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ALLEN & MAJOR
ASSOCIATES, INC.

February 7, 2020

To: Denise M. Gaffey
Director and City Planner
562 Main Street, 2nd Floor
Melrose, MA 02176

A&M Project #: 2674-01A
Re: Oak Grove Mill, LLC
99 Washington Street
Sewer Impact Analysis
REVISION 2

Copy: Oak Grove Mill, LLC, files

Dear Ms. Gaffey

On behalf of our client, Oak Grove Mill, LLC, Allen & Major Associates, Inc. (A&M) has prepared this letter to provide a sewer impact analysis for the proposed redevelopment of 99 Washington Street. The sewer impact analysis was requested during the January 8, 2020 Melrose Planning Staff meeting to facilitate the City's review of the sewer flows within Washington Street and the downstream sewer infrastructure. Based on the results of this analysis, there is adequate capacity within the City's sewer system to accommodate the additional sewer flows resulting from the conversion of the property from commercial space to residential use.

The "Utility Plan Narrative" submitted under separate cover, calculated the existing sewer flows from the existing buildings to be 6,538 gallons per day (GPD). The proposed sewer flows associated with the conversion to residential use are calculated to be 21,120 GPD. The increase of 14,582 GPD of sewer flow is the subject of this sewer impact analysis.

A&M was provided a copy of the City of Melrose GIS sewer routing diagram for this area in the city. Using the GIS database and property cards, the existing sewer flows for the contributing area were calculated using 310CMR (Title 5) flow rates, GIS bedroom counts, and GIS floor areas. Attached to this letter is a summary of the flow rates for each of the properties, which contribute flow to the sewer within Washington Street and Stone Place. In accordance with the guidance provided in the New England Interstate Water Pollution Control Commission (NEIWPCC) Technical Release 16 (TR-16), a peaking factor of 5.6 was applied to all flows to account for surges during times of peak use.

Very Truly Yours,
ALLEN & MAJOR ASSOCIATES, INC.

Brian D. Jones, PE
Senior Project Manager

Attachments:

