Summary for Subcatchment 1S:

Runoff = 1.64 cfs @ 12.07 hrs, Volume= 0.118 af, Depth= 5.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.16"

Area (sf)	CN	Description
0	98	Roofs, HSG B
8,982	98	Paved parking, HSG B
3,350	69	50-75% Grass cover, Fair, HSG B
12,332	90	Weighted Average
3,350		27.17% Pervious Area
8,982		72.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, DIRECT ENTRY**

Summary for Subcatchment 2S:

Runoff = 6.91 cfs @ 12.07 hrs, Volume= 0.511 af, Depth= 5.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.16"

Area (sf)	CN	Description
3,625	98	Roofs, HSG B
37,732	98	Paved parking, HSG B
8,692	69	50-75% Grass cover, Fair, HSG B
50,049	93	Weighted Average
8,692		17.37% Pervious Area
41,357		82.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, DIRECT ENTRY**

Summary for Subcatchment 3S:

Runoff = 10.14 cfs @ 12.07 hrs, Volume= 0.750 af, Depth= 5.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.16"

Area (sf)	CN	Description
26,443	98	Roofs, HSG B
35,090	98	Paved parking, HSG B
11,910	69	50-75% Grass cover, Fair, HSG B
73,443	93	Weighted Average
11,910		16.22% Pervious Area
61,533		83.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, DIRECT ENTRY**

Summary for Subcatchment 10S:

Runoff = 0.60 cfs @ 12.08 hrs, Volume= 0.041 af, Depth= 2.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.16"

Area (sf)	CN	Description
0	98	Roofs, HSG B
0	98	Paved parking, HSG B
7,620	69	50-75% Grass cover, Fair, HSG B
7,620	69	Weighted Average
7,620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, DIRECT ENTRY**

Summary for Subcatchment 20S:

Runoff = 3.30 cfs @ 12.07 hrs, Volume= 0.261 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.16"

Area (sf)	CN	Description
23,003	98	Roofs, HSG B
0	98	Paved parking, HSG B
0	69	50-75% Grass cover, Fair, HSG B
23,003	98	Weighted Average
23,003		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, DIRECT ENTRY**

Summary for Subcatchment 21S:

Runoff = 3.27 cfs @ 12.07 hrs, Volume= 0.230 af, Depth= 4.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.16"

Area (sf)	CN	Description
0	98	Roofs, HSG B
15,094	98	Paved parking, HSG B
11,235	69	50-75% Grass cover, Fair, HSG B
26,329	86	Weighted Average
11,235		42.67% Pervious Area
15,094		57.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, DIRECT ENTRY**

Summary for Subcatchment 30S:

Runoff = 1.65 cfs @ 12.07 hrs, Volume= 0.130 af, Depth= 5.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.16"

Area (sf)	CN	Description
11,502	98	Roofs, HSG B
0	98	Paved parking, HSG B
0	69	50-75% Grass cover, Fair, HSG B
11,502	98	Weighted Average
11,502		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct Entry**

Summary for Subcatchment 31S:

Runoff = 9.07 cfs @ 12.07 hrs, Volume= 0.659 af, Depth= 5.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr Rainfall=6.16"

Area (sf)	CN	Description
0	98	Roofs, HSG B
51,042	98	Paved parking, HSG B
16,328	69	50-75% Grass cover, Fair, HSG B
67,370	91	Weighted Average
16,328		24.24% Pervious Area
51,042		75.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct Entry**

Summary for Reach 33R:

Inflow Area = 1.133 ac, 77.23% Impervious, Inflow Depth = 4.01" for 25-Yr event
Inflow = 5.69 cfs @ 12.09 hrs, Volume= 0.378 af
Outflow = 5.69 cfs @ 12.09 hrs, Volume= 0.378 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach 34R:

Inflow Area = 1.811 ac, 79.30% Impervious, Inflow Depth = 4.54" for 25-Yr event
Inflow = 9.07 cfs @ 12.07 hrs, Volume= 0.685 af
Outflow = 9.07 cfs @ 12.07 hrs, Volume= 0.685 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 31P: INFIL_1

Inflow Area = 0.528 ac,100.00% Impervious, Inflow Depth = 5.92" for 25-Yr event
Inflow = 3.30 cfs @ 12.07 hrs, Volume= 0.261 af
Outflow = 2.67 cfs @ 12.12 hrs, Volume= 0.261 af, Atten= 19%, Lag= 3.3 min
Discarded = 0.04 cfs @ 6.13 hrs, Volume= 0.112 af
Primary = 2.63 cfs @ 12.12 hrs, Volume= 0.148 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 86.98' @ 12.12 hrs Surf.Area= 1,601 sf Storage= 3,067 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 229.7 min (973.6 - 743.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	84.25'	1,365 cf	**30.50'W x 52.50'L x 3.54'H Field A** 5,671 cf Overall - 2,258 cf Embedded = 3,413 cf x 40.0% Voids
#2A	84.75'	2,258 cf	**Cultec R-330XLHD** x 42 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

3,623 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	86.00'	**12.0" Round Culvert** L= 52.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 86.00' / 84.96' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Discarded	84.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 6.13 hrs HW=84.29' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=2.63 cfs @ 12.12 hrs HW=86.98' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 2.63 cfs @ 3.36 fps)

Summary for Pond 39P: INFIL_2

Inflow Area = 0.264 ac,100.00% Impervious, Inflow Depth = 5.92" for 25-Yr event
Inflow = 1.65 cfs @ 12.07 hrs, Volume= 0.130 af
Outflow = 0.33 cfs @ 12.49 hrs, Volume= 0.130 af, Atten= 80%, Lag= 25.0 min
Discarded = 0.04 cfs @ 8.75 hrs, Volume= 0.105 af
Primary = 0.29 cfs @ 12.49 hrs, Volume= 0.026 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 88.51' @ 12.49 hrs Surf.Area= 1,601 sf Storage= 2,589 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 436.1 min (1,179.9 - 743.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	86.25'	1,365 cf	**30.50'W x 52.50'L x 3.54'H Field A** 5,671 cf Overall - 2,258 cf Embedded = 3,413 cf x 40.0% Voids
#2A	86.75'	2,258 cf	**Cultec R-330XLHD** x 42 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
		3,623 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	88.25'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 88.25' / 86.25' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Discarded	86.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 8.75 hrs HW=86.29' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.29 cfs @ 12.49 hrs HW=88.51' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.29 cfs @ 1.74 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: Runoff Area=12,332 sf 72.83% Impervious Runoff Depth=7.73"
Tc=5.0 min CN=90 Runoff=2.47 cfs 0.182 af

Subcatchment2S: Runoff Area=50,049 sf 82.63% Impervious Runoff Depth=8.10"
Tc=5.0 min CN=93 Runoff=10.24 cfs 0.775 af

