

December 4, 2019

Beth Rudolph, PE
Town Engineer
Engineering Department
71 Mount Vernon Street
Winchester, MA 01890

Re: **Water and Sewer System Peer Review for Proposed 147-Unit Apartment Building at 19-35 River Street by SLV River Street, LLC**

Ms. Rudolph:

In accordance with our Agreement for Engineering Services, dated November 7, 2019, Weston & Sampson is pleased to present our per review of the water and sewer system at the proposed 147-unit apartment building at 19-35 River Street. The purpose of our review was to evaluate the project's impacts on the town's water and sewer system.

Weston & Sampson reviewed the following documents provided by the Town of Winchester:

- 19-35 River Street, Winchester, MA – Application for a Comprehensive Permit, Sections 1-16, June 2019
- Flow Metering Report, Flow Assessment Services, August 7, 2019
- Sewer Inspection Videos (CO-47 to CO-2), PipeLogix Inc., April 24, 2019

Project Description

SLV River Street, LLC's proposed development at 19-35 River Street, Winchester, MA, includes 147 housing units. The housing units include 33 – one bedroom apartments, 95 – two bedroom apartments, and 19 – three bedroom apartments.

Sewer System Evaluation

The sewer system for 19-35 River Street will connect to the town's wastewater system on River Street at sewer manholes CO-45 and CO-46. Wastewater discharged from the development flows by gravity on River Street and through the Conant Road ROW to manhole CO-2 where it enters the MWRA collection system.

The proposed development will produce Title V flow of 30,800 gallons per day (gpd) (280 bedrooms x 110 gpd/bedroom) and a peak flow of 175,560 gpd (30,800 gpd x 5.7 peaking factor). Title V was used to determine per bedroom flows from the development. Title V flows were originally established to provide guidance for the design septic systems but are commonly used to determine per bedroom flows from proposed developments. Title V flows are generally accepted to be a "peaked" flow and are larger than anticipated average daily flow rates. A peaking factor of 5.7 from the TR-16, Design of Wastewater Treatment Works, 2011 Edition, Figure 2-1 Ratio of Extreme Flow to Average Daily Flow was applied to Title V flows to calculate the peak flows used in our analysis. This method produces a high theoretical flow rate that is unlikely to be reached and is being used to demonstrate a conservative analysis of the available pipe capacity.

Weston & Sampson evaluated the existing sewer infrastructure on River Street between the upstream manhole (CO-47) and the downstream manhole (CO-2) where it discharges into the MWRA collection system. As part of the evaluation, Weston & Sampson performed a hydraulic capacity analysis (Appendix A), reviewed pipe inspection data provided by the town, and performed sewer manhole inspections between CO-47 and CO-2. A locus map of the sewer system investigation is included as Figure 1.

Hydraulic Capacity Analysis

Weston & Sampson performed a hydraulic capacity analysis of the sewers downstream of the proposed development. The purpose of the analysis was to determine if the existing sewers have adequate capacity to accommodate the proposed sewer flows from the 19-35 River Street development. The hydraulic capacity analysis table (Appendix A) was constructed using sewer pipe invert elevations, diameters, lengths, and materials from sewer record drawings provided by the Winchester Engineering Department. This analysis does not consider flow conditions in the MWRA collection system, downstream of manhole CO-2. During surcharging events in the MWRA system, sewer flow will back up into the River Street and Conant Road sewers, reducing available pipe capacity.

Based on the hydraulic capacity analysis, the existing pipe capacities range from 417.525 gpm to 1,089.793 gpm. The limiting pipe segment is in the Conant Road ROW, between manhole CO-44 and CO-2.

Flow Assessment Services (FAS) performed flow metering of the River Street and Conant Road ROW sewers between May 21, 2019 and July 11, 2019. As indicated in FAS's report, dated August 7, 2019, the minimum daily flow was 8.421 gpm and the maximum flow was 25.558 gpm. The average daily flow was 17.075 gpm. The estimated peak flow is 97.328 GPM (17.075 gpd x 5.7 peaking factor)

The total estimated post development peak flow, including the existing sewer's estimated peak flow (97.328 gpm) and the development's estimated peak flow (121.917 gpm), is 219.244 gpm. This flow represents approximately 53% of the available capacity in the limiting pipe segment. Therefore, the existing sewer capacity on River Street between manhole CO-47 and manhole CO-2 is adequate to accommodate the proposed sewer flows.