1. Existing and proposed sanitary sewer flows
2. Existing and proposed sewer pipe analysis

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EXISTING

7-Feb-20

Sanitary Sewer Flows for 99 Washington Street Sewer Impact Analysis

A&M Project: 2674-01A

All flow rates based on 310CMR 15.203

Bedroom counts taken from Melrose GIS

ADDRESS	TYPE	UNIT	QUANTITY	FLOW RATE (GPD)	FLOW (GPD)	FLOW with TR16 peaking factor of 5.6 & convert to CFS (CFS)
5 Brazil Street (Parcel ID: B2-0-9)	residential	bedroom	2	110	220	0.002
9 Brazil Street (Parcel ID: B2-0-8)	residential	bedroom	1	110	110	0.001
12 Brazil Street (Parcel ID: B2-0-26)	residential	bedroom	2	110	220	0.002
13 Brazil Street (Parcel ID: B2-0-7)	residential	bedroom	2	110	220	0.002
17-19 Brazil Street (Parcel ID: B2-0-6)	residential	bedroom	6	110	660	0.006
18 Brazil Street (Parcel ID: B2-0-27)	residential	bedroom	3	110	330	0.003
23 Brazil Street (Parcel ID: B2-0-5)	residential	bedroom	3	110	330	0.003
24 Brazil Street (Parcel ID: B2-0-28)	residential	bedroom	2	110	220	0.002
28-30 Brazil Street (Parcel ID: B2-0-29)	residential	bedroom	5	110	550	0.005
29-33 Brazil Street (Parcel ID: B2-0-4)	residential	bedroom	8	110	880	0.008
32-34 Brazil Street (Parcel ID: B2-0-30)	residential	bedroom	4	110	440	0.004
35-41 Brazil Street (Parcel ID: B2-0-3)	residential	bedroom	8	110	880	0.008
38-40 Brazil Street (Parcel ID: B2-0-31)	residential	bedroom	5	110	550	0.005
42-44 Brazil Street (Parcel ID: B2-0-32)	residential	bedroom	6	110	660	0.006
45-47 Brazil Street (Parcel ID: B2-0-2)	residential	bedroom	4	110	440	0.004
48 Brazil Street (Parcel ID: B2-0-33)	residential	bedroom	4	110	440	0.004
51 Brazil Street (Parcel ID: B2-0-1)	residential	bedroom	4	110	440	0.004
52-54 Brazil Street (Parcel ID: B2-0-34)	residential	bedroom	5	110	550	0.005
60 Brazil Street (Parcel ID: B1-0-4)	residential	bedroom	3	110	330	0.003
64 Brazil Street (Parcel ID: B1-0-3)	residential	bedroom	3	110	330	0.003
1 Washington Street (Parcel ID: B2-0-21)	commercial	1,000 s.f.	16.32	75	1224	0.011
2 Washington Street (Parcel ID: B1-0-5)	residential	bedroom	144	110	15840	0.137
37 Washington St (Parcel ID: B2-0-17)	residential	bedroom	49	110	5390	0.047
72 Washington Street (Parcel ID: B2-0-10)	residential	bedroom	2	110	220	0.002
76 Washington Street (Parcel ID: B2-0-11)	residential	bedroom	4	110	440	0.004
82 Washington Street (Parcel ID: B2-0-12)	residential	bedroom	2	110	220	0.002
98-100 Washington (Parcel ID: B2-0-13A)	residential	bedroom	5	110	550	0.005
TOTAL FLOW UPSTREAM OF PROJECT SITE (99 WASHINGTON STREET):						**0.283**
99 Washington Street (Parcel ID: B2-0-12)	Flow taken from project utility narrative				**6538**	**0.057**
108 Washington St (Parcel ID: B2-0-13)	residential	bedroom	2	110	220	0.002
112 Washington Street (Parcel ID: B3-0-6)	residential	bedroom	4	110	440	0.004
115 Washington Street (Parcel ID: B3-0-43)	residential	bedroom	2	110	220	0.002
116 Washington Street (Parcel ID: B3-0-5)	residential	bedroom	5	110	550	0.005
121 Washington Street (Parcel ID: B3-0-42)	residential	bedroom	3	110	330	0.003
125 Washington Street (Parcel ID: B3-0-41)	residential	bedroom	2	110	220	0.002
126 Washington Street (Parcel ID: B3-0-8)	residential	bedroom	2	110	220	0.002
131 Washington Street (Parcel ID: B3-0-40)	residential	bedroom	3	110	330	0.003
134 Washington Street (Parcel ID: B3-0-9)	residential	bedroom	2	110	220	0.002
135 Washington Street (Parcel ID: B3-0-39)	residential	bedroom	2	110	220	0.002
140 Washington Street (Parcel ID: B3-0-10)	residential	bedroom	3	110	330	0.003
88-90 Goodyear Avenue (Parcel ID: B3-0-4)	residential	bedroom	7	110	770	0.007
92-94 Goodyear Avenue (Parcel ID: B3-0-3)	residential	bedroom	9	110	990	0.009
98 Goodyear Avenue (Parcel ID: B3-0-2)	residential	bedroom	3	110	330	0.003
100-102 Goodyear Avenue (Parcel ID: B3-0-1)	residential	bedroom	6	110	660	0.006
38 Stone Place (Parcel ID: B3-0-44)	residential	bedroom	2	110	220	0.002
TOTAL FLOW UPSTREAM OF 12" STONE PLACE SEWER:						**0.394**
47 Washington St (Parcel ID: B2-0-17)	residential	bedroom	85	110	9350	0.081
1000-4000 Stone Place (Parcel ID: B3-0-57)	residential	bedroom	367	110	40370	0.350
TOTAL FLOW UPSTREAM OF MWRA 30"x42" INTERCEPTOR:						**0.825**

