TETRA TECH

April 18, 2013

Paul Cincotta
New England Development
One Wells Avenue
Newton, MA 02459

**Re: University Station**
**Response to Utility Review Comments**

Dear Paul:

Tetra Tech has completed our review of the comments provided by BETA Group dated April 4, 2013. For ease of review, responses are numbered to coincide with the numbering system utilized in the original letters. Responses are shown in *italic* font.

**April 4, 2013 Correspondence from BETA Group**

**Sewer:**

**Comment 1:** Profiles should be developed and provided for all sewers within the public way. All utility crossings should be shown on profiles to demonstrate there are no utility conflicts.

***Response:*** *Roadway profiles within the Town layout will include the sewers.*

**Comment 2:** More detail on removing, cutting, capping and removal or abandonment of existing sewer mains and all other utilities should be included to clearly demonstrate the disposition of any existing utilities throughout the project site. In general, labeling should be shown at a Construction Document level of design.

***Response:*** *Additional labeling will be shown at the Construction Document level.*

**Comment 3:** It is difficult to read background information on existing utilities, please adjust print settings as needed. In particular there should be increased contrast on utility plans to more clearly show proposed drain utilities.

***Response:*** *Printing settings will be adjusted if possible and shown on the*

Engineering and Architecture Services
One Grant Street
Framingham, MA 01701
Tel 508.903.2000 Fax 508.903.2001

*Construction Documents.*

**Comment 4:** The sewer line running from the intersection of Rosemont Road and University Avenue and Bluehill Drive will be difficult to access in the future. We recommend extending lining the existing sewer main through this portion of the project to minimize and potentially eliminate any need for future maintenance of this pipe.

***Response:*** *Lining of this section of pipe is under consideration and will be included on the Construction Documents if the proponent chooses to proceed with additional sewer lining.*

**Comment 5:** The existing sewer running cross country to the south west of Harvard Street (sheet C-114/124) needs to be moved to be outside the extents of the proposed detention pond area.

***Response:*** *The existing cross country sewer will be relocated outside of the proposed detention pond area. A sketch of the proposed relocation is attached.*

**Comment 6:** The pipe between SMH's 3.7 and 3.6 has a slope of .002. This is below a minimum slope of .004. Design should be adjusted to increase this slope.

***Response:*** *The design has been adjusted to increase the invert at SMH 3.7 in order to achieve a slope of .005 in this section of sewer pipe.*

**Comment 7:** It is unclear where flow from SMH 5.0 enters the system. Please clarify what sewer mains are to remain and what mains are to be removed or abandoned.

***Response:*** *SMH 5.0 is to be installed as a dog-house type manhole on the existing sewer line on the southeast side of University Avenue. This sewer line on the southeast side of University Avenue enters the main 14" sewer on the northwest side of University Avenue at ESMH F. A sketch of this section of University Avenue clarifying the path of flow from the SMH 5.0 connection through the system to ESMH F is attached. Also attached is an updated hydraulic analysis table with the flows through the southeast sewer main included and the entry flow to the main line sewer at ESMH F highlighted in red. As stated in response to Comment 2, additional labeling will be shown at the Construction Document level for removal or abandonment of existing utilities including any sewer pipe or manholes.*

**Comment 8:** In the hydraulic analysis, a peaking factor from average day to peak hour of 2.0 seems low. Typically peaking factors are in the 4.0 to 5.0 range. While capacity

should not be affected, we suggest the final version of the calculation include this update.

***Response:*** *For our hydraulic analysis we used Title 5 maximum daily flows to estimate our average daily design flow or maximum daily flow. As discussed and agreed upon with Andrew Dennehy of BETA, given that the maximum daily flow was used as the average, we feel that a peaking factor of 2.0 to estimate the high (peak hour) is sufficient.*

**Comment 9:** Details should show insulation of sewers to be done for sewers with less than five feet of cover. Indicate all locations on the plans where concrete encasement is required.

***Response:*** *Detail Sheet D-503 has an "Insulated Sewer" detail, typical of industry standards. Where sewer pipe is installed with less than four feet of cover it shall be insulated. If less than three feet of cover is available in vehicular areas the sewer shall be concrete encased. Locations where insulation or concrete encasement is required due to lack of cover will be shown on the Construction Documents as necessary.*

**Comment 10:** Where sewers cross over water mains, sewers shall be placed such that joints are not directly over water mains and sewer shall be encased in concrete. Indicate all locations on the plans where concrete encasement is required.