Sewer System Plan Review

Weston & Sampson reviewed the proposed sewer system layout, included on the Utilities Plan (Sheet C-104), produced by Allen & Major Associates, Inc. There are two (2) proposed connections into the town's sewer system. The building's 8-inch PVC sewer service connects to manhole CO-46 and the 4-inch CI service from the parking garage (gas/oil separator) connects to CO-45.

The proposed 8-inch PVC sewer service's invert elevation (27.00) at CO-46 is approximately 1.93 feet below grade. It appears the shallow sewer service was designed to avoid vertical conflicts with the existing 12-inch RCP drain (invert elevation 25.76) and 8-inch AC water main on River Street, and the proposed 12-inch HDPE drain (invert elevation 24.01) located in the sidewalk. This design results in approximately 1.3 feet of cover over the 8-inch PVC service. Weston & Sampson recommends that the service connection has a minimum cover of 4-feet.

The proposed service connection between the gas/oil separator and manhole CO-45 is designed as 4-inch cast iron. Weston & Sampson recommends that the service be a minimum 6-inch diameter and ductile iron.

The two (2) proposed services connect to existing block manholes, CO-45 and CO-46. Weston & Sampson recommends replacing the existing block manholes with precast manholes at these locations.

River Street Sewer System Rehabilitation Recommendations

Weston & Sampson reviewed sewer pipe inspection video provided by the town and performed manhole inspections on River Street and Conant Road ROW. The River Street/Conant Road ROW sewer system consists of approximately 814 linear feet of 8-inch asbestos cement pipe and five (5) block sewer manholes.

Our review of the pipe inspection video identified three (3) active services in the direction of 19-35 River Street, which will be disconnected once the existing buildings are demolished. We recommend abandoning these services at the mainline by plugging them with grout and installing a cured-in-place short liner over the service connection. The inspection also identified two (2) active services with infiltration staining at the break-in pipe connection. We recommend installing lateral liners at these locations.

TV inspection of CO-44 to CO-2 identified moderate debris along the invert of the pipe from station 1+50 to station 2+80. Complete TV inspection of this pipe segment was obtained; however, we recommend performing additional cleaning in this pipe segment.

Our review of the manhole inspection data identified two (2) manholes with active infiltration and four (4) manholes with root intrusion. Weston & Sampson recommends performing root treatment at CO-44 and CO-47 and cementitious lining at CO-2, CO-44, and CO-47. Manholes CO-45 and CO-46 are recommended to be replaced with precast manholes as discussed above.

Weston & Sampson recommends the following sewer rehabilitations:

- Install two (2) lateral liners
- Abandon existing sewer services at 19-35 River Street. Plug service with grout and install cured-in-place short liner; three (3) services, 12 linear feet of short liners
- Perform manhole chemical root treatment at CO-44 and CO-47
- Perform grouting and cementitious lining of manholes at CO-2, CO-44, and CO-47; 23.7 vertical feet
- Install new precast manholes at CO-45 and CO-46 for building service connection and gas/oil separation connection; 12.1 vertical feet
- Perform heavy cleaning and television inspection, CO-44 to CO-2, 290 linear feet

The estimated cost of these sewer rehabilitations is \$63,888. The proposed sanitary sewer rehabilitations are indicated on the map included as Figure 2.

It is our understanding that the town requires a sewer demand fee of \$2,400 per unit. Weston & Sampson recommends that a payment of \$352,800 be made in accordance with the town's policy.

Water System Evaluation

Weston & Sampson completed the water system evaluation of the proposed 147 unit development at 19-35 River Street in Winchester. The proposed development's water service will be obtained by connecting to the 8-inch asbestos cement water main in River Street, which is part of the town's Middle Low water service system.

One hydrant flow test was performed by Allen & Major Associates, Inc. in April 2019. The results of the flow test indicated an available fire flow of 2,840 gpm at 20 psi at the hydrant on River Street in front of the proposed location of the development.