PROPOSED

7-Feb-20

Sanitary Sewer Flows for 99 Washington Street Sewer Impact Analysis

A&M Project: 2674-01A

All flow rates based on 310CMR 15.203

Bedroom counts taken from Melrose GIS

ADDRESS	TYPE	UNIT	QUANTITY	FLOW RATE (GPD)	FLOW (GPD)	FLOW with TR16 peaking factor of 5.6 & convert to CFS (CFS)
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TOTAL FLOW UPSTREAM OF PROJECT SITE (99 WASHINGTON STREET):						**0.283**
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38 Stone Place (Parcel ID: B3-0-44)	residential	bedroom	2	110	220	0.002
TOTAL FLOW UPSTREAM OF 12" STONE PLACE SEWER:						**0.521**
47 Washington St (Parcel ID: B2-0-17)	residential	bedroom	85	110	9350	0.081
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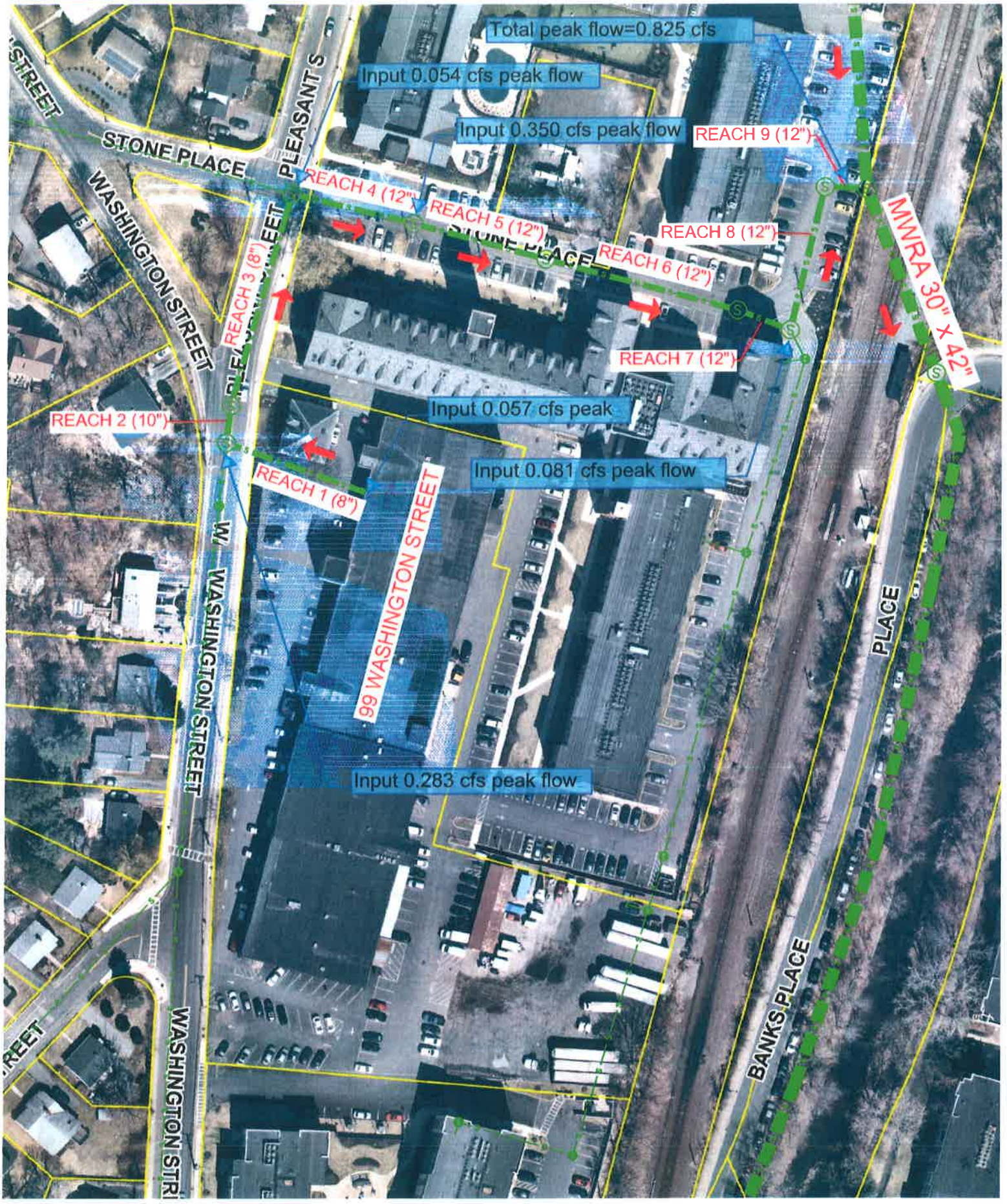
TOTAL FLOW UPSTREAM OF MWRA 30"x42" INTERCEPTOR:						**0.951**