***Response:*** *Detail Sheet C-504 has two details, typical of industry standards, to address where sewers cross over or under water mains. The "Sewer or Drain Crossing Detail" shows minimum vertical separation requirements between water and sewer and the "Concrete Encasement Detail" is provided for instances where this separation cannot be met. Locations where concrete encasement is required will be shown on the Construction Documents as necessary.*

**Comment 11:** For the Sewer Operations and Maintenance Plan, it should be noted that recommendations that are made for future inspection and maintenance will be determined by the Town.

***Response:*** *The Sewer Operations and Maintenance Plan is intended to cover all on-site sewer system pipes and structures. The Property Owner possesses the primary responsibility for overseeing and implementing the O&M Plan. Records of Inspection & Maintenance will be available to the Town as stated in the O&M Plan and future inspection and maintenance will be done in consultation with the Town.*

**Water:**

**Comment 1:** Dedham Westwood Water is to provide review comments on the water system relative to general operation of the system including overall demand, fire fighting capacity etc. It is assumed that all details for water construction will be reviewed and approved by DWWD. Provide documentation confirming that all DWWD issues have been satisfactorily resolved.

***Response:*** *A copy of review comments will be provided.*

**Comment 2:** Please confirm that the Westwood Fire Department has reviewed and approved system layout including hydrant location, flow/pressure criteria etc. for fire fighting.

***Response:*** *We are currently working with Chief Scoble on fire truck turning movements, hydrant locations and other firefighting criteria. Comments provided by the Chief will be incorporated to the Site Plans.*

**Private Utilities:**

**Comment 1:** Private utility companies will need to review and approve the layout and size of the private utilities proposed for the project. We recommend documentation of their approval be provided to the Town prior to the construction of any utilities.

***Response:*** *Designs will be coordinated with Private utility companies.*

As always, please do not hesitate to contact me should you have any questions or wish to discuss any of the enclosed information in greater detail. I can be reached at (508) 903-2085.

Sincerely,

Nathan H. Cheal, P.E.
Project Manager

C: Paul Cincotta – New England Development
John Twohig, Esq. – Goulston & Storrs
Bob Daylor, PE, PLS - Tt
Austin Turner – Tt

Enc: S-G1 Cross Country Sewer Proposed Relocation Graphic
S-G2 University Avenue Sewer Graphic
Updated University Station Sewer Hydraulic Analysis

P:\3659\127-3659-12003\DOCS\LETTERS\UNIVERSITYSTATION-RESPONSE_TO_UTILITY_COMMENTS-041613DOCX.DOCX

SMH9.11 TO BE INSTALLED
ON EXISTING 8" SS
R=61.0
I OUT=56.00 (PROP)
I IN=56.96 (EXIST)

8" PVC
L=122'
S=0.0298

SMH9.10
R=57.0
I OUT=52.26
I IN=52.36

SMH
RIM=55.38
INV.1=47.2'

8" PVC
L=277'
S=0.0150

ABANDON
EXIST 8" SS
AND SMHS

ABANDON
EXIST 8" SS

SMH
RIM=53.66
INV.1=45.7'

SMH9.9
R=56.5
I OUT=48.00
I IN=48.10
48" SD INV = 49.5
8" SS CROWN = 48.5
APPROX. 1' OF CLEARANCE

SMH9.2
R=54.30
I OUT=51.18
I IN=51.23

8" PVC TO REPLACE EXIST. 8"SS
L=106'
S=0.0150

SMH9.1
R=54.30
I OUT=47.30
I IN=47.40 (NW)
I IN = 47.40 (N)

SMH
RIM=53.84

8" PVC
L=84'
S=0.0449

ABANDON EXIST. SMH

CUT, CAP AND
ABANDON
EXIST 8" SS

8" PVC
L=50'
S=0.0460

ESMH9.0
R=53.44
I OUT=45.0
I IN=45.0(N)
I IN=45.0(W)

NO PARKING
FIRE LANE
PIV
W

0 20' 40' 80'
SCALE: 1:40

Bar Measures 1 inch

TETRA TECH
www.tetratech.com
One Grant Street
Framingham, Massachusetts 01701
Phone: 508.903.2000 Fax: 508.903.2001