Subcatchment3S: Runoff Area=73,443 sf 83.78% Impervious Runoff Depth=8.10"
Tc=5.0 min CN=93 Runoff=15.02 cfs 1.138 af

Subcatchment10S: Runoff Area=7,620 sf 0.00% Impervious Runoff Depth=5.16"
Tc=5.0 min CN=69 Runoff=1.10 cfs 0.075 af

Subcatchment20S: Runoff Area=23,003 sf 100.00% Impervious Runoff Depth=8.70"
Tc=5.0 min CN=98 Runoff=4.80 cfs 0.383 af

Subcatchment21S: Runoff Area=26,329 sf 57.33% Impervious Runoff Depth=7.25"
Tc=5.0 min CN=86 Runoff=5.07 cfs 0.365 af

Subcatchment30S: Runoff Area=11,502 sf 100.00% Impervious Runoff Depth=8.70"
Tc=5.0 min CN=98 Runoff=2.40 cfs 0.191 af

Subcatchment31S: Runoff Area=67,370 sf 75.76% Impervious Runoff Depth=7.85"
Tc=5.0 min CN=91 Runoff=13.59 cfs 1.012 af

Reach 33R: Inflow=8.54 cfs 0.630 af
Outflow=8.54 cfs 0.630 af

Reach 34R: Inflow=14.22 cfs 1.089 af
Outflow=14.22 cfs 1.089 af

Pond 31P: INFIL_1 Peak Elev=87.51' Storage=3,446 cf Inflow=4.80 cfs 0.383 af
Discarded=0.04 cfs 0.117 af Primary=3.81 cfs 0.265 af Outflow=3.85 cfs 0.383 af

Pond 39P: INFIL_2 Peak Elev=88.89' Storage=2,986 cf Inflow=2.40 cfs 0.191 af
Discarded=0.04 cfs 0.115 af Primary=1.44 cfs 0.077 af Outflow=1.48 cfs 0.191 af

Total Runoff Area = 6.236 ac Runoff Volume = 4.122 af Average Runoff Depth = 7.93"
21.77% Pervious = 1.358 ac 78.23% Impervious = 4.879 ac

Summary for Subcatchment 1S:

Runoff = 2.47 cfs @ 12.07 hrs, Volume= 0.182 af, Depth= 7.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.94"

Area (sf)	CN	Description
0	98	Roofs, HSG B
8,982	98	Paved parking, HSG B
3,350	69	50-75% Grass cover, Fair, HSG B
12,332	90	Weighted Average
3,350		27.17% Pervious Area
8,982		72.83% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, DIRECT ENTRY**

Summary for Subcatchment 2S:

Runoff = 10.24 cfs @ 12.07 hrs, Volume= 0.775 af, Depth= 8.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.94"

Area (sf)	CN	Description
3,625	98	Roofs, HSG B
37,732	98	Paved parking, HSG B
8,692	69	50-75% Grass cover, Fair, HSG B
50,049	93	Weighted Average
8,692		17.37% Pervious Area
41,357		82.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, DIRECT ENTRY**

Summary for Subcatchment 3S:

Runoff = 15.02 cfs @ 12.07 hrs, Volume= 1.138 af, Depth= 8.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.94"

Area (sf)	CN	Description
26,443	98	Roofs, HSG B
35,090	98	Paved parking, HSG B
11,910	69	50-75% Grass cover, Fair, HSG B
73,443	93	Weighted Average
11,910		16.22% Pervious Area
61,533		83.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, DIRECT ENTRY**

Summary for Subcatchment 10S:

Runoff = 1.10 cfs @ 12.07 hrs, Volume= 0.075 af, Depth= 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.94"

Area (sf)	CN	Description
0	98	Roofs, HSG B
0	98	Paved parking, HSG B
7,620	69	50-75% Grass cover, Fair, HSG B
7,620	69	Weighted Average
7,620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, DIRECT ENTRY**

Summary for Subcatchment 20S:

Runoff = 4.80 cfs @ 12.07 hrs, Volume= 0.383 af, Depth= 8.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.94"

Area (sf)	CN	Description
23,003	98	Roofs, HSG B
0	98	Paved parking, HSG B
0	69	50-75% Grass cover, Fair, HSG B
23,003	98	Weighted Average
23,003		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, DIRECT ENTRY**

Summary for Subcatchment 21S:

Runoff = 5.07 cfs @ 12.07 hrs, Volume= 0.365 af, Depth= 7.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.94"

Area (sf)	CN	Description
0	98	Roofs, HSG B
15,094	98	Paved parking, HSG B
11,235	69	50-75% Grass cover, Fair, HSG B
26,329	86	Weighted Average
11,235		42.67% Pervious Area
15,094		57.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, DIRECT ENTRY**

Summary for Subcatchment 30S:

Runoff = 2.40 cfs @ 12.07 hrs, Volume= 0.191 af, Depth= 8.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.94"

Area (sf)	CN	Description
11,502	98	Roofs, HSG B
0	98	Paved parking, HSG B
0	69	50-75% Grass cover, Fair, HSG B
11,502	98	Weighted Average
11,502		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct Entry**

Summary for Subcatchment 31S:

Runoff = 13.59 cfs @ 12.07 hrs, Volume= 1.012 af, Depth= 7.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Yr Rainfall=8.94"

Area (sf)	CN	Description
0	98	Roofs, HSG B
51,042	98	Paved parking, HSG B
16,328	69	50-75% Grass cover, Fair, HSG B
67,370	91	Weighted Average
16,328		24.24% Pervious Area
51,042		75.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Direct Entry**

Summary for Reach 33R:

Inflow Area = 1.133 ac, 77.23% Impervious, Inflow Depth = 6.68" for 100-Yr event
Inflow = 8.54 cfs @ 12.09 hrs, Volume= 0.630 af
Outflow = 8.54 cfs @ 12.09 hrs, Volume= 0.630 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Reach 34R:

Inflow Area = 1.811 ac, 79.30% Impervious, Inflow Depth = 7.22" for 100-Yr event
Inflow = 14.22 cfs @ 12.08 hrs, Volume= 1.089 af
Outflow = 14.22 cfs @ 12.08 hrs, Volume= 1.089 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 31P: INFIL_1

Inflow Area = 0.528 ac,100.00% Impervious, Inflow Depth = 8.70" for 100-Yr event
Inflow = 4.80 cfs @ 12.07 hrs, Volume= 0.383 af
Outflow = 3.85 cfs @ 12.13 hrs, Volume= 0.383 af, Atten= 20%, Lag= 3.3 min
Discarded = 0.04 cfs @ 3.70 hrs, Volume= 0.117 af
Primary = 3.81 cfs @ 12.13 hrs, Volume= 0.265 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 87.51' @ 12.13 hrs Surf.Area= 1,601 sf Storage= 3,446 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 175.3 min (914.3 - 739.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	84.25'	1,365 cf	**30.50'W x 52.50'L x 3.54'H Field A** 5,671 cf Overall - 2,258 cf Embedded = 3,413 cf x 40.0% Voids
#2A	84.75'	2,258 cf	**Cultec R-330XLHD** x 42 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