EXISTING SEWER ANALYSIS



Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1	39.50	37.24	120.0	0.0188	0.013	8.0	0.0	0.0
2	2	36.34	36.26	28.0	0.0029	0.013	10.0	0.0	0.0
3	3	36.26	35.55	176.0	0.0040	0.013	8.0	0.0	0.0
4	4	35.55	34.65	98.0	0.0092	0.010	12.0	0.0	0.0
5	5	34.65	34.27	106.0	0.0036	0.010	12.0	0.0	0.0
6	6	34.27	33.71	158.0	0.0035	0.010	12.0	0.0	0.0
7	7	33.71	33.58	40.0	0.0033	0.010	12.0	0.0	0.0
8	8	33.58	33.14	116.0	0.0038	0.010	12.0	0.0	0.0
9	9	33.14	33.11	30.0	0.0010	0.010	12.0	0.0	0.0

Time span=0.00-1.00 hrs, dt=0.01 hrs, 101 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Reach 1: 8" Sewer service from 99 Washington Avg. Flow Depth=0.09' Max Vel=2.25 fps Inflow=0.06 cfs 218 cf
8.0" Round Pipe n=0.013 L=120.0' S=0.0188 '/' Capacity=1.66 cfs Outflow=0.06 cfs 215 cf

Reach 2: 10" Washington Street Avg. Flow Depth=0.31' Max Vel=1.86 fps Inflow=0.34 cfs 1,233 cf
10.0" Round Pipe n=0.013 L=28.0' S=0.0029 '/' Capacity=1.17 cfs Outflow=0.34 cfs 1,228 cf

Reach 3: 8" Washington Street Avg. Flow Depth=0.31' Max Vel=2.13 fps Inflow=0.34 cfs 1,228 cf
8.0" Round Pipe n=0.013 L=176.0' S=0.0040 '/' Capacity=0.77 cfs Outflow=0.34 cfs 1,200 cf

Reach 4: 12" Stone Place Avg. Flow Depth=0.20' Max Vel=3.51 fps Inflow=0.40 cfs 1,418 cf
12.0" Round Pipe n=0.010 L=98.0' S=0.0092 '/' Capacity=4.44 cfs Outflow=0.40 cfs 1,407 cf

Reach 5: 12" Stone Place Avg. Flow Depth=0.36' Max Vel=3.00 fps Inflow=0.75 cfs 2,679 cf
12.0" Round Pipe n=0.010 L=106.0' S=0.0036 '/' Capacity=2.77 cfs Outflow=0.75 cfs 2,653 cf

Reach 6: 12" Stone Place Avg. Flow Depth=0.36' Max Vel=2.99 fps Inflow=0.75 cfs 2,653 cf
12.0" Round Pipe n=0.010 L=158.0' S=0.0035 '/' Capacity=2.76 cfs Outflow=0.75 cfs 2,613 cf

Reach 7: 12" Stone Place Avg. Flow Depth=0.36' Max Vel=2.90 fps Inflow=0.75 cfs 2,613 cf
12.0" Round Pipe n=0.010 L=40.0' S=0.0033 '/' Capacity=2.64 cfs Outflow=0.75 cfs 2,603 cf

Reach 8: 12" Stone Place Avg. Flow Depth=0.37' Max Vel=3.15 fps Inflow=0.83 cfs 2,894 cf
12.0" Round Pipe n=0.010 L=116.0' S=0.0038 '/' Capacity=2.85 cfs Outflow=0.83 cfs 2,863 cf