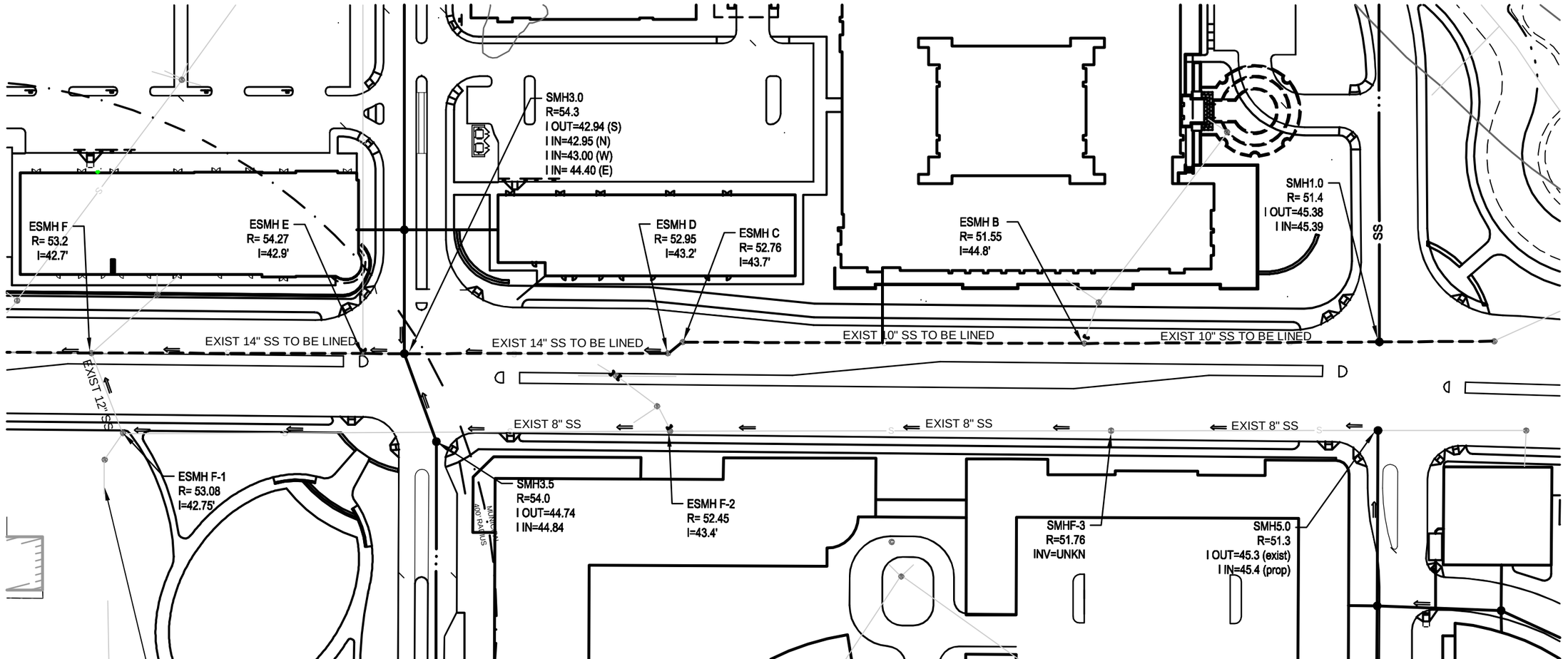
| MARK | DATE | DESCRIPTION | BY |
|---|---|---|---|

UNIVERSITY STATION
Westwood, Massachusetts

Cross Country Sewer
Proposed Relocation

| | |
|---|---|
| Project No.: | 127-3659-12003 |
| Designed By: | MKM |
| Drawn By: | MKM |
| Checked By: | AFT |

S-G1




TETRA TECH
www.tetratech.com
One Grant Street
Framingham, Massachusetts 01701
Phone: 508.903.2000 Fax: 508.903.2001

| MARK | DATE | DESCRIPTION | BY |
|---|---|---|---|

UNIVERSITY STATION
Westwood, Massachusetts

University Avenue Sewer

| | |
|---|---|
| Project No.: | 127-3659-12003 |
| Designed By: | MKM |
| Drawn By: | MKM |
| Checked By: | AFT |

S-G2

Bar Measures 1 inch

4/12/2013 3:25:40 PM - P:\36591\127-3659-12003\CAD\SHEETFILES\VARIOUS FIGURES\UNIVERSITY AVE SEWER_2013.04.12.DWG - RECOS, MELISSA