3,623 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	86.00'	**12.0" Round Culvert** L= 52.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 86.00' / 84.96' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Discarded	84.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 3.70 hrs HW=84.29' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=3.81 cfs @ 12.13 hrs HW=87.51' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 3.81 cfs @ 4.85 fps)

Summary for Pond 39P: INFIL_2

Inflow Area = 0.264 ac,100.00% Impervious, Inflow Depth = 8.70" for 100-Yr event
Inflow = 2.40 cfs @ 12.07 hrs, Volume= 0.191 af
Outflow = 1.48 cfs @ 12.16 hrs, Volume= 0.191 af, Atten= 38%, Lag= 5.4 min
Discarded = 0.04 cfs @ 7.28 hrs, Volume= 0.115 af
Primary = 1.44 cfs @ 12.16 hrs, Volume= 0.077 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 88.89' @ 12.16 hrs Surf.Area= 1,601 sf Storage= 2,986 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 338.5 min (1,077.5 - 739.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	86.25'	1,365 cf	**30.50'W x 52.50'L x 3.54'H Field A** 5,671 cf Overall - 2,258 cf Embedded = 3,413 cf x 40.0% Voids
#2A	86.75'	2,258 cf	**Cultec R-330XLHD** x 42 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
		3,623 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	88.25'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 88.25' / 86.25' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Discarded	86.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 7.28 hrs HW=86.29' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=1.44 cfs @ 12.16 hrs HW=88.89' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 1.44 cfs @ 2.72 fps)

DESIGN CONSULTANTS, INC.
CLOSED DRAINAGE SYSTEM CALCULATIONS
10-YEAR FREQUENCY

Project: 15 King Street
Proj. #: 2019-053
Date: 1/12/21
By: WK
Ckd by:

Notes: n= 0.013 for reinforced concrete pipe
n= 0.010 for high density polyethylene pipe (smooth interior)
c=0.95 (impervious areas)
c=0.20 (for lawn/planting areas)

Line		Length	Area Imp.	Area Perv.	CA	SUM	Time of	Rainfall	Req. Cap.	Pipe	Slope	Flow Full		Design Vel.		Rim	Inv. Elevations			Pipe Cover	Time in
From	To	(ft)	(acres)	(acres)		CA	Concen.	I (in./hr.)	Qd (cfs)	(in)	(ft/ft)	Qf (cfs)	Vf (fps)	Vd (fps)	Comments	Elev.(ft)	Upper	Lower	Q/Qf		Pipe
CB 3	DMH 3	86	0.11	0.01	0.11	0.11	5.00	5.40	0.57	12	0.020	6.55	8.34	4.3		88.75	84.75	83.03	0.09	3.00	0.33
INFIL 1	DMH 3	52	0.53	0.00	0.50	0.50	5.00	5.40	2.69	12	0.020	6.55	8.34	6.7		89.60	86.00	84.97	0.41	2.60	0.13
DMH 3	DMH 2	192				0.60	5.00	5.40	3.27	12	0.020	6.55	8.34	7.1		90.10	82.93	79.09	0.50	6.17	0.45
TD 1	DMH 1	8	0.05	0.00	0.05	0.05	5.00	5.40	0.24	8	0.020	2.22	6.35	3.5		76.00	74.00	73.74	0.11	1.33	0.04
CB 1	DMH 2	18	0.07	0.00	0.07	0.07	5.00	5.40	0.36	12	0.020	6.55	8.34	3.8		84.50	80.50	80.14	0.05	3.00	0.08
CB 2	DMH 2	18	0.12	0.00	0.11	0.11	5.00	5.40	0.60	12	0.020	6.55	8.34	4.4		84.50	80.50	80.14	0.09	3.00	0.07
DMH 1	DMH 2	69				0.05	5.00	5.40	0.24	12	0.020	6.55	8.34	3.4		76.50	73.74	72.36	0.04	1.76	0.34
DMH 2	EX CB 2	30				0.83	5.00	5.40	4.47	12	0.020	5.04	6.41	6.5	RCP	84.10	71.60	71.00	0.89	11.50	0.08
CB 14	DMH 10	12	0.09	0.01	0.09	0.09	5.00	5.40	0.47	12	0.020	6.55	8.34	4.1		88.40	85.95	85.72	0.07	1.45	0.05
CB 15	DMH 10	10	0.12	0.02	0.12	0.12	5.00	5.40	0.63	12	0.020	6.55	8.34	4.4		88.40	85.92	85.72	0.10	1.48	0.04
DMH 10	DMH 9	56				0.20	5.00	5.40	1.10	12	0.010	4.63	5.90	4.1		88.50	85.62	85.06	0.24	1.88	0.23
CB 12	DMH 9	21	0.16	0.02	0.16	0.16	5.00	5.40	0.84	12	0.020	6.55	8.34	4.8		87.75	85.48	85.06	0.13	1.27	0.07
CB 13	DMH 9	10	0.19	0.03	0.18	0.27	5.00	5.40	1.47	12	0.020	6.55	8.34	5.7		87.75	85.25	85.06	0.22	1.50	0.03
DMH 9	DMH 8	167				0.63	5.00	5.40	3.41	15	0.005	5.94	4.84	4.3		87.90	84.96	84.12	0.57	1.69	0.65
CB 11	DMH 8	22	0.11	0.04	0.12	0.12	5.00	5.40	0.62	12	0.020	6.55	8.34	4.4		90.10	86.10	85.65	0.10	3.00	0.08
INFIL 2	DMH 8	110	0.26	0.00	0.25	0.25	5.00	5.40	1.35	12	0.020	6.55	8.34	5.5		91.10	87.00	84.81	0.21	3.10	0.33
DMH 8	DMH 7	28				1.00	5.00	5.40	5.38	15	0.010	8.40	6.85	6.3		90.10	84.02	83.74	0.64	4.83	0.07
CB 9	DMH 7	22	0.06	0.02	0.06	0.06	5.00	5.40	0.32	12	0.020	6.55	8.34	3.6		89.41	85.40	84.96	0.05	3.01	0.10
CB 10	DMH 7	22	0.07	0.00	0.06	0.06	5.00	5.40	0.34	12	0.020	6.55	8.34	3.7		89.54	85.50	85.06	0.05	3.04	0.10
DMH 7	DMH 6	183				1.12	5.00	5.40	6.04	15	0.010	8.40	6.85	6.5		90.10	83.74	81.91	0.72	5.11	0.47
CB 7	DMH 6	16	0.04	0.00	0.04	0.04	5.00	5.40	0.21	12	0.020	6.55	8.34	3.2		88.75	84.75	84.44	0.03	3.00	0.08
CB 8	DMH 6	14	0.05	0.01	0.05	0.05	5.00	5.40	0.29	12	0.020	6.55	8.34	3.5		88.90	84.90	84.61	0.04	3.00	0.07
DHM 6	DMH 5	28				1.21	5.00	5.40	6.53	15	0.020	11.88	9.68	8.5		89.10	81.81	81.25	0.55	6.04	0.05
CB 4	DMH 5	25	0.18	0.01	0.18	0.18	5.00	5.40	0.95	12	0.020	6.55	8.34	5.0		88.90	84.90	84.40	0.15	3.00	0.08
CB 5	DMH 5	21	0.05	0.01	0.05	0.05	5.00	5.40	0.25	12	0.020	6.55	8.34	3.4		88.01	84.50	84.08	0.04	2.51	0.10
CB 6	DMH 5	23	0.05	0.01	0.05	0.05	5.00	5.40	0.28	12	0.020	6.55	8.34	3.5		88.36	84.50	84.04	0.04	2.86	0.11
DMH 5	DMH 4	29				1.48	5.00	5.40	8.02	15	0.020	9.14	7.45	7.5	RCP	88.50	81.15	80.57	0.88	5.10	0.06