Reach 9: 12" Stone Place Avg. Flow Depth=0.54' Max Vel=1.92 fps Inflow=0.83 cfs 2,863 cf
12.0" Round Pipe n=0.010 L=30.0' S=0.0010 '/' Capacity=1.46 cfs Outflow=0.83 cfs 2,850 cf

Summary for Reach 1: 8" Sewer service from 99 Washington

Inflow = 0.06 cfs @ 0.00 hrs, Volume= 218 cf, Incl. 0.06 cfs Base Flow
Outflow = 0.06 cfs @ 0.34 hrs, Volume= 215 cf, Atten= 0%, Lag= 20.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-1.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 2.25 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 2.23 fps, Avg. Travel Time= 0.9 min

Peak Storage= 3 cf @ 0.34 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 1.66 cfs

8.0" Round Pipe
n= 0.013
Length= 120.0' Slope= 0.0188 '/'
Inlet Invert= 39.50', Outlet Invert= 37.24'

Summary for Reach 2: 10" Washington Street

Inflow = 0.34 cfs @ 0.34 hrs, Volume= 1,233 cf, Incl. 0.28 cfs Base Flow
Outflow = 0.34 cfs @ 0.34 hrs, Volume= 1,228 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-1.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 1.86 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.86 fps, Avg. Travel Time= 0.3 min

Peak Storage= 5 cf @ 0.33 hrs
Average Depth at Peak Storage= 0.31'
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 1.17 cfs

10.0" Round Pipe
n= 0.013
Length= 28.0' Slope= 0.0029 '/'
Inlet Invert= 36.34', Outlet Invert= 36.26'

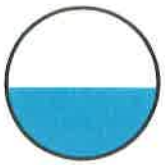
Summary for Reach 3: 8" Washington Street

Inflow = 0.34 cfs @ 0.34 hrs, Volume= 1,228 cf
Outflow = 0.34 cfs @ 0.61 hrs, Volume= 1,200 cf, Atten= 0%, Lag= 16.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-1.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 2.13 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 2.10 fps, Avg. Travel Time= 1.4 min

Peak Storage= 28 cf @ 0.61 hrs
Average Depth at Peak Storage= 0.31'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 0.77 cfs

8.0" Round Pipe
n= 0.013
Length= 176.0' Slope= 0.0040 '/'
Inlet Invert= 36.26', Outlet Invert= 35.55'



Summary for Reach 4: 12" Stone Place

Inflow	=	0.40 cfs @	0.61 hrs, Volume=	1,418 cf, Incl. 0.06 cfs Base Flow
Outflow	=	0.40 cfs @	0.61 hrs, Volume=	1,407 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-1.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 3.51 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 3.45 fps, Avg. Travel Time= 0.5 min

Peak Storage= 11 cf @ 0.61 hrs
Average Depth at Peak Storage= 0.20'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 4.44 cfs

12.0" Round Pipe
n= 0.010
Length= 98.0' Slope= 0.0092 '/'
Inlet Invert= 35.55', Outlet Invert= 34.65'

Summary for Reach 5: 12" Stone Place

Inflow	=	0.75 cfs @	0.61 hrs, Volume=	2,679 cf, Incl. 0.35 cfs Base Flow
Outflow	=	0.75 cfs @	0.61 hrs, Volume=	2,653 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-1.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 3.00 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.97 fps, Avg. Travel Time= 0.6 min

Peak Storage= 27 cf @ 0.61 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.77 cfs

12.0" Round Pipe
n= 0.010
Length= 106.0' Slope= 0.0036 '/'
Inlet Invert= 34.65', Outlet Invert= 34.27'

Summary for Reach 6: 12" Stone Place

Inflow = 0.75 cfs @ 0.61 hrs, Volume= 2,653 cf
Outflow = 0.75 cfs @ 0.62 hrs, Volume= 2,613 cf, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-1.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 2.99 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 2.92 fps, Avg. Travel Time= 0.9 min

Peak Storage= 40 cf @ 0.62 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.76 cfs

12.0" Round Pipe
n= 0.010
Length= 158.0' Slope= 0.0035 '/'
Inlet Invert= 34.27', Outlet Invert= 33.71'