# University Station Sewer Hydraulic Analysis
## Updated 4/16/2013

Office B & C Connection to Rosemont

| Upstream Manhole | Downstream Manhole | Max. Day Flow Added (gpd) | Upstream Invert Elev. (ft) | Downstream Invert Elev. (ft) | Pipe Size (in) | Length (ft) | Slope (ft/ft) | Flow Capacity Full (mgd) | Proposed Flow (gpd) | | | Velocity (ft/s) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | High (peak hour) | Average (max day) | Low (min. day) | High | Average | Low |
| SMH7.3 | SMH7.2 | 9,158 | 100.50 | 91.98 | 8 | 289 | 0.029 | 1.34 | 18,315 | 9,158 | 1,145 | 2.09 | 1.70 | 0.90 |
| SMH7.2 | SMH7.1 | 0 | 91.88 | 82.12 | 8 | 316 | 0.031 | 1.37 | 18,315 | 9,158 | 1,145 | 2.13 | 1.72 | 0.91 |
| SMH7.1 | SMH7.0 | 9,158 | 82.02 | 79.60 | 8 | 79 | 0.031 | 1.37 | 36,630 | 18,315 | 2,289 | 2.62 | 2.12 | 1.13 |

Rosemont to University Ave Connection Sewer (includes upstream flows of 11,813 gpd at SMH8.0 from exist. Rosemont offices)

| Upstream Manhole | Downstream Manhole | Max. Day Flow Added (gpd) | Upstream Invert Elev. (ft) | Downstream Invert Elev. (ft) | Pipe Size (in) | Length (ft) | Slope (ft/ft) | Flow Capacity Full (mgd) | Proposed Flow (gpd) | | | Velocity (ft/s) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | High (peak hour) | Average (max day) | Low (min. day) | High | Average | Low |
| SMH8 | SMH1.7 | 30,128 | 74.00 | 71.79 | 8 | 69 | 0.032 | 1.40 | 60,255 | 30,128 | 3,766 | 2.13 | 1.73 | 0.91 |
| SMH1.7 | SMH1.6 | 0 | 71.69 | 69.09 | 8 | 113 | 0.023 | 1.18 | 60,255 | 30,128 | 3,766 | 1.91 | 1.54 | 0.81 |
| SMH1.6 | SMH1.5 | 0 | 68.99 | 64.85 | 8 | 179 | 0.023 | 1.19 | 60,255 | 30,128 | 3,766 | 1.91 | 1.54 | 0.81 |
| SMH1.5 | SMH1.4 | 0 | 64.75 | 61.19 | 8 | 156 | 0.023 | 1.18 | 60,255 | 30,128 | 3,766 | 1.90 | 1.53 | 0.81 |
| SMH1.4 | SMH1.3 | 0 | 61.09 | 58.44 | 8 | 119 | 0.022 | 1.17 | 60,255 | 30,128 | 3,766 | 1.88 | 1.53 | 0.80 |
| SMH1.3 | SMH1.2 | 0 | 58.34 | 53.86 | 8 | 210 | 0.021 | 1.14 | 60,255 | 30,128 | 3,766 | 1.85 | 1.49 | 0.79 |
| SMH1.2 | SMH1.1 | 0 | 53.76 | 51.14 | 8 | 97 | 0.027 | 1.28 | 60,255 | 30,128 | 3,766 | 2.02 | 1.62 | 0.85 |
| SMH1.1 | SMH1.0 | 0 | 51.04 | 45.40 | 8 | 258 | 0.022 | 1.15 | 60,255 | 30,128 | 3,766 | 1.88 | 1.51 | 0.80 |

Retail L, N, O and Residential A2 Connection to University Ave

| Upstream Manhole | Downstream Manhole | Max. Day Flow Added (gpd) | Upstream Invert Elev. (ft) | Downstream Invert Elev. (ft) | Pipe Size (in) | Length (ft) | Slope (ft/ft) | Flow Capacity Full (mgd) | Proposed Flow (gpd) | | | Velocity (ft/s) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | High (peak hour) | Average (max day) | Low (min. day) | High | Average | Low |
| SMH3.4 | SMH3.3 | 2,545 | 57.60 | 56.89 | 8 | 71 | 0.010 | 0.78 | 5,090 | 2,545 | 318 | 0.67 | 0.54 | 0.28 |
| SMH3.3 | SMH3.2 | 0 | 56.79 | 54.48 | 8 | 191 | 0.012 | 0.86 | 5,090 | 2,545 | 318 | 0.72 | 0.58 | 0.30 |
| SMH3.2 | SMH3.1 | 29,920 | 54.38 | 45.28 | 8 | 185 | 0.049 | 1.73 | 64,930 | 32,465 | 4,058 | 2.53 | 2.04 | 1.08 |
| SMH3.1 | SMH3.0 | 1,595 | 45.18 | 43.00 | 8 | 92 | 0.024 | 1.20 | 68,119 | 34,060 | 4,257 | 2.00 | 1.62 | 0.85 |