Appendix H: TSS Removal Sheet

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Deep Sump Hooded Catch Basins

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
	0.00	0.75	0.00	0.75
	0.00	0.75	0.00	0.75
	0.00	0.75	0.00	0.75
	0.00	0.75	0.00	0.75

Total TSS Removal = 25%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 15 King Street

Prepared By: Design Consultants, Inc.

Date: 1/12/2021

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

Appendix I: O&M Plan

Operation & Maintenance Plan (Permanent BMPs)

FOR

King's Residences
15 King Street,
Peabody, MA

Date: January 12, 2021

Owner/Operator: TBD

Inspection and Maintenance Schedule

Facility personnel will inspect the stormwater management system on a routine basis not less than once per month for the first six (6) months of operation and annually thereafter. Refer to plans for landscaped area locations. Inspection and maintenance shall be performed as follows:

1. Landscaped Areas:

Landscaped areas shall be inspected and maintained on a regular basis. Areas that may be subject to erosion will be stabilized and reseeded immediately. Inspect soil and repair eroded areas monthly. Re-plant void areas as needed. Remove litter and debris monthly. Remove and replace dead vegetation twice per year in spring and fall. Replace soil media if ponding is witnessed more than 48 hours after rainfall event.

2. Roof Drains:

Inspections: The downspout inlets on the roof of the building will need periodic maintenance to ensure proper function. The required interval for this maintenance will vary by season; however, downspout inlets should be inspected for debris before the rainy season. When trees and other deciduous vegetation shed leaves that drop into the gutters, this will inhibit the flow of water and possibly clog downspouts. The leaves and/or debris must be removed in order for the system to work as designed.

Maintenance: Debris, such as leaves and trash, shall be removed by hand. Sediments shall be swept and collected or vacuumed.

3. Catch Basins:

Inspect CBs four times per year and at the end of foliage and snow removal seasons. Remove CB grate and measure from lowest invert in CB down to top of sediment. If sediment is within 2 feet of invert, structure shall be cleaned.

Inspection procedure is as follows:

a) Set up any necessary safety equipment around the access grate. Safety equipment should notify passing pedestrians and road traffic that work is being done.
b) Remove the grate to the inlet.
c) Without entering the vessel, look down into the chamber to inspect the inside.
d) Make note of any irregularities.
e) Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the outer annulus of the chamber.
f) Using a sediment probe measure the depth of sediment that has collected in the sump of the vessel.
g) On the Maintenance Log record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.
h) Securely replace the grate.
i) Take down safety equipment.
j) Notify the City of any irregularities noted during inspection.

Maintenance:

a) Set up any necessary safety equipment around the access grate of the catch basin. Safety equipment should notify passing pedestrian and road traffic that work is being done.
b) Remove the grate to the basin
c) Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.
d) Remove floatables stored on the surface of the water with the vactor hose or the skimmer net.
e) Using a sediment probe, measure the depth of sediment that has collected in the sump of the vessel and record it in the Maintenance Log
f) Once all floatables have been removed, drop the vactor hose to the base of the sump. Vactor out the sediment and gross debris off the sump floor.
g) Retract the vactor hose from the vessel.
h) On the Maintenance Log, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured.
i) Also note any apparent irregularities such as damaged components or blockages.
j) Securely replace the grate.

Stormwater System Inspection Report

General Information			
Location: 15 King Street			
Date of Inspection		Start/End Time	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Purpose of Inspection			
Weather Information			
Has it rained since the last inspection? ❑Yes ❑No			
Weather at time of this inspection?			

Site-Specific Stormwater Devices

	Description	Installed and Operating Properly?	Corrective Action Needed	Date for Corrective Action/Responsible Person
1		❑Yes ❑No		
2		❑Yes ❑No		
3		❑Yes ❑No		
4		❑Yes ❑No		
5		❑Yes ❑No		
6		❑Yes ❑No		
7		❑Yes ❑No		
8		❑Yes ❑No		

Overall Site Issues

	Description		Corrective Action	Date for Corrective Action/Responsible Person
1	Are all slopes properly stabilized?	❑Yes ❑No		
2	Are natural resource areas (e.g., streams, wetlands, etc.) being subjected to erosion?	❑Yes ❑No		
3	Are discharge points free of sediment deposits?	❑Yes ❑No		

Certification Statement:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name:

Signature:

Date:

Commonwealth of Massachusetts

DEPARTMENT OF HOUSING & COMMUNITY DEVELOPMENT

Charles D. Baker, Governor ◆ Karyn E. Polito, Lt. Governor ◆ Jennifer D. Maddox, Undersecretary

January 14, 2021

Ms. Frances Bisazza-Gallugi, Chairperson
Peabody Zoning Board of Appeals
City Hall
24 Lowell Street
Peabody, MA 01960

Re: HDG King Street LLC Inc., Comprehensive Permit Application for 15 King Street, Peabody, MA

Dear Ms. Frances Bisazza-Gallugi:

The Department of Housing and Community Development (DHCD) is in receipt of a letter December 15, 2020 on behalf of the Peabody Zoning Board of Appeals (Board) to the HDG King Street LLC, regarding its application for a Comprehensive Permit for 15 King Street, Peabody, MA. The December 15, 2020, letter seeks to provide notice pursuant to 760 CMR 56.03(8) that the Board considers that, in connection with the Applicant's Comprehensive Permit application a denial of the permit or the imposition of conditions or requirements would be consistent with local needs on the ground that the Statutory Minima as defined under 760 CMR 56.03(3)(a) ("Housing Unit Minimum" of SHI Eligible Housing Units in excess of 10% of total housing units) has been satisfied. The Board is also claiming "Recent Progress Toward Housing Unit Minimum" pursuant to 760 CMR 56.03(5).

