merrimack River,(Bradford side). With these upgrades, the City now captures over 97 percent of the wet weather events in Haverhill.

TABLE 1.1: WASTEWATER PLANT DESIGN PARAMETERS

Parameter	Value
Influent Flow (mgd)	
Average	18.1
Maximum Day	39.2
Peak Rate	60
Biochemical oxygen demand (lb/d)	17,650
Total Suspended Solids (lb/d)	18,560

SECTION 2: FLOW COMPONENTS

Sanitary sewer system flow has three components: Base Flow, Infiltration and Inflow.

2.1. BASE FLOW

Base flow can be determined in several ways with varying degrees of accuracy. Water consumptions data adjusted for seasonal peaks, irrigation, unmetered connections, and water meter inaccuracies are often used. Also, minimum flow rates can be measured to estimate infiltration rates, which than can be subtracted from metered flow during dry weather conditions.

2.1.1. DATA SUMMARY WASTEWATER

The City of Haverhill has recently completed a Geographic Information System, (GIS), which was used to obtain the sewer diameter and lengths. **TABLE 2-1: CITY OF HAVERHILL SUMMARY SEWERS WITH CALCULATED INFILTRATION,** gives a summary for the different sewer diameters and sewer lengths with calculated infiltration rates for the entire City.

Sewer services were estimated to be a 6-inch diameter with a length of 80 feet. The following is the calculation use to arrive at the sewer service:

Equation 2-1: (Sewer service length) X(Number of sewer account)= Total footage

Example 2-1: 80*14,991=1,199,280(ft.)

TABLE 2-1: CITY OF HAVERHILL SUMMARY SEWERS WITH CALCULATED INFILTRATION\INFLOW

CITY OF HAVERHILL SUMMARY CALCULATED INFILTRATION RATES

Diameter	Total Footage	Miles	Total I/I (gpdidm)
8	437,336	82.83	910,086
10	78,774	14.92	204,910
12	185,079	35.05	577,718
14	2,336	0.44	8,508
15	49,808	9.43	194,342
16	418	0.08	1,739
18	32,907	6.23	154,076
20	7,118	1.35	37,033
21	12,441	2.36	67,957
22	2,007	0.38	11,483
24	30,477	5.77	190,265
30	23,950	4.54	186,897
32	1,538	0.29	12,805
36	10,993	2.08	102,946
42	2,884	0.55	31,505
48	11,060	2.09	138,097
50	5,251	0.99	68,290
54	4,950	0.94	69,532
60	6,248	1.18	97,519
66	7,058	1.34	121,164
72	1,419	0.27	26,570
84	588	0.11	12,847
6	1,199,200	227.1212121	1,871,633

Totals	914,639	173	5,097,923
Haverhill's annual I/I rate for 2007 (gpdidm)			1,373
Average sewer service diam. (in.)			6
Estimate sewer service length (ft)			80
# Accounts:			14,990

2.1.2 CITY OF HAVERHILL WATER/WASTEWATER ACCOUNTS

Water and wastewater meter readings were obtained from the Water and Wastewater Billing Office. These records were broken out into Residential and Commercial accounts that have City water and City sewerage. In addition Commercial and Residential accounts that have City water but **no** City sewerage. This analysis revealed that currently the City of Haverhill has **14,990** Commercial and Residential sewer accounts.

Haverhill paperboard (HPB) domestic and industrial flows are pump directly into the City's force main. HPB is billed separately for domestic sewerage, (as a residential user) as well as industrial process flows. HPB water and sewerage flows were subtracted from the sewer accounts totals.

2.1.3. CSO PHASE I STUDY

Phase I of the Combine Sewer Overflow study required the City to developed a Supervisory Control And Data Acquisition SCADA, system, completed in June 2006. The SCADA system was queried to obtain daily flows to the Haverhill Water Pollution Control Facility (HWPCF) for the entire calendar year of 2007.

2.1.4. WASTEWATER ACCOUNTS NOT INCLUDED

HWPCF receives flows from the Town of Groveland that is pumped into the HWPCF's force main. The daily flow rate from Groveland equals **222,413 gallons**. The daily flow was subtracted from the HWPCF daily flow.