The purpose of this evaluation was to determine if the proposed development will receive adequate water pressure and fire flows from the existing Winchester water system, and if the development may have any adverse impact on the Winchester water system.

Regulations and Evaluation Criteria

Massachusetts Department of Environmental Protection (DEP) regulations were used as the basis for our determination. DEP Guidelines and Policies for Public Water System and Massachusetts General Law (310 CMR 22.04) require that any public water system must provide 35 pounds per square inch (psi) pressure to all homes and business under all normal conditions of flow. Normal conditions include peak hour demands, usually the most severe demand conditions that occurs during the hottest summer days.

DEP Guidelines and Policies for Public Water Systems and Massachusetts General Law (310 CMR 22.19) require that any public water system shall provide 20 psi pressure under fire flow situations. System adequacy is evaluated under a fire flow situation occurring during a maximum day domestic demand condition. MassDEP sets regulations with guidance from the Insurance Services Office's (ISO) needed fire flow requirements.

The ISO is an independent organization that services insurance companies and fire departments. ISO estimates needed fire flow requirements at representative locations throughout communities and publishes the methodology for calculating needed fire flow for individual buildings. The ISO publishes the Guide for Determination of Needed Fire Flow. Given these guidelines, the required fire flow for this building should be determined by the developer's fire protection engineer.

Service Area and Model Development

Innovyze InfoWater hydraulic modeling software was used to model the impact of the proposed development on the water distribution system. The fire flow results presented above were used to calibrate the model.

The proposed development includes 147 units, as described in the Project Description. The water demands for the proposed development were determined using Title 5 wastewater design criteria of 110 gallons per day per bedroom. There are 280 bedrooms proposed for the development. This demand value was then considered the maximum day demand for the proposed development.

A peak hour demand was obtained by multiplying the maximum day demand by a peaking factor of 1.5. Table 1 shows the estimated water demands for the proposed development.

TABLE 1
Estimated Water Demand – 19-35 River Street

Demand Condition	Daily Demand (gpd)
Maximum Day	30,800
Peak Hour	46,200

The demands shown in Table 1 are to be used for planning purposes. The demand does not represent the true peak demand based on fixture count that will be used for sizing the water services and meters within the proposed development.

Modeling Results

The following demand conditions must be met, as per the DEP Guidelines for Public Water Systems and Massachusetts General Law (310 CMR 22.19):

- The water system must maintain a minimum working pressure of 35 psi under all normal conditions of flow
- The available fire flow at the high point in the development during maximum day demand must be greater than the ISO's required fire flow at 20 psi

Pressure

The hydraulic model indicates that the proposed development will receive approximately 55 to 68 psi at the first floor elevation of the proposed building, dependent on tank level and demand condition. During summer high demand conditions with the water storage tank at its lowest typical level, pressures could drop to the lower end of the above range. During winter demand conditions with the water storage tank at its highest typical level, pressures will tend toward the higher end of the above range. Therefore, pressures are expected to remain above the required minimum pressure of 35 psi during normal conditions of flow.

Fire Flow

The hydraulic model indicates that the proposed development will receive an available fire flow between 2,300 and 2,900 gallons per minute (gpm) at 20 psi, dependent on tank level and demand condition. Apartment complexes similar to the one proposed typically require a flow in the range of 2,500 gpm at 20 psi for firefighting. The actual

fire flow required will depend on building construction materials, number of stories, and fire sprinkler system type and should be confirmed by the developer's fire protection engineer.

Water System Plan Review

Weston & Sampson reviewed the proposed water system layout, included on the Utilities Plan (Sheet C-104), produced by Allen & Major Associates, Inc. There is one (1) proposed connection into the town's water system. The building's 6-inch ductile iron water service is proposed to connect to the existing 8-inch asbestos cement water main in River Street with triple gate valves. Within the private property, the proposed 6-inch connection then divides into a 6-inch fire service connection and a 4-inch domestic service connection, with a proposed 6-inch gate valve on the 6-inch fire service. The plan proposes retaining the existing fire hydrant on River Street.