Summary for Reach 7: 12" Stone Place

Inflow = 0.75 cfs @ 0.62 hrs, Volume= 2,613 cf
Outflow = 0.75 cfs @ 0.62 hrs, Volume= 2,603 cf, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-1.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 2.90 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.82 fps, Avg. Travel Time= 0.2 min

Peak Storage= 10 cf @ 0.62 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.64 cfs

12.0" Round Pipe
n= 0.010
Length= 40.0' Slope= 0.0033 '/'
Inlet Invert= 33.71', Outlet Invert= 33.58'

Summary for Reach 8: 12" Stone Place

Inflow = 0.83 cfs @ 0.62 hrs, Volume= 2,894 cf, Incl. 0.08 cfs Base Flow
Outflow = 0.83 cfs @ 0.63 hrs, Volume= 2,863 cf, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-1.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 3.15 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 3.07 fps, Avg. Travel Time= 0.6 min

Peak Storage= 31 cf @ 0.63 hrs
Average Depth at Peak Storage= 0.37'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.85 cfs

12.0" Round Pipe
n= 0.010
Length= 116.0' Slope= 0.0038 '/'
Inlet Invert= 33.58', Outlet Invert= 33.14'

Summary for Reach 9: 12" Stone Place

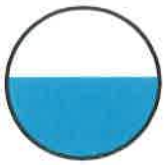
Existing MWRA interceptor invert elevation is 31.06

Inflow	=	0.83 cfs @	0.63 hrs, Volume=	2,863 cf
Outflow	=	0.83 cfs @	0.63 hrs, Volume=	2,850 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-1.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 1.92 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.86 fps, Avg. Travel Time= 0.3 min

Peak Storage= 13 cf @ 0.63 hrs
Average Depth at Peak Storage= 0.54'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 1.46 cfs

12.0" Round Pipe
n= 0.010
Length= 30.0' Slope= 0.0010 '/'
Inlet Invert= 33.14', Outlet Invert= 33.11'



PROPOSED SEWER ANALYSIS

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1	39.50	37.24	120.0	0.0188	0.013	8.0	0.0	0.0
2	2	36.34	36.26	28.0	0.0029	0.013	10.0	0.0	0.0
3	3	36.26	35.55	176.0	0.0040	0.013	8.0	0.0	0.0
4	4	35.55	34.65	98.0	0.0092	0.010	12.0	0.0	0.0
5	5	34.65	34.27	106.0	0.0036	0.010	12.0	0.0	0.0
6	6	34.27	33.71	158.0	0.0035	0.010	12.0	0.0	0.0
7	7	33.71	33.58	40.0	0.0033	0.010	12.0	0.0	0.0
8	8	33.58	33.14	116.0	0.0038	0.010	12.0	0.0	0.0
9	9	33.14	33.11	30.0	0.0010	0.010	12.0	0.0	0.0

Time span=0.00-1.00 hrs, dt=0.01 hrs, 101 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Reach 1: 8" Sewer service from 99 Washington Avg. Flow Depth=0.15' Max Vel=3.11 fps Inflow=0.18 cfs 654 cf
8.0" Round Pipe n=0.013 L=120.0' S=0.0188 '/' Capacity=1.66 cfs Outflow=0.18 cfs 648 cf

Reach 2: 10" Washington Street Avg. Flow Depth=0.36' Max Vel=2.02 fps Inflow=0.46 cfs 1,666 cf
10.0" Round Pipe n=0.013 L=28.0' S=0.0029 '/' Capacity=1.17 cfs Outflow=0.46 cfs 1,659 cf

Reach 3: 8" Washington Street Avg. Flow Depth=0.37' Max Vel=2.30 fps Inflow=0.46 cfs 1,659 cf
8.0" Round Pipe n=0.013 L=176.0' S=0.0040 '/' Capacity=0.77 cfs Outflow=0.46 cfs 1,624 cf

Reach 4: 12" Stone Place Avg. Flow Depth=0.23' Max Vel=3.78 fps Inflow=0.52 cfs 1,842 cf
12.0" Round Pipe n=0.010 L=98.0' S=0.0092 '/' Capacity=4.44 cfs Outflow=0.52 cfs 1,829 cf