Retail J, K, Q & P Connection to University Ave

| Upstream Manhole | Downstream Manhole | Max. Day Flow Added (gpd) | Upstream Invert Elev. (ft) | Downstream Invert Elev. (ft) | Pipe Size (in) | Length (ft) | Slope (ft/ft) | Flow Capacity Full (mgd) | Proposed Flow (gpd) | | | Velocity (ft/s) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | High (peak hour) | Average (max day) | Low (min. day) | High | Average | Low |
| SMH4.10 | SMH4.9 | 3,477 | 53.77 | 51.63 | 8 | 215 | 0.010 | 0.78 | 6,953 | 3,477 | 435 | 0.74 | 0.59 | 0.31 |
| SMH4.9 | SMH4.7 | 0 | 51.53 | 50.68 | 8 | 86 | 0.010 | 0.78 | 6,953 | 3,477 | 435 | 0.73 | 0.59 | 0.31 |
| SMH4.8 | SMH4.7 | 13,580 | 52.30 | 50.68 | 8 | 163 | 0.010 | 0.78 | 27,160 | 13,580 | 1,698 | 1.12 | 0.90 | 0.48 |
| SMH4.7 | SMH4.6 | 0 | 50.58 | 47.26 | 8 | 332 | 0.010 | 0.78 | 34,113 | 17,057 | 2,132 | 1.20 | 0.97 | 0.51 |
| SMH4.6 | SMH4.3 | 0 | 47.16 | 46.56 | 8 | 61 | 0.010 | 0.77 | 34,113 | 17,057 | 2,132 | 1.19 | 0.96 | 0.50 |
| *SMH4.5* | *SMH4.4* | 3,477 | 55.50 | *50.25* | 8 | 252 | 0.021 | 1.13 | 6,953 | 3,477 | 435 | 0.95 | 0.76 | 0.40 |
| *SMH4.4* | *SMH4.3* | 0 | *50.15* | *47.49* | 8 | 133 | 0.020 | 1.10 | 6,953 | 3,477 | 435 | 0.93 | 0.75 | 0.40 |
| SMH4.3 | SMH4.2 | 0 | 46.46 | 44.27 | 8 | 219 | 0.010 | 0.78 | 41,066 | 20,533 | 2,567 | 1.27 | 1.02 | 0.54 |
| SMH4.2 | SMH4.1 | 0 | 44.17 | 42.84 | 8 | 133 | 0.010 | 0.78 | 41,066 | 20,533 | 2,567 | 1.27 | 1.02 | 0.54 |
| SMH4.1 | SMH4.0 | 1,284 | 42.74 | 41.60 | 8 | 114 | 0.010 | 0.78 | 43,634 | 21,817 | 2,727 | 1.29 | 1.04 | 0.55 |

# University Station Sewer Hydraulic Analysis
## Updated 4/16/2013

Retail R Connection to Harvard

| Upstream Manhole | Downstream Manhole | Max. Day Flow Added (gpd) | Upstream Invert Elev. (ft) | Downstream Invert Elev. (ft) | Pipe Size (in) | Length (ft) | Slope (ft/ft) | Flow Capacity Full (mgd) | Proposed Flow (gpd) | | | Velocity (ft/s) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | High (peak hour) | Average (max day) | Low (min. day) | High | Average | Low |
| Building R | SMH6.1 | 45,000 | 51.00 | 46.90 | 8 | 297 | 0.014 | 0.92 | 90,000 | 45,000 | 5,625 | 1.82 | 1.47 | 0.77 |
| SMH6.1 | SMH6.0 | 0 | 46.80 | 43.90 | 8 | 208 | 0.014 | 0.92 | 90,000 | 45,000 | 5,625 | 1.82 | 1.47 | 0.77 |

Retail E, F, G, H, I Connection to Harvard

| Upstream Manhole | Downstream Manhole | Max. Day Flow Added (gpd) | Upstream Invert Elev. (ft) | Downstream Invert Elev. (ft) | Pipe Size (in) | Length (ft) | Slope (ft/ft) | Flow Capacity Full (mgd) | Proposed Flow (gpd) | | | Velocity (ft/s) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | High (peak hour) | Average (max day) | Low (min. day) | High | Average | Low |
| SMH10.0 | SMH9.9 | 4,094 | 55.00 | 48.26 | 8 | 337 | 0.020 | 1.10 | 8,187 | 4,094 | 512 | 0.98 | 0.79 | 0.42 |
| SMH9.9 | SMH9.0 | 0 | 48.16 | 45.00 | 8 | 158 | 0.020 | 1.10 | 8,187 | 4,094 | 512 | 0.98 | 0.79 | 0.42 |