DHCD is also in receipt of a December 16, 2020 letter from Attorney Jason Panos who represents the Applicant, HDG King Street LLC. Attorney Panos challenges the City's claim(s) of safe harbor and notes that the Board did not file its safe harbor claim (s) in a timely manner.

Procedure for Safe Harbor Assertion

Pursuant to 760 CMR 56.03(8), if a Board considers that, in connection with an Application, a denial of the permit or the imposition of conditions or requirements would be consistent with local needs on the grounds that the *Statutory Minima* defined at 760 CMR 56.03(3)(b) or (c) have been satisfied or that one or more of the grounds set forth in 760 CMR 56.03(1) have been met, it must do so according to the following procedures. Within 15 days of the opening of the local hearing for the Comprehensive Permit, the Board shall provide written notice to the Applicant, with a copy to the Department, that it considers that a denial of the permit or the imposition of conditions or requirements would be consistent with local needs, the grounds that it believes have been met, and the factual basis for that position, including any necessary supportive documentation.

Also pursuant to 760 CMR 56.03(8), if the Applicant wishes to challenge the Board's assertion, it must do so by providing written notice to the Department, with a copy to the Board, within 15 days of its receipt of the Board's notice, including any documentation to support its position. The Department shall thereupon review the materials provided by both parties and issue a decision within 30 days of its receipt of all materials.

Regulatory Background: Computation of Housing Unit Minimum and Recent Progress Toward Housing Unit Minimum

Computation of Housing Unit Minimum, 760 CMR 56.03(3)(a)

Housing Unit Minimum. For purposes of calculating whether the city or town's SHI Eligible Housing units exceed 10% of its total housing units, pursuant to M.G.L. c. 40B, § 20 and 760 CMR 56.00, there shall be a presumption that the latest SHI contains an accurate count of SHI Eligible Housing and total housing units. In the course of a review procedure pursuant to 760 CMR 56.03(8), a party may introduce evidence to rebut this presumption, which the Department shall review on a case-by-case basis, applying the standards of eligibility for the SHI set forth in 760 CMR 56.03(2). The total number of housing units shall be that total number of year-round units enumerated for the city or town in the latest available United States Census.

Recent Progress Toward Housing Unit Minimum, 760 CMR 56.03(5)

Recent progress toward a municipality's Statutory Minima shall mean that the number of SHI Eligible Housing units that have been created within the municipality during the 12 months prior to the date of the Comprehensive Permit application, evidenced by being inventoried by the Department or established according to 760 CMR 56.03(3)(a) as occupied, available for occupancy, or under permit as of the date of the Applicant's initial submission to the Board, is equal to or greater than 2% of the municipality's total housing units, as determined in accordance with 760 CMR 56.03(3)(a).

Background and Timeline: HDG King Street LLC, Comprehensive Permit Application for 15 King Street, Peabody, MA

- March 10, 2020: Governor Baker declares a State of Emergency due to the COVID-19 pandemic.
- April 3, 2020: Chapter 53 of the Acts of 2020 is signed into law. Chapter 53, *inter alia*, suspended requirements that a hearing commence within a specific time period after the filing of an application or request for approval of a permit during the state of emergency (and 45 days thereafter or a later date prescribed by law).
- May 13, 2020: HDG King Street LLC Inc., files a Comprehensive Permit Application for 15 King Street, Peabody, MA.
- September 12, 2020: The Board claims that the public hearing was opened on September 12, 2020.
- October 5, 2020: The Applicant claims that the public hearing was opened on October 5, 2020.
- October 20, 2020: Safe Harbor notification period passes without the Board's declaration of safe harbor.
- November 9, 2020: Board hearing continues.
- November 10, 2020: Chapter 201 of the Acts of 2020 is signed into law. Chapter 201, *inter alia*, lifts the suspension of permit hearing commencement under Chapter 53 of the Acts of 2020 as of

December 1, 2020, unless such date is extended by a waiver from the Secretary of the Executive Office of Housing and Economic Development.

- December 7, 2020: Board votes to invoke safe harbors.
- December 15, 2020: Board electronically sends safe harbor claims to Applicant and DHCD.
- December 16, 2020: Applicant challenges safe harbor claims and copies of the challenge are electronically sent to Board and DHCD.

Notice Requirements under 760 CMR 56.03(8)

DHCD finds that the Board failed to submit notice to the Applicant within 15 days of opening up the local hearing,[1] and failed to provide necessary supportive documentation. The Applicant's attorney, after noting its objection to the Board's untimely submission, submitted a response with supporting arguments and documentation the next day.

The Board suggests that its safe harbor assertion and other deadlines were tolled pursuant to Chapter 53 of the Acts of 2020 also known as the "Municipal Relief Act") (referred to herein as the "Act"), subsequently amended by Chapter 201 of the Acts of 2020 as as noted above. The Act allowed flexibility to conservation commissions, planning boards, zoning appeal boards, and other local permit granting authorities to defer or stay opening public hearings. DHCD notes that while the Act allowed for the delay in opening public hearings (the Board delayed the opening of the hearing for several months), the extending of deadlines for issuing permits, and the tolling of deadlines for constructive approvals and denials of permits, the Act did not relieve the Board of the deadline for safe harbor assertion under the Chapter 40B regulations once it opened the public hearing. The safe harbor assertion under 760 CMR 56.03(8) is not itself a "permit" within the meaning of the Act.[2] The Board also refers to Governor Baker's State of Emergency order, which did not itself toll permitting. Although the Governor's subsequent COVID-19 Order # 17 (issued March 26, 2020) did toll permitting by state permitting agencies, that Order is inapplicable here, as it pertains to state permits by state permitting agencies and not to local permitting. Furthermore, COVID-19 Order #17 was rescinded and replaced by COVID-19 Order #42 on July 2, 2020 (lifting suspensions on permitting deadlines as of August 10, 2020 and other dates specified in the order).

DHCD notes that even if the Board's submission had been timely, it does not appear that the Town met the grounds for its asserted safe harbors at the time of the Applicant's application, as discussed further below.

Statutory Minimum – SHI Eligible Housing in Excess of 10% of Total Housing Units

The SHI is used to measure a community's stock of low-or moderate-income housing for the purposes of M.G.L. Chapter 40B, the Comprehensive Permit Law. While housing developed under Chapter 40B is eligible for inclusion on the SHI, other types of housing qualify to count toward a community's affordable housing stock so long as they meet the SHI eligibility criteria set forth in DHCD's c. 40B

[1] Although the Board and the Applicant have cited different dates for the opening of the public hearing as noted in the timeline above, both dates precede the safe harbor assertion by more than 15 days and therefore the discrepancy does not impact DHCD's finding of untimeliness.