HWPCF receives flows from Haverhill Paperboard Company, which also is pumped into the HWPCF's force main. The daily flow rate equals **56,233 gallons**. The daily flow was subtracted from the HWPCF daily pump gallons.

Table 2-2: shows this calculation for the month of January.

TABLE 2-2: WASTEWATER FLOWS AFTER GROVELAND AND HAVERHILL PAPER BORAD IS SUBTRACTED

Date	WWTP TOTAL MGD	Groveland Flows	HPB	WWTP FINAL MGD
1/1/07	19.42	222,413	56,233	19.14
1/2/07	12.34	222,413	56,233	12.06
1/3/07	11.70	222,413	56,233	11.42
1/4/07	11.48	222,413	56,233	11.20
1/5/07	11.15	222,413	56,233	10.87
1/6/07	10.90	222,413	56,233	10.62
1/7/07	10.05	222,413	56,233	9.77
1/8/07	22.14	222,413	56,233	21.86
1/9/07	13.38	222,413	56,233	13.10
1/10/07	12.46	222,413	56,233	12.18
1/11/07	11.77	222,413	56,233	11.49
1/12/07	11.48	222,413	56,233	11.20
1/13/07	11.58	222,413	56,233	11.30
1/14/07	11.90	222,413	56,233	11.62
1/15/07	18.10	222,413	56,233	17.82
1/16/07	12.55	222,413	56,233	12.27
1/17/07	11.54	222,413	56,233	11.26
1/18/07	11.37	222,413	56,233	11.09
1/19/07	12.61	222,413	56,233	12.33
1/20/07	11.10	222,413	56,233	10.82
1/21/07	10.86	222,413	56,233	10.58
1/22/07	10.47	222,413	56,233	10.19
1/23/07	10.16	222,413	56,233	9.88
1/24/07	10.01	222,413	56,233	9.73
1/25/07	9.82	222,413	56,233	9.54
1/26/07	9.29	222,413	56,233	9.01
1/27/07	9.36	222,413	56,233	9.08
1/28/07	9.57	222,413	56,233	9.29
1/29/07	9.16	222,413	56,233	8.88
1/30/07	9.03	222,413	56,233	8.75
1/31/07	9.55	222,413	56,233	9.27

2.1.5. WASTEWATER FLOW SUMMARY

Table 2.3 below summarizes the entire flow distribution for the City of Haverhill.

TABLE 2-3: WASTEWATER FLOW SUMMARY 2007

Annual HWPCF Total Flow, (MG)	3,697.31
Average Flow (MGD)	10.13
HWPCF Base flow (MGD)	5.032
I/I Est. Rate(MGD)	5.098

2.2. DATA SUMMARY WATER TREATMENT PLANT

Water pumped from the Water Treatment Plant was captured utilizing SCADA. Daily consumption data was queried with the following equation:

Equation 2-2: Daily Finished Water Flow pump daily **minus** storage tank level increasing **plus** storage tank decreases. This equation was used to develop the daily total water consumption rate for all residents regardless if the resident was on city sewerage.

To derive water consumption flows, which are connected to the City's sewerage system, **Table 2-4** and **Equation 2-3** was develop.

TABLE 2-4: TOTAL WATER FLOW DISTRIBUTION GALLONS FOR 2007

Total Water Flow Distributions Gallons for 2007			
	Gallons	Percentage	Daily MG
Total Gallons pump from Water Treatment	2,136,091,804		5.85
Unaccounted water usage gallons	290,508,485		0.80
Unaccounted water from ASR 2007 report		13.60%	
Total gallon use after unaccounted water is s	1,845,583,318		5.06
Total Gallons Commercial **Not** on Sewer	83,252,400		0.23
Total Gallons Residential **Not** on Sewer	138,737,544		0.38
Total Not on Sewer	221,989,944		0.61
Total Gallons Commercial on Sewer	633,650,996		1.74
Total Gallons Residential On Sewer	878,623,988		2.41
Total Public Property on sewer not billed	76,711,514		0.21
Total Gallons on Sewer	1,588,986,498		4.35
Percentage, base upon flow data, on City sewer		86.10%	
Percentage Not on City Sewer system		12.03%	
Variance applied to each day for water accounts not on sewer		0.04%	
Water flow data was obtained from John D'Aoust Water Treatment Facility manager.			