Office A Connection to Harvard

| Upstream Manhole | Downstream Manhole | Max. Day Flow Added (gpd) | Upstream Invert Elev. (ft) | Downstream Invert Elev. (ft) | Pipe Size (in) | Length (ft) | Slope (ft/ft) | Flow Capacity Full (mgd) | Proposed Flow (gpd) | | | Velocity (ft/s) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | High (peak hour) | Average (max day) | Low (min. day) | High | Average | Low |
| SMH9.8 | SMH9.7 | 7,155 | 102.50 | 94.59 | 8 | 134 | 0.059 | 1.90 | 14,310 | 7,155 | 894 | 1.69 | 1.38 | 0.72 |
| SMH9.7 | ESMH9.6 | 0 | 94.50 | 79.00 | 8 | 250 | 0.062 | 1.94 | 14,310 | 7,155 | 894 | 1.73 | 1.39 | 0.74 |

Harvard Street Sewer (includes upstream flows of 25,833 gpd at ESMH9.6 from NSTAR)

| Upstream Manhole | Downstream Manhole | Max. Day Flow Added (gpd) | Upstream Invert Elev. (ft) | Downstream Invert Elev. (ft) | Pipe Size (in) | Length (ft) | Slope (ft/ft) | Flow Capacity Full (mgd) | Proposed Flow (gpd) | | | Velocity (ft/s) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | High (peak hour) | Average (max day) | Low (min. day) | High | Average | Low |
| ESMH9.6 | SMH9.5 | 32,988 | *78.90* | *75.40* | *8* | *42* | *0.083* | 2.25 | 65,976 | 32,988 | 4,124 | 3.06 | 2.47 | 1.31 |
| SMH9.5 | SMH9.4 | 0 | *75.30* | 69.79 | 8 | 67 | 0.082 | 2.24 | 65,976 | 32,988 | 4,124 | 3.04 | 2.45 | 1.30 |
| SMH9.4 | SMH9.3 | 0 | 69.69 | 64.88 | 8 | 90 | 0.053 | 1.81 | 65,976 | 32,988 | 4,124 | 2.61 | 2.12 | 1.12 |
| SMH9.3 | SMH9.2 | 0 | 64.78 | 51.23 | 8 | 252 | 0.054 | 1.81 | 65,976 | 32,988 | 4,124 | 2.62 | 2.13 | 1.12 |
| SMH9.2 | SMH9.1 | 0 | 51.18 | 47.40 | 8 | 84 | 0.045 | 1.66 | 65,976 | 32,988 | 4,124 | 2.48 | 1.99 | 1.05 |
| SMH9.1 | ESMH9.0 | 0 | 47.30 | 45.00 | 8 | 50 | 0.046 | 1.67 | 65,976 | 32,988 | 4,124 | 2.49 | 2.01 | 1.06 |
| ESMH9.0 | SMH6.0 | 4,094 | *45.00* | 43.90 | 8 | 135 | 0.008 | 0.70 | 74,163 | 37,082 | 4,635 | 1.42 | 1.15 | 0.60 |
| SMH6.0 | ESMH P | 46,109 | 43.80 | 42.80 | 8 | 129 | 0.008 | 0.69 | 166,381 | 83,191 | 10,399 | 1.78 | 1.45 | 0.76 |
| ESMH P | ESMH O | 2,505 | 42.80 | 40.60 | 8 | 318 | 0.007 | 0.65 | 171,391 | 85,696 | 10,712 | 1.73 | 1.40 | 0.74 |
| ESMH O | ESMH M | 0 | 40.60 | 39.70 | 8 | 43 | 0.021 | 1.13 | 171,391 | 85,696 | 10,712 | 2.55 | 2.06 | 1.08 |