[2] The Act defines "permit" as "a permit, variance, special permit, license, amendment, extension, or other approval issued by a permit granting authority pursuant to a statute, ordinance, bylaw, rule or regulation, whether ministerial or discretionary." The Act's provisions for delays and tolling are also provided in the context of permits that are applied for or requested, as opposed to safe harbors that are asserted under 760 CMR 56.03(8) to foreclose the process of reviewing a comprehensive permit application.

guidelines, section II.A.[3] Section II.A.1 ("Project Eligibility Criteria") sets forth SHI eligibility requirements for an eligible Subsidy, affordability/income eligibility, affordable housing costs, a Use Restriction, and an Affirmative Fair Housing Marketing and Resident Selection Plan. Section II.A.2 ("Unit Eligibility Criteria") addresses other SHI eligibility requirements, including timing of eligibility, and, along with Section II.A.6, time lapses for SHI eligibility based upon timing of building and occupancy permit issuance.

In asserting that the Town has met the Statutory Minimum safe harbor, the Board states that the Town has "increased its SHI percentage from 8.1% to 10%" over the past 18 months." DHCD's SHI records indicate that the SHI percentage for Peabody is, and was at the time of the Applicant's application, 9.6% (there were 2,128 units on and/or eligible for the SHI out of 22,135 year-round total housing units at the time of the application).[4] The Board does not state that it has SHI Eligible Housing units in *excess* of 10% as required by the statute and regulations, nor does it rebut the accuracy of the SHI or provide supporting documentation for its position. Although the Board refers to 742 rent-controlled manufactured housing and 450 "affordable" Family Accessory Living Area units, it does not address whether such housing units meet the SHI eligibility criteria, and acknowledges that such units may not qualify for the SHI.

Recent Progress

In asserting that the Town has met the Recent Progress safe harbor, the Board states that it has preserved and added over 420 affordable units, specifically referencing its issuance of a comprehensive permit for a 60-unit rental project known as Ezio Place, and its laudable efforts in aiding preservation of the 284-rental unit project known as the Tannery (I). As the comprehensive permit for Ezio Place was issued on September 17, 2019, the 60 units were created on that date, i.e., becoming SHI-eligible for the first time, and as this occurred within the 12 months preceding the Applicant's application, they qualified to count towards the Recent Progress calculation under 760 CMR 56.03(5). The Board also references the Tannery I units,[5] which were subjected to an Equivalent Affordability Restriction granted pursuant to M.G.L. c. 40T regulations in July of 2017, a copy of which was provided by the Applicant. This restriction preserved affordability due to expire in 2018, and allowed for the continued inclusion of units on the SHI until 2023. The Applicant argues that the Affordable Housing Restriction granted in June of 2019, a copy of which the Applicant also provided, only further extended affordability until 2062, but did not create new units within the 12 months preceding the Applicant's application. Even if DHCD credits the Tannery I units towards Recent Progress based on the 2019 restriction along with the Ezio Place units, they do not amount to the minimum of 443 units (2% of the 22,135 year-round total housing units) required for the safe harbor.

The 116 units at the proposed project known as The Residences at Farm Avenue that the Board appears to count towards the Recent Progress safe harbor cannot be credited, as the Board acknowledges that a comprehensive permit had yet to be issued for the units at the time of the Applicant's application, and the Board has not otherwise established that the units became SHI-eligible during the 12 months preceding the application.

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[3] https://www.mass.gov/files/documents/2017/10/10/guidecomprehensivepermit.pdf .

[4] This figure includes the Ezio Place and Tannery I units discussed units discussed below, as well as other units the Town submitted for SHI inclusion that appear to have been SHI-eligible at the time of the Applicant's application (61 units at the Brown School Residences, 5 units at Terrace Estates, and 19 housing rehabilitation units). It does not include units at the proposed project at 27R Avenue (known as The Residences at Farm Avenue), which are not SHI-eligible as this project had yet to receive a comprehensive permit as of the date of the Applicant's application.

[5] The Board refers to 248 units, however the correct number is 284 as evidenced by the affordability restrictions.

Conclusion:

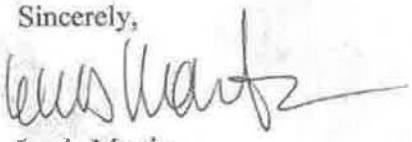
DHCD finds the Board has not met the safe harbor regulatory deadline in accordance with 760 CMR 56.03(8). Thus, DHCD does not have a regulatory basis for making a determination that 760 CMR 56.03(3)(a) (housing unit minimum of SHI Eligible Housing units exceeding 10% of total housing units) or 760 CMR 56.03(5) (recent progress toward housing unit minimum) had been achieved as of the date the comprehensive permit application was filed. Even if the Board had met the safe harbor regulatory deadline, DHCD agrees with the Applicant that the Board has not met its burden of proving satisfaction of the grounds for asserting both safe harbors.

If either the Board or the Applicant wishes to appeal this decision pursuant to 760 CMR 56.03(8), that party shall file an interlocutory appeal with the Housing Appeals Committee (HAC) on an expedited basis, pursuant to 760 CMR 56.05(9)(c) and 56.06(7)(e)(11), within 20 days of its receipt of the decision, with a copy to the other party and to the Department.

DHCD notes that due to the COVID-19 State of Emergency, the HAC issued "Standing Order 2020-01:Filing and Service in Cases before the Committee" and "Housing Appeals Committee Rules for Electronic Filing," both of which became effective April 15, 2020, and on March 23, 2020, DHCD issued the "Waiver of Filing and Service Requirements of 760 CMR 56.06(6)." These documents have been posted on the Committee's webpage at https://www.mass.gov/service-details/housing-appeals-committee-hac. Note also that the aforementioned emergency amendments to 760 CMR 56.00 include amendments to HAC filing, service, and hearing requirements.

If you have further questions, please contact Phillip DeMartino, Technical Assistance Program Coordinator, at (617) 573-1357 or Phillip.DeMartino@mass.gov.