Equation: 2-3: Total Actual Water Demand **minus** (Total Actual Water Demand **multiplied by** Variance applied to each day for unaccounted water flows) **multiplied by** (Percentage, base upon flow data, on City sewer).

Example 2-2: January 1: [5.72- (5.72*.0004)] X.8610 = 4.920 MGD water flow consume and on city sewerage.

This equation was used for each day, which is the City's **BASE FLOW** to the Wastewater Treatment Plant. From this **BASE FLOW** infiltration and inflow amounts can be calculated. The Average Base flow for Calendar year 2007 is **5.033 MGD.**

In order to calculate population served, which is on City sewerage Table: 2-5 was developed.

TABLE 2-5: POPULATION SERVED ON CITY'S SEWERAGE SYSTEM

Type of Residential Service Connection (single-family, two-family, etc.)	Total # of service connections to each Type	# of households per service connection (1 for single family, 2 for two-family, etc.)	# of household
Single- Family: 13123	13123	1	13123
Two-Family: 1910	1910	2	3820
Three Family: 458	458	3	1374
Four or More Family 358	358	4	1432
		Totals	**19,749**
		% on sewer	86.10%
		Total on sewer	**17,003**
# of Households	**Average Household Size from DHCD website**		**Population Served**
	2.51		**42,678**
Per Captia Flow Rate	gal./per captia	**Population Served**	
	117.90	**42,678**	5.03

This calculation follows a similar calculation taken from Haverhill's 2007 **Public Water Supply Annual Statistical Report, ASR 2007, (PWSID # 312800)** and adjust base upon **86.10%** of water pumped from the Water Treatment Plant is connected to City sewerage system. This table reveals that **42,686** residents are connected to the City's sewerage system. Based upon an average **BASE FLOW** of 5.033 MGD and 42,686 residents the per captia flow rate is **117.9 gpcd.**

2.3. INFILTRATION

Infiltration is the water entering a collection system from groundwater sources, through defective pipes, leaking pipe joints, connections and manhole bases and walls. Water entering the system through this route is usually very clean and pollution free.

2.3.1 DRY WEATHER

The City defines dry weather as **a Minimum 72 Hours No Rainfall Over 0.1 Inches.** Utilizing this definition, the annual wet days were recorded. The City of Haverhill records rainfall utilizing a Rainwise Rain Gage, which is recorded in 15-minutes intervals. This gage is use for the City's annual CSO report, Haverhill experienced 90 wet days for the 2007 calendar year, (and 275 dry weather days for the 2007 calendar year.

Equation 2-4: WWTP Flow MGD **minus** WWTP Base Flow, (this is BASE FLOW from Equation 2-2).

Example 2-3: 9/1/07 5.14-4.289 = 0.85MGD

Based upon **Equation 2-2** infiltration was calculated for all days which dry weather occurred, 275-days of dry weather. Dry weather is defined as minimum 72 hours no rainfall over 0.1-inches.

TABLE 2-6: DRY WEATHER CONDITIONS 2007

Total Dry Weather (MGD):	863.66
2007 Average base upon 275 days dry weather (MGD):	3.14
2007 Annual avergage base upon 365 days (MGD):	2.37
Citywide I/I rate using for 275 days 3.14 MGD (gpdidm):	846
Number of Dry Weather (days):	275

2.4. INFLOW

Inflow is water discharged to a collection system from roof leaders, cellars, yard drains, combined sewer overflows, catch basins, manhole covers, storm water, and/or surface runoff.

2.4.1. INFLOW CALCULATION

Based upon **Equation 2-2** inflow was calculated for all days which wet weather occurred, 90-days for calendar year 2007.