Assisted Living, Office E & Residential B Connection University Ave

| Upstream Manhole | Downstream Manhole | Max. Day Flow Added (gpd) | Upstream Invert Elev. (ft) | Downstream Invert Elev. (ft) | Pipe Size (in) | Length (ft) | Slope (ft/ft) | Flow Capacity Full (mgd) | Proposed Flow (gpd) | | | Velocity (ft/s) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | High (peak hour) | Average (max day) | Low (min. day) | High | Average | Low |
| SMH3.7 | SMH3.6 | 20,625 | 47.15 | 46.30 | 8 | 170 | 0.005 | 0.55 | 41,250 | 20,625 | 2,578 | 1.00 | 0.81 | 0.42 |
| SMH3.6 | SMH3.5 | 13,750 | 46.20 | 44.84 | 8 | 273 | 0.005 | 0.55 | 68,750 | 34,375 | 4,297 | 1.17 | 0.95 | 0.50 |
| SMH3.5 | SMH3.0 | 53,405 | 44.74 | 44.40 | 8 | 63 | 0.005 | 0.57 | 175,560 | 87,780 | 10,973 | 1.61 | 1.29 | 0.68 |

# University Station Sewer Hydraulic Analysis
## Updated 4/16/2013

Residential C, Office W, Retail R & T, Restaurant B &C, Hotel V Connection University Ave

| Upstream Manhole | Downstream Manhole | Max. Day Flow Added (gpd) | Upstream Invert Elev. (ft) | Downstream Invert Elev. (ft) | Pipe Size (in) | Length (ft) | Slope (ft/ft) | Flow Capacity Full (mgd) | Proposed Flow (gpd) | | | Velocity (ft/s) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | High (peak hour) | Average (max day) | Low (min. day) | High | Average | Low |
| SMH5.8 | SMH5.7 | 5,000 | 48.40 | 48.10 | 8 | 58 | 0.005 | 0.56 | 10,000 | 5,000 | 625 | 0.65 | 0.53 | 0.28 |
| SMH5.7 | SMH5.6 | 0 | 48.00 | 47.52 | 8 | 97 | 0.005 | 0.55 | 10,000 | 5,000 | 625 | 0.65 | 0.52 | 0.28 |
| SMH5.6 | SMH5.5 | 0 | 47.42 | 46.88 | 8 | 108 | 0.005 | 0.55 | 10,000 | 5,000 | 625 | 0.64 | 0.52 | 0.27 |
| SMH5.5 | SMH5.1 | 0 | 46.78 | 46.14 | 8 | 128 | 0.005 | 0.55 | 10,000 | 5,000 | 625 | 0.64 | 0.52 | 0.27 |
| SMH5.4 | SMH5.3 | 4,375 | 48.40 | 47.38 | 8 | 196 | 0.005 | 0.56 | 8,750 | 4,375 | 547 | 0.63 | 0.51 | 0.27 |
| SMH5.3 | SMH5.2 | 17,600 | 47.28 | 46.70 | 8 | 117 | 0.005 | 0.55 | 43,950 | 21,975 | 2,747 | 1.02 | 0.82 | 0.43 |
| SMH5.2 | SMH5.1 | 5,750 | 46.60 | 46.14 | 8 | 92 | 0.005 | 0.55 | 55,450 | 27,725 | 3,466 | 1.09 | 0.88 | 0.47 |
| SMH5.1 | SMH5.0 | 20,680 | 46.04 | 45.40 | 8 | 130 | 0.005 | 0.55 | 106,810 | 53,405 | 6,676 | 1.34 | 1.08 | 0.57 |
| SMH5.0 | ESMHF-3 | 0 | 45.30 | 44.60 | 8 | 196.000 | 0.004 | 0.47 | 115,560 | 57,780 | 7,223 | 1.22 | 0.99 | 0.52 |
| ESMHF-3 | ESMHF-2 | 0 | 44.60 | 43.40 | 8 | 325.000 | 0.004 | 0.47 | 159,510 | 79,755 | 9,969 | 1.36 | 1.10 | 0.58 |
| ESMHF-2 | ESMHF-1 | 0 | 43.40 | 42.75 | 8 | 180.000 | 0.004 | 0.47 | 214,960 | 107,480 | 13,435 | 1.49 | 1.20 | 0.63 |
| ESMHF-1 | ESMH F | 0 | 42.75 | 42.70 | 12 | 82.000 | 0.001 | 0.57 | 321,770 | 160,885 | 20,111 | 0.85 | 0.69 | 0.36 |