Reach 5: 12" Stone Place Avg. Flow Depth=0.38' Max Vel=3.12 fps Inflow=0.87 cfs 3,101 cf
12.0" Round Pipe n=0.010 L=106.0' S=0.0036 '/' Capacity=2.77 cfs Outflow=0.87 cfs 3,072 cf

Reach 6: 12" Stone Place Avg. Flow Depth=0.39' Max Vel=3.11 fps Inflow=0.87 cfs 3,072 cf
12.0" Round Pipe n=0.010 L=158.0' S=0.0035 '/' Capacity=2.76 cfs Outflow=0.87 cfs 3,028 cf

Reach 7: 12" Stone Place Avg. Flow Depth=0.40' Max Vel=3.01 fps Inflow=0.87 cfs 3,028 cf
12.0" Round Pipe n=0.010 L=40.0' S=0.0033 '/' Capacity=2.64 cfs Outflow=0.87 cfs 3,016 cf

Reach 8: 12" Stone Place Avg. Flow Depth=0.40' Max Vel=3.27 fps Inflow=0.95 cfs 3,307 cf
12.0" Round Pipe n=0.010 L=116.0' S=0.0038 '/' Capacity=2.85 cfs Outflow=0.95 cfs 3,273 cf

Reach 9: 12" Stone Place Avg. Flow Depth=0.59' Max Vel=1.98 fps Inflow=0.95 cfs 3,273 cf
12.0" Round Pipe n=0.010 L=30.0' S=0.0010 '/' Capacity=1.46 cfs Outflow=0.95 cfs 3,259 cf

Summary for Reach 1: 8" Sewer service from 99 Washington

Inflow	=	0.18 cfs @	0.00 hrs, Volume=	654 cf, Incl. 0.18 cfs Base Flow
Outflow	=	0.18 cfs @	0.23 hrs, Volume=	648 cf, Atten= 0%, Lag= 13.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-1.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 3.11 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 3.10 fps, Avg. Travel Time= 0.6 min

Peak Storage= 7 cf @ 0.23 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 1.66 cfs

8.0" Round Pipe
n= 0.013
Length= 120.0' Slope= 0.0188 '/'
Inlet Invert= 39.50', Outlet Invert= 37.24'

Summary for Reach 2: 10" Washington Street

Inflow	=	0.46 cfs @	0.23 hrs, Volume=	1,666 cf, Incl. 0.28 cfs Base Flow
Outflow	=	0.46 cfs @	0.07 hrs, Volume=	1,659 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-1.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 2.02 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.01 fps, Avg. Travel Time= 0.2 min

Peak Storage= 6 cf @ 0.07 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 1.17 cfs

10.0" Round Pipe
n= 0.013
Length= 28.0' Slope= 0.0029 '/'
Inlet Invert= 36.34', Outlet Invert= 36.26'

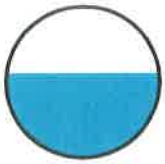
Summary for Reach 3: 8" Washington Street

Inflow	=	0.46 cfs @	0.07 hrs, Volume=	1,659 cf
Outflow	=	0.46 cfs @	0.58 hrs, Volume=	1,624 cf, Atten= 0%, Lag= 30.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-1.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 2.30 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 2.27 fps, Avg. Travel Time= 1.3 min

Peak Storage= 35 cf @ 0.57 hrs
Average Depth at Peak Storage= 0.37'
Bank-Full Depth= 0.67' Flow Area= 0.3 sf, Capacity= 0.77 cfs

8.0" Round Pipe
n= 0.013
Length= 176.0' Slope= 0.0040 '/'
Inlet Invert= 36.26', Outlet Invert= 35.55'



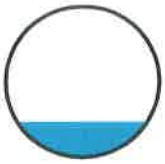
Summary for Reach 4: 12" Stone Place

Inflow	=	0.52 cfs @	0.58 hrs, Volume=	1,842 cf, Incl. 0.06 cfs Base Flow
Outflow	=	0.52 cfs @	0.58 hrs, Volume=	1,829 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-1.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 3.78 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.72 fps, Avg. Travel Time= 0.4 min