Equation 2-5: WWTP Flow MGD **minus** WWTP Base Flow, (this is BASE FLOW from Equation 2-3).

Example 2-4: 1/7/07 19.14-4.683 = 14.46 MGD

TABLE 2-7: WET WEATHER CONDITIONS 2007

SWMM CSO 2007 (MG):	56.47
Total Wet Weather (MGD):	1,083.54
2007 Average base upon 90 days wet weather (MGD):	12.04
2007 Annual avergage base upon 365 days (MGD):	2.97
Citywide I/I wet weather rate using 90 days 12.04 MGD (gpdidm):	3,243
Wet Weather (days):	90

2.4.2. COMBINE SEWER OVERFLOW CSO

The City has submitted to EPA and DEP "SWMM Model Calibration and Evaluation of Existing Conditions" report prepared by CDM dated July1998. This SWMM Model was adjusted for 2007 due to the weir **Little River South NPDES number 21E** was raised. Total CSO flow is **56.47 MG**. This CSO flow was added to the Inflow section of this analysis.

2.5. EXCESSIVE INFILTRATION/INFLOW

The quantity of infiltration and inflow, which can be economically eliminated from the collection system by rehabilitation, as determined by a cost effectiveness analysis that compares the costs for transportation and treatment of the infiltration/inflow.

According to "DEP Guidelines for Performing Infiltration/Inflow Analyses And Sewer System Evaluation Survey" Revised January, 1993, excessive infiltration is 4,000 gallons per day per inch-mile (gpdim). As can be seen in Table 2.2 Haverhill's total I/I is **1,373 gpdidm**, which clearly demonstrates Haverhill does not have an Infiltration/Inflow problem.

SECTION 3: INFILTRATION/INFLOW

3.1. TRANSPORTATION OPERATION AND MAINTENANCE COSTS

According to EXISTING SEWER EVALUATION & REHABILITATION WEF Manual of Practice FD-6 " To determine whether I/I is excessive, rough cost comparison between transportation and treatment or elimination of I/I through corrective action are made. If I/I is excessive, the next phase should be the sewer system evaluation survey."

3.1.1. VEHICULAR COSTS

The City purchased a sewer jet machine on a 5-year lease payment plan. For 2007 the last payment was sent, which was **$29, 329.**

3.1.2. LABORER COSTS

The City of Haverhill currently has the following Job Positions, which deal directly with Collection system

Job Position	Current Staff Size
Collection System Supervisor	1
Senior Collection System operator	1
Collection System Operators	4
Highway Department	2

An analysis was conducted for calendar year for all positions mention above, which included any overtime. Base upon this analysis total labor for 2007 equal **$436,951.**

3.1.3. GASOLINE

Gasoline usage summary was obtain for each vehicle for Wastewater and broken out to services for Collection Division. The following vehicles are use for the collection division S-10 range pick-up Truck; S-12 F250 Utility Truck; S-13 F350 Utility Truck; S-5 Diesel Mack catch Basin Cleaner, and S-11 diesel Sewer Jet Machine. These records reveled total gasoline usage to be **$ 13,316.**

3.1.4. POWER COSTS

National Grid bills for the City main pumping station located at 40 South Mill Street revealed a total power requirement of **$ 230,200**. To pump the City sewerage it was estimates that 75% of the power was allocated to pumping.

3.1.5. COLLECTION SYSTEM MAINTENANCE

The City of Haverhill has one account devoted to the collections system called Lift Station Account, (LSTA). Review for calendar year 2007 revealed **$54,341** was spent on Collection System Maintenance.

3.1.6. DEBT SERVICE

The City has committed to the CSO Phase I and associated treatment plant upgrades, which equal $20.1- Million expenditure. Capital expenditures, which were bonded, were also added to the debt service. Total debt service equals $1,307,000.

3.2. TRANSPORTATION OPERATION & MAINTENANCE COSTS FOR INFILTRATION/INFLOW

Table 3-1: below represent the transportation costs to pump infiltration and inflow to HWPCF base upon Energy and Operation and Maintenance of the Collection system.