Weston & Sampson recommends the following revisions to the proposed development's water system layout:

- The 6-inch fire service connection and the 4-inch domestic service connection are currently shown as coming off the same 6-inch connection at the existing 8-inch main. It is recommended that these two connections be separated, with individual connections at the 8-inch main. They should both come off the 8-inch main with an 8"x8"x6" tee, and then the line for the 4-inch domestic service connection should be reduced from 6-inch to 4-inch. Gate valves should be installed on both service lines at the main.
- The water main in River Street should be looped around the back of the proposed development and hydrants are recommended at the sides and back of the property.
- The option to loop the watermain through the site to tie into the currently dead-end water mains in Kirk Street and Wendell Street was considered. The height of the proposed retaining wall on the rear property line, at 13 to 20 feet in height, prevents this option.
- There is currently only one fire hydrant proposed for the development: that of the existing fire hydrant on River Street, near the Southeasterly end of the building. It is recommended that two additional hydrants are provided around the back of the building, on the proposed looped water main. In addition, at least four additional hydrants should be provided in total. The exact location and number of hydrants shall be confirmed by the Winchester Fire Department.

Weston & Sampson appreciates the opportunity to assist the Engineering Department in this matter. We are available at your earliest convenience to discuss our report.

Sincerely,

WESTON & SAMPSON ENGINEERS, INC.



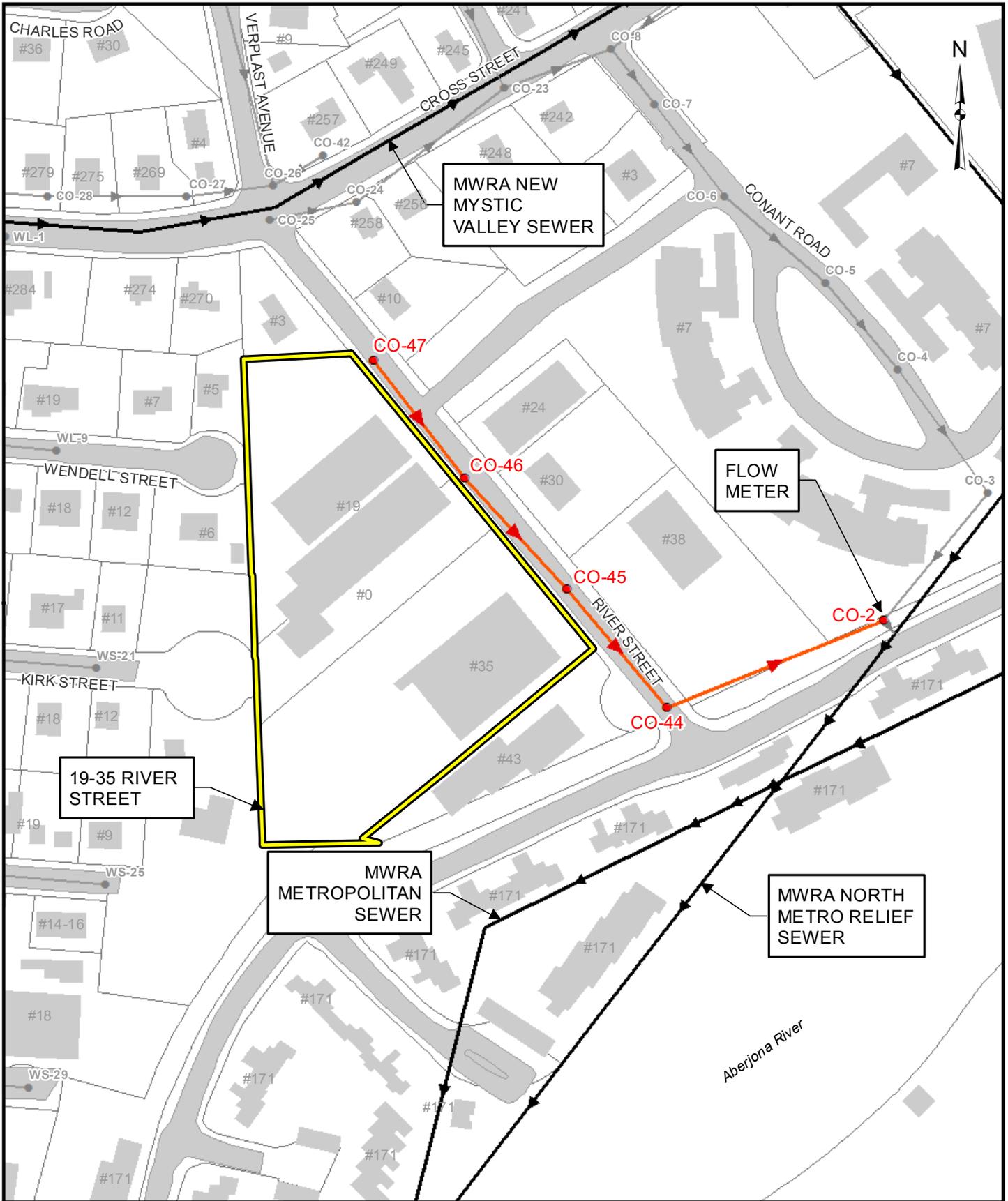
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David M. Elmer, PE
Discipline Leader/Vice President