Sincerely,



Louis Martin
Director, Division of Community Services

cc: The Honorable Edward A. Bettencourt, Mayor, City of Peabody
Al Chow, HDG King Street LLC
Jason Panos, Esq., The Panos Law Group
Paul Haverty, Esq., Blatman, Bobrowski & Haverty, LLC

City of Peabody
DEPARTMENT OF PUBLIC SERVICES
50 FARM AVENUE
PEABODY, MASSACHUSETTS 01960-3902

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MEMO TO: Peabody Zoning Board of Appeals

FROM: William Paulitz, P.E., City Engineer William Paulitz 1/21/21

SUBJECT: 15 King Street

DATE: February 1, 2021

CC: Robert LaBossiere, Director (via email)
Curt Bellavance, Community Development Director (via email)
Ezra Haber Glenn, AICP, Public Planning, Research & Implementations, Inc. (via email)
Wayne Keefner, P.E., Design Consultants, Inc. (via email)
Scott Thornton, P.E., Vanasse & Associates, Inc. (via email)
Al Chow, HDG King Street, LLC (via email)
Jason Panos, Esquire (via email)
Bruce Adams, P.E., Weston & Sampson (via email)
Cassandra Albrecht, E.I.T., Weston & Sampson (via email)
Tiffany Labrier, P.E., Tighe & Bond (via email)
Janet Carter Bernardo, P.E., Horsley Witten Group (via email)
Rodney Emery, P.E., PTOE, WorldTECH Engineering (via email)

****

The Department of Public Services is in receipt of the following documents for 15 King Street:

1) King's Residences Chapter 40B Comprehensive Permit Application
2) Design Khalsa Architectural Plans for King's Residences dated 3/20/2020
3) Design Consultants, Inc.'s Preliminary Site Development Plan for King's Residences dated 3/16/2020
4) Design Consultants, Inc.'s Preliminary Site Development Plan for King's Residences sheet C-102 dated 3/16/2020, revised 1/12/2021
5) Design Consultants, Inc.'s Stormwater Management Plan dated 3/6/2020 revised 1/12/2021
6) Weston & Sampson Water Service System Evaluation dated 1/29/2021
7) Tighe & Bond Wastewater Capacity Peer Review Letter dated 1/29/2021
8) Horsley Witten Group Stormwater & Environmental Peer Review Letter dated 1/22/2021
9) WorldTECH Engineering Traffic Peer Review Letter dated 12/23/2020

We offer the following comments:

Water

Be advised the applicant shall address Weston & Sampson's recommendations within their peer review letter dated January 29, 2021 attached to this memorandum.

In addition, please find the specific recommendations being issued by our Department:

1) All water connections shall be cut and capped at the main prior to demolition of the existing buildings.

2) Be advised there are 2 water mains located within King Street, a 12-inch water main and a 6-inch water main. All new water services shall be tied into the City's 12-inch water main.

3) The applicant will install 4 additional gates along King Street to isolate each building to minimize future water interruptions to the complex.

4) The Peabody Fire Department should be requested to weigh in on the lack of proposed fire hydrants on the property. Be advised all future hydrant locations need to be approved by this Department.

Wastewater

Please find Tighe & Bond's recommendations within their peer review letter dated January 29, 2021 attached to this memorandum. Be advised the applicant will be required to follow the recommendations outlined in this letter in respect to CCTV inspecting the Ellsworth Road, King Street and Lowell Street sewer mains[1] (estimated cost $5,000 - $10,000[2]) and the rehabilitation recommendations that result from the inspection (estimated cost $175,000-$200,000[2]). This work shall be completed prior to the issuance of a sewer permit from this Department and will be considered the applicant's fulfillment of the City's Inflow/Infiltration reduction project assigned by the City.

In addition, please find the specific recommendations being issued by our Department:

1) All wastewater connections shall be cut and capped at the sewer main prior to demolition of the existing buildings.

2) The site plan shows the proposed sewer lateral for Building A tying into an existing onsite sewer manhole. The existing onsite wastewater infrastructure is over 60 years old (ranging from 1908-1962). A new sewer lateral is to be installed from Building A to the City's sewer main located within King Street.

3) The applicant needs to show their proposed sewer laterals for Building B and Building C on the site plan.

[1] As shown highlighted on Image 1 on sheet 5 of Tighe & Bond Peer Review Letter dated 1/29/2021.

[2] Cost estimates taken from Tighe & Bond Peer Review Letter dated 1/29/2021

Stormwater & Environmental
Be advised the applicant shall address the Horsley Witten Group's recommendations within their peer review letter dated January 22, 2021 attached to this memorandum.

In addition, please find the specific recommendations being issued by our Department:

1) Soil testing needs to be completed within infiltration area #2 prior to this Department continuing its review.

2) The applicant shall increase the volume of infiltration in infiltration area #1 to achieve the runoff reductions that were originally proposed under their initial stormwater application dated 3/6/2020.

3) The applicant shall justify why parking lot stormwater is not being infiltrated onsite.

4) Details for infiltration area #1 and #2 shall be included on the site plan detail sheet.

5) The applicant shall provide groundwater mounding calculations for both onsite infiltration areas.

6) Prior to the City issuing a building permit the applicant shall provide this Department with a copy of the finalized roof connection plan that shows the roof drainage tying into the 2 infiltration beds.

7) A bed bottom inspection shall be conducted of the proposed infiltration beds by the applicant's licensed soil evaluator and this Department. This inspection shall take place prior to the installation of any stone within the infiltration beds.

8) The applicant is proposing to tie into the stormwater system on Southwick Road. It should be noted this a private road and drainage system, and as such the applicant will need to gain permission to do so. The applicant shall confirm the condition of this line and determine if there is adequate capacity to handle this direct tie-in. Ultimately this drainage system ties into the City's drainage on Lowell Street, as such the tie in should take place down gradient of the existing catch basin.

9) A 12-inch wide (min.) by 4-inch high (min.) concrete berm shall be installed between the proposed trench drain and garage entrance. This is to be installed to minimize the amount of stormwater entering the parking garage and ultimately the City's sewer system if the trench drain were not to be properly maintained.

10) All onsite catch basins are to be installed with 4-feet sumps and hoods.

11) Drain manholes DMH 2 and DMH 5 shall be converted into water quality inlet structures.

12) The applicant shall specify on the plan which catch basins within Ellsworth Road, King Street and Southwick Road that are to be fitted with silt sacks.

13) The applicant shall address slope stabilization for all slopes greater than 4:1.

Traffic & Pedestrian Accommodations
Be advised the applicant shall address the WorldTECH Engineering's recommendations within their peer review letter dated December 23, 2020 attached to this memorandum. This letter addresses recommended upgrades at the following intersections: Lowell/King/Endicott, King/Ellsworth and Lowell/Emerson in addition to onsite parking issues.

In addition, please find the specific recommendations being issued by our Department:

1) The applicant shall conduct a safety audit of the Lowell/King/Endicott intersection as part of the applicant's approval. At a minimum the upgrade recommendations listed in the December 23, 2020 WorldTECH Engineering letter shall be implemented.

2) The applicant will be responsible for installing an ADA compliant concrete sidewalk along their frontage along Ellsworth Road and King Street. This installation shall include straight granite curbing.

3) The parking garage access drive is greater than 13.5% grade and terminates with a 90-degree turn. This combination will be problematic in the wintertime.