TABLE 3-1: INFILTRATION/INFLOW O & M COSTS

INFILTRATION/INFLOW

HWPCF WASTEWATER TRANSPORTATION O & M COSTS

TOTAL WASTEWATER TRANSPORTATION O & M COSTS

ITEM	2007	COMMENTS
VECHICULAR	$29,329	base cost, independent of flow
LABOR	$436,951	base cost, independent of flow
Gasoline	$10,359	
ENERGY	$230,200	75% of cost is flow driven
CS Maint	$54,341	
Interest on CS Captial	$1,307,274	Captial Projects for Collection System and CSO phase I
TOTAL	**$2,068,453**	
days/year	365	
avg Q, gpd	10,129,622	average daily plant flow includes inflow
factor	1000	
cost/1000gals/day	**$0.559**	wastewater transportation costs per 1000gals/day

ACTUAL COSTS TO PUMP WASTEWATER

ENERGY	$230,200	75% of cost is flow driven
	$172,650	annual cost to actually pump wastewater
days/year	365	
avg Q, gpd	10,129,622	average daily plant flow
factor	1000	
cost/1000gals/day	**$0.047**	wastewater transportation costs per 1000gals/day

COST TO PUMP INFILTRATION/INFLOW

cost/1000gals/day	**$0.047**	wastewater transportation costs per 1000gals/day
I/I in 1000gals/day	5,097.923	Avg. annual I/I in 1000gals/day
days/year	365	
cost to pump I/I	**$86,889**	annual cost to pump I/I wastewater

3.3. REHABILITATION COSTS

According to "***EPA Handbook Sewer System Infrastructure Analysis and Rehabilitation***" 1991, Chapter 6 provides sewer rehabilitation costs for the following type of sewer rehabilitation:
Excavation; Grouting; Sliplining using HDPE; Sliplining using PE pipe; Sliplining using Thermosetting Resin; Cured-in-Place.

Table 3-2 lists these rehabilitation costs for 1991 costs. The items in blue were estimated costs as the EPA manual did not have a costs. Not included are manhole rehabilitation costs. The minimum rehabilitation cost is $48.4 Million and the maximum rehabilitation is $186 Million. The loan payment for 20 years at 2% interest on $48 Million is $2,962,040 per year. This far exceeds the $86,889 transportation and treatment costs.