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FIGURE 1
SEWER INVESTIGATION SUMMARY

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- Manhole Inspected
- Other Manhole
- ➔ Sewer Inspected
- ➔ Other Sewer Gravity Main
- ➔ MWRA Sewer Main

FIGURE 1
TOWN OF WINCHESTER, MASSACHUSETTS
19-35 RIVER STREET PEER REVIEW
SEWER INVESTIGATION SUMMARY LOCUS

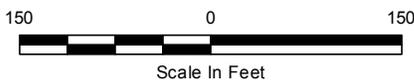


FIGURE 2

RECOMMENDED SEWER SYSTEM REHABILITATIONS

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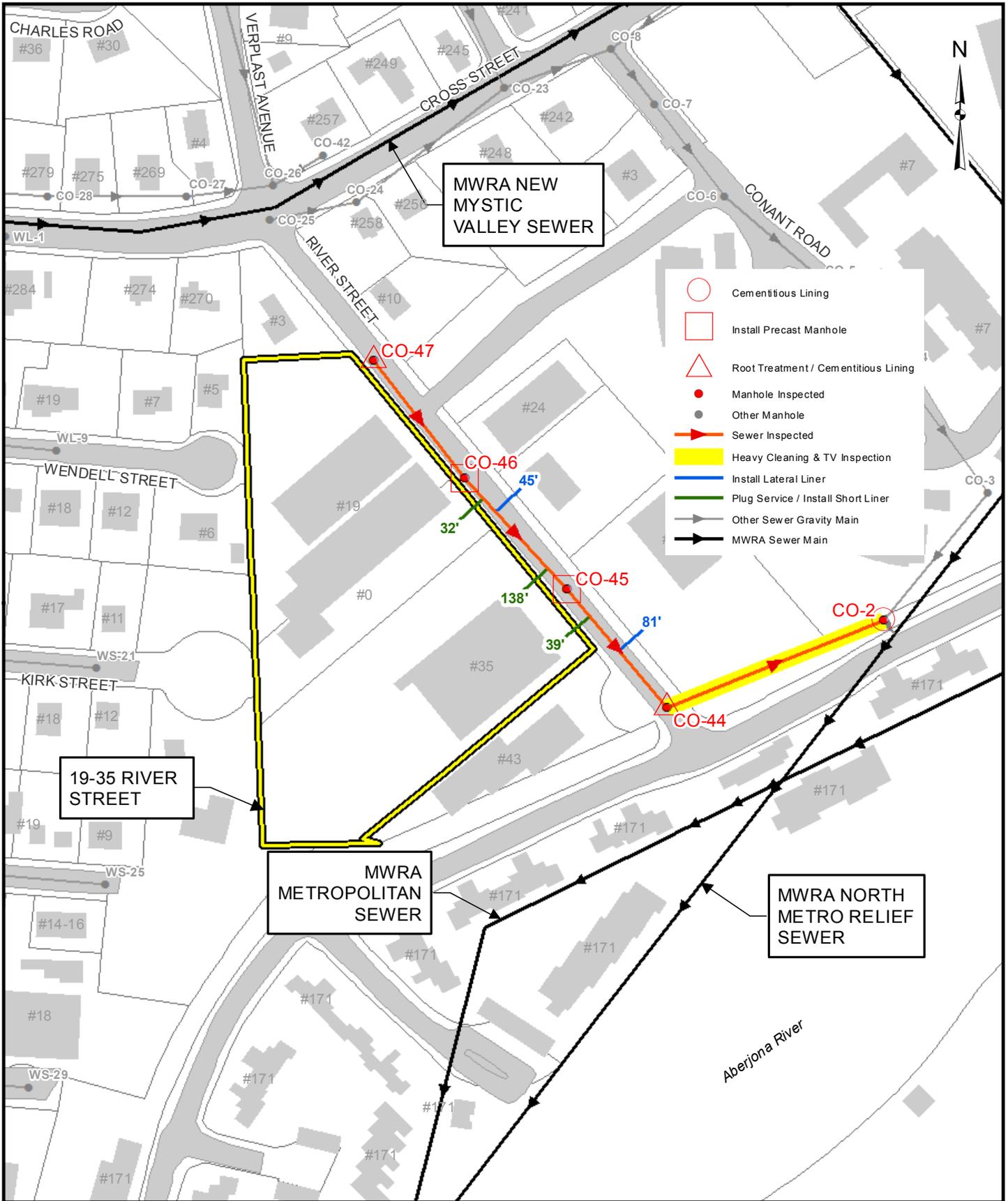
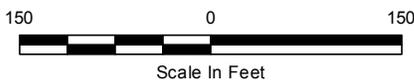