Peak Storage= 13 cf @ 0.58 hrs
Average Depth at Peak Storage= 0.23'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 4.44 cfs

12.0" Round Pipe
n= 0.010
Length= 98.0' Slope= 0.0092 '/'
Inlet Invert= 35.55', Outlet Invert= 34.65'



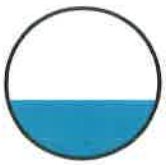
Summary for Reach 5: 12" Stone Place

Inflow	=	0.87 cfs @	0.58 hrs, Volume=	3,101 cf, Incl. 0.35 cfs Base Flow
Outflow	=	0.87 cfs @	0.58 hrs, Volume=	3,072 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-1.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 3.12 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 3.09 fps, Avg. Travel Time= 0.6 min

Peak Storage= 30 cf @ 0.58 hrs
Average Depth at Peak Storage= 0.38'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.77 cfs

12.0" Round Pipe
n= 0.010
Length= 106.0' Slope= 0.0036 '/'
Inlet Invert= 34.65', Outlet Invert= 34.27'



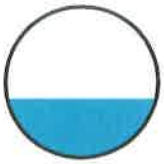
Summary for Reach 6: 12" Stone Place

Inflow	=	0.87 cfs @	0.58 hrs, Volume=	3,072 cf
Outflow	=	0.87 cfs @	0.60 hrs, Volume=	3,028 cf, Atten= 0%, Lag= 1.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-1.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 3.11 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 3.04 fps, Avg. Travel Time= 0.9 min

Peak Storage= 44 cf @ 0.60 hrs
Average Depth at Peak Storage= 0.39'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.76 cfs

12.0" Round Pipe
n= 0.010
Length= 158.0' Slope= 0.0035 '/'
Inlet Invert= 34.27', Outlet Invert= 33.71'



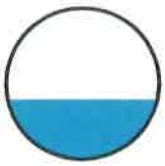
Summary for Reach 7: 12" Stone Place

Inflow	=	0.87 cfs @	0.60 hrs, Volume=	3,028 cf
Outflow	=	0.87 cfs @	0.60 hrs, Volume=	3,016 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-1.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 3.01 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.94 fps, Avg. Travel Time= 0.2 min

Peak Storage= 12 cf @ 0.60 hrs
Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.64 cfs

12.0" Round Pipe
n= 0.010
Length= 40.0' Slope= 0.0033 '/'
Inlet Invert= 33.71', Outlet Invert= 33.58'



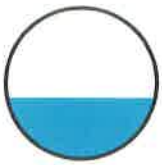
Summary for Reach 8: 12" Stone Place

Inflow	=	0.95 cfs @	0.60 hrs, Volume=	3,307 cf, Incl. 0.08 cfs Base Flow
Outflow	=	0.95 cfs @	0.61 hrs, Volume=	3,273 cf, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-1.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 3.27 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 3.18 fps, Avg. Travel Time= 0.6 min

Peak Storage= 34 cf @ 0.61 hrs
Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 2.85 cfs

12.0" Round Pipe
n= 0.010
Length= 116.0' Slope= 0.0038 '/'
Inlet Invert= 33.58', Outlet Invert= 33.14'



Summary for Reach 9: 12" Stone Place

Existing MWRA interceptor invert elevation is 31.06

Inflow	=	0.95 cfs @	0.61 hrs, Volume=	3,273 cf
Outflow	=	0.95 cfs @	0.62 hrs, Volume=	3,259 cf, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-1.00 hrs, dt= 0.01 hrs / 3
Max. Velocity= 1.98 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.92 fps, Avg. Travel Time= 0.3 min

Peak Storage= 14 cf @ 0.61 hrs
Average Depth at Peak Storage= 0.59'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 1.46 cfs

12.0" Round Pipe
n= 0.010
Length= 30.0' Slope= 0.0010 '/'
Inlet Invert= 33.14', Outlet Invert= 33.11'