TABLE 3-2: CITY OF HAVERHILLSEWER REHABILITION COSTS

		Excavation Costs		Grouting Costs		Sliplining with HDPE		Sliplining with PE Pipe		Sliplining Thermosetting Resin		Cured in Place					
Dia.	Total Footage	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Min	MAX	Min	MAX
		($/LF)	($/LF)	($/LF)	($/LF)	($/LF)	($/LF)	($/LF)	($/LF)	($/LF)	($/LF)	($/LF)	($/LF)	($/LF)	($/LF)	Costs	Costs
8	437,336	$ 50	$ 75	$ 24	$36	$9	$20	$40	$60	$25	$30	$45	$60	$9	$75	$3,936,020	$32,800,167
10	78,774	$ 55	$ 85	$ 28	$42	$17	$33	$45	$70	$33	$43	$60	$75	$17	$85	$1,339,166	$6,695,831
12	185,079	$ 65	$ 95	$ 32	$48	$25	$45	$50	$75	$40	$55	$68	$100	$25	$100	$4,626,969	$18,507,877
14	2,336	$ 70	$ 105	$ 34	$51	$27	$48	$55	$80	$45	$58	$75	$125	$27	$125	$61,914	$292,045
15	49,808	$ 73	$ 108	$ 36	$54	$28	$51	$58	$83	$50	$62	$80	$131	$28	$131	$1,394,619	$6,524,823
16	418	$ 75	$ 110	$ 38	$57	$30	$55	$60	$95	$55	$65	$85	$138	$30	$138	$12,536	$57,668
18	32,907	$ 80	$ 120	$ 40	$60	$33	$68	$65	$80	$63	$75	$90	$145	$33	$145	$1,069,469	$4,771,475
20	7,118	$ 95	$ 145	$ 49	$81	$35	$70	$69	$92	$70	$85	$95	$153	$35	$153	$249,146	$1,085,564
21	12,441	$ 105	$ 160	$ 68	$102	$42	$82	$72	$103	$75	$87	$100	$160	$42	$160	$522,502	$1,990,484
22	2,007	$ 115	$ 175	$ 72	$90	$49	$94	$75	$115	$80	$88	$105	$175	$49	$175	$98,321	$351,146
24	30,477	$ 125	$ 190	$ 76	$95	$56	$106	$95	$135	$85	$90	$110	$190	$56	$190	$1,706,706	$5,790,610
30	23,950	$ 135	$ 205	$ 96	$144	$63	$118	$115	$155	$100	$130	$135	$220	$63	$220	$1,508,843	$5,268,975
32	1,538	$ 160	$ 225	$110	$165	$70	$130	$135	$175	$115	$140	$140	$250	$70	$250	$107,680	$384,571
36	10,993	$ 185	$ 245	$124	$186	$80	$155	$155	$190	$130	$150	$155	$270	$80	$270	$879,464	$2,968,190
42	2,884	$ 210	$ 265	NA	NA	$93	$193	$190	$230	$145	$175	$165	$305	$93	$305	$266,746	$879,541
48	11,060	$ 235	$ 285	NA	NA	$105	$230	$220	$275	$170	$200	$185	$350	$105	$350	$1,161,324	$3,871,079
50	5,251	$ 238	$ 288	NA	NA	NA	NA	$240	$302	$180	$208	$195	$370	$180	$370	$945,113	$1,942,733
54	4,950	$ 240	$ 295	NA	NA	NA	NA	$265	$329	$190	$215	$205	$390	$190	$390	$940,522	$1,930,545
60	6,248	$ 275	$ 340	NA	NA	NA	NA	$290	$355	$215	$255	NA	NA	$215	$355	$1,343,375	$2,218,131
66	7,058	$ 310	$ 395	NA	NA	NA	NA	$333	$403	$215	$275	NA	NA	$215	$403	$1,517,372	$2,844,189
72	1,419	$ 365	$ 450	NA	NA	NA	NA	$375	$460	NA	NA	NA	NA	$365	$460	$517,809	$652,582
84	588	$ 415	$ 505	NA	NA	NA	NA	$457	$494	NA	NA	NA	NA	$415	$505	$244,000	$296,915
6	1,199,200	$ 45	$ 70	$ 20	$ 30	NA	NA	$35	$60	NA	NA	$30	$45	$20	$70	$23,984,000	$83,944,000
														Totals:		$48,433,614	$186,069,140

Minimum Rehab finance annual costs: ($2,962,040.89)

3.4. CONCLUSIONS

The City of Haverhill has clearly demonstrated that there is no Infiltration/Inflow problem. DEP states that excessive I/I is greater than **4,000 gpdidm**, the I/I rate for the City of Haverhill is **1,373 gpdidm** for 2007 calendar year.

Analysis of the City's collection system for 2007 clearly indicates the non-existence of excessive infiltration/inflow. All design literature and case studies show that the City's collection system to be operating within acceptable quantities for infiltration/inflow. Therefore, the evaluation phase of the study has not been undertaken.

Transportation and treatment costs are **$86,889** per year and rehabilitation costs for full implementation is **$2,292,040** per year.

3.5. WAIVER REQUEST

Since, we have demonstrated by the submittal of this report that we are not experiencing excessive infiltration/inflow, we respectfully request a waiver Part 3 Infiltration/Inflow Plan page 14 of 18 of our 2008 NPDES Permit.

3.6. REFERENCES

"Sewer System Infrastructure Analysis and Rehabilitation" United States Environmental Protection Agency EPA/625/6-91/030 October 1991 Chapter 6 Sewer System Rehabilitation

"DEP Guidelines for Performing Infiltration/Inflow Analyses And Sewer System Evaluation Survey" Revised January, 1993

"Manual of Practice FD-6; *Existing Sewer Evaluation & Rehabilitation.* Water Pollution Control Federation (1983)