FIGURE 2
TOWN OF WINCHESTER, MASSACHUSETTS
19-35 RIVER STREET PEER REVIEW
RECOMMENDED SEWER SYSTEM REHABILITATIONS



APPENDIX A
HYDRAULIC CAPACITY ANALYSIS

**19-35 RIVER STREET PEER REVIEW
WINCHESTER, MA**

HYDRAULIC CAPACITY ANALYSIS

Location	Upstream Manhole ID	Downstream Manhole ID	Upstream Invert Elevation ¹ (ft)	Downstream Invert Elevation ¹ (ft)	Diameter (in)	Pipe Material	Roughness	Length (ft)	Slope	Velocity (fps)	Manning's Pipe Capacity (gpm)	Existing Peak Flow ² (gpm)	19-35 River Street Peak Flow ³ (gpm)	Total Peak Flow (gpm)	Percent Capacity
River Street	CO-47	CO-46	36.77	29.69	8	AC	0.013	176	4.016%	7.0	1,089.793	97.328	121.917	219.244	20%
River Street	CO-46	CO-45	29.69	24.95	8	AC	0.013	160	2.962%	6.0	935.983	97.328	121.917	219.244	23%
River Street	CO-45	CO-44	24.95	21.90	8	AC	0.013	183	1.670%	4.5	702.739	97.328	121.917	219.244	31%
Conant Road ROW	CO-44	CO-2	21.90	20.16	8	AC	0.013	295	0.589%	2.7	417.525	97.328	121.917	219.244	53%

Notes:

- Sewer manhole invert elevations are based on the Sewer Assessment Plan, River Street, August 6, 1971.
- Flow Assessment Services performed flow metering at manhole CO-2, Conant Road ROW, between May 21, 2019 and July 11, 2019. Minimum observed flow was 8.421 gpm on 7/11/2019. Maximum flow recorded during the metering period was 25.558 gpm on 5/23/19. Average daily flow was 17.075 gpm. Peak flow = 17.075 x 5.7 = 97.328
- Proposed flow contribution from the development was calculated using Title V flow rate (110 gpm/bedroom). The development includes 33 - 1 bedroom units, 95 - 2 bedroom units, and 19 - 3 bedroom units as indicated on Drawing Number A005. Total flow = 280 bedrooms x 110 gpd/bedroom = 30,800 gpd (21.389 gpm). Peak flow = 21.389 gpm x 5.7 = 121.917 gpm
- Peak flow was calculated using a peaking factor of 5.7 based on TR-16, Design of Wastewater Treatment Works, 2011 Edition, Figure 2-1 Ratio of Extream Flow to Average Daily Flow.