University Avenue Existing Relined Sewer (includes upstream flows of 22,836 gpd at ESMH A from sewer force main and 405,000 gpd at ESMH A from 10"ss )

| Upstream Manhole | Downstream Manhole | Max. Day Flow Added (gpd) | Upstream Invert Elev. (ft) | Downstream Invert Elev. (ft) | Pipe Size (in) | Length (ft) | Slope (ft/ft) | Flow Capacity Full (mgd) | Proposed Flow (gpd) | | | Velocity (ft/s) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | High (peak hour) | Average (max day) | Low (min. day) | High | Average | Low |
| ESMH A | SMH1.0 | 427,836 | 45.60 | 45.39 | 10 | 83 | 0.003 | 0.93 | 855,672 | 427,836 | 53,480 | 1.94 | 1.57 | 0.82 |
| SMH1.0 | ESMH B | 30,128 | 45.38 | 44.80 | 10 | 216 | 0.003 | 0.95 | 915,927 | 457,964 | 57,245 | 2.02 | 1.63 | 0.86 |
| ESMH B | ESMH C | 22,550 | 44.80 | 43.70 | 10 | 293 | 0.004 | 1.13 | 961,027 | 480,514 | 60,064 | 2.30 | 1.86 | 0.98 |
| ESMH C | ESMH D | 0 | 43.70 | 43.20 | 10 | 10 | 0.050 | 4.12 | 961,027 | 480,514 | 60,064 | 5.64 | 4.57 | 2.41 |
| ESMH D | SMH3.0 | 0 | 43.20 | 42.95 | 14 | 193 | 0.001 | 1.63 | 961,027 | 480,514 | 60,064 | 1.51 | 1.23 | 0.65 |
| SMH3.0 | ESMH E | 121,840 | 42.94 | 42.90 | 14 | 29 | 0.001 | 1.68 | 1,204,706 | 602,353 | 75,294 | 1.66 | 1.34 | 0.71 |
| ESMH E | ESMH F | 0 | 42.90 | 42.70 | 14 | 197 | 0.001 | 1.44 | 1,204,706 | 602,353 | 75,294 | 1.49 | 1.21 | 0.63 |
| ESMH F | ESMH G | 53,405 | 42.70 | 42.30 | 14 | 141 | 0.003 | 2.40 | 1,311,516 | 655,758 | 81,970 | 2.18 | 1.77 | 0.93 |
| ESMH G | ESMH H | 0 | 42.30 | 41.70 | 14 | 280 | 0.002 | 2.09 | 1,311,516 | 655,758 | 81,970 | 1.99 | 1.60 | 0.85 |
| ESMH H | SMH4.0 | 7,000 | 41.70 | 41.56 | 16 | 255 | 0.001 | 1.51 | 1,325,516 | 662,758 | 82,845 | 1.22 | 0.98 | 0.52 |
| SMH4.0 | ESMH I | 21,817 | 41.55 | 41.50 | 16 | 86 | 0.001 | 1.55 | 1,369,150 | 684,575 | 85,572 | 1.25 | 1.01 | 0.53 |
| ESMH I | ESMH J | 0 | 41.50 | 40.60 | 16 | 396 | 0.002 | 3.07 | 1,369,150 | 684,575 | 85,572 | 2.01 | 1.63 | 0.85 |
| ESMH J | ESMH K | 0 | 40.60 | 40.30 | 20 | 370 | 0.001 | 3.33 | 1,369,150 | 684,575 | 85,572 | 1.36 | 1.10 | 0.58 |
| ESMH K | ESMH L | 1,800 | 40.30 | 39.90 | 20 | 359 | 0.001 | 3.90 | 1,372,750 | 686,375 | 85,797 | 1.52 | 1.23 | 0.65 |
| ESMH L | ESMH M | 0 | 39.90 | 39.70 | 20 | 50 | 0.004 | 7.39 | 1,372,750 | 686,375 | 85,797 | 2.36 | 1.91 | 1.01 |
| ESMH M | ESMH N | 85,696 | 39.70 | 39.20 | 20 | 253 | 0.002 | 5.20 | 1,544,141 | 772,071 | 96,509 | 1.92 | 1.55 | 0.81 |

* n for typical sewers = 0.013
* n for lined sewers= 0.01
** low flow was developed by assuming 1/8 of the average daily flow according to the sewer diurnal curve developed by MWRA's Master Planning and CSO Facility Planning.
*** In general, prop. upstream SMH INV is 7.5' below grade to ensure separation below watermain crossings and SS lateral exist through building foundations.
**** Upstream Flows include: 25,833 gpd at ESMH9.6 from NSTAR
22,836 gpd at ESMH A from sewer force main and 405,000 gpd at ESMH A from 10"ss
11,813 gpd at SMH8.0 from exist. Rosemont offices