4) The applicant shall provide a turning template for delivery and moving trucks for the proposed parking lot.

5) Two of the three dumpster locations don't appear to be accessible for pickup. The applicant shall address this issue.

6) The applicant is requesting a 31% reduction in parking spaces (310-spaces down to 213-spaces) while proposing 64% of those remaining spaces (136-spaces) be designated as compact. The combination of reducing the number of parking spaces while increasing the number of compact spaces will most likely result in an inadequate number of onsite parking spaces. It is recommended that if the Board chooses to allow the reduction of the number of onsite parking spaces, that a minimum parking ratio of 1.7 is held resulting in a total number of 227 parking spaces. Of these 227 parking spaces it is recommended that a maximum of 10% of them (22-spaces) be allowed to be designated as compact.

7) The applicant needs to show the designated snow storage locations on the property. These areas shall be located within the property and designated in areas that do not interfere with pedestrian access and vehicle line of sight. In addition, the applicant shall not plow snow off of their property and into the City's Right-of-Way.

Be advised the following documents are attached to this memorandum:

1) Weston & Sampson Water Service System Evaluation dated 1/29/2021
2) Tighe & Bond Wastewater Capacity Peer Review Letter dated 1/29/2021
3) Horsley Witten Group Stormwater & Environmental Peer Review Letter dated 1/22/2021[1]
4) WorldTECH Engineering Traffic Peer Review Letter dated 12/23/2020[2]

Should you have any questions and/or comments please feel free to contact me at 978-536-7126.

[1] The Horsley Witten Group letter was previously provided to both the Board and the applicant's representative on 1/28/2021.

[2] The WorldTECH Engineering letter was previously provided to both the applicant's representative on 12/23/2020 and to the Board on 1/15/2021.

Weston & Sampson

55 Walkers Brook Drive, Suite 100, Reading, MA 01867
Tel: 978.532.1900

January 29, 2021

William G. Paulitz, PE
City Engineer
City of Peabody
Department of Public Services
50 Farm Avenue
Peabody, MA 01960

Re: **King's Residences Development, Peabody MA**
Water Service System Evaluation

Dear Mr. Paulitz:

As required, Weston & Sampson has completed the water system evaluation of the proposed King's Residences development, located at 15 King Street in Peabody, MA. The purpose of this evaluation was to determine if the proposed development will receive adequate water pressure and fire flows from the existing Peabody water system, as well as any impact the development may have on existing Peabody water customers in the area.

This development includes 133 condominium type housing units, encompassing 221 bedrooms, in 3 five-story buildings. The plans provided by Khalsa Design Inc. indicate that the proposed development's water service will be obtained by connecting to the existing 12-inch cast iron water main in King Street. Each building will be fed by separate domestic and fire water service lines. The size of the domestic and fire water service lines is not shown on the plans, but there is a note that they are to be confirmed by the plumbing and fire protection engineers. There are no proposed hydrants shown on the proposed development's property.

REGULATIONS AND EVALUATION CRITERIA

Massachusetts Department of Environmental Protection (MassDEP) regulations were used as the basis for our determination. MassDEP Guidelines and Policies for Public Water Systems 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 businesses under all normal conditions of flow. Normal conditions include peak hour demands, usually the most severe demand condition that occurs during the hottest summer days.

MassDEP 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 regulation 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. The 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 the plan for the development and these guidelines, the minimum required fire flow for this development can be estimated at 2,000 – 2,500 gallons per minute (gpm) at 20 psi.

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. We currently maintain a hydraulic model of the city's water distribution system in this software package, making it possible to add the development and model its effects on the water system.

The water demands for the existing condition and proposed development were provided by HDG King Street LLC, as calculated by Allen & Major Associates, Inc. and were based on Title V (310 CMR 15.000) wastewater flow generation estimates. The maximum daily flow rate for the existing condition was calculated to be 12,317 gallons

per day (gpd) and for the proposed development was calculated to be 26,741 gpd. This equates to an expected increase of 14,424 gpd.

An average day demand for the development was obtained by dividing the maximum day demand by a peaking factor of 2. A peak hour demand for the development 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 Demands – King's Residences

Demand Condition	Daily Demand (gpd)
Average Day	13,371
Maximum Day	26,741
Peak Hour	40,112

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.

The plans provided by Khalsa Design Inc. indicate that the highest finished floor elevation in the proposed development is the fifth floor of each building at 129.3 feet. The domestic pressure to the proposed development was modeled at this proposed highpoint, as it represents a worst-case scenario.

MODELING RESULTS

Average day, maximum day, and peak hour demands were imposed on the calibrated model to identify flow and/or pressure deficiencies within the proposed development and in the surrounding system.

Peak Hour

Under the worst case peak hour demand condition, the water system is required to maintain a minimum working pressure of 35 psi.

One hydrant flow test was conducted by Allen & Major Associates, Inc. on March 3, 2020 and revealed a static pressure of 70 psi at the hydrant on King Street nearest the proposed development. This static pressure was confirmed in the hydraulic model. At this static pressure, the top floors of the proposed development would receive a pressure of 48.7 psi. As this data is from March, which typically sees average day demands, the pressure at the top floors of the proposed development is expected to be approximately 5-10 psi lower during the summer months. The maximum pressure expected at the ground level of the development is 85 psi. During all scenarios, the pressure is expected to be in excess of the required 35 psi.

Fire Flow

It is anticipated that the fire flow requirement for the proposed development will be approximately 2,000 to 2,500 gpm for at least 2 hours at a residual pressure of 20 psi. The flow requirement includes two components – fire sprinklers and fire hydrant hose stream. The actual fire flow requirement will depend on building use, construction materials, number of stories, fire sprinkler system type, etc. and is typically calculated by the developer's fire protection engineer following decisions on the above.

The flow test conducted by Allen & Major Associates, Inc. on March 3, 2020 revealed an available fire flow of approximately 5,120 gpm at 20 psi on King Street across the street from the proposed development. This flow test is representative of an average day demand condition.

The hydraulic model confirmed the results of the flow test, in that there is sufficient fire flow available on King Street adjacent to the proposed development to exceed the expected requirement of 2,000 to 2,500 gpm at 20 psi.

PLAN REVIEW

Weston & Sampson has reviewed the plans prepared by Khalsa Design Inc. for the proposed King's Residences development. We recommend the following revisions:

- As noted on the plans, the domestic and fire water service lines' material is to be confirmed by the plumbing engineer and the fire protection engineer, respectively. The material should be ductile iron. The plumbing engineer and fire protection engineer should also confirm the size of the domestic and fire water service lines.
- There are no proposed hydrants currently shown on the plans. At least three fire hydrants, one per building, should be added to the development. These fire hydrants should be located a suitable distance away from each building, so they are accessible by the fire department during a fire.
- To provide for redundancy, 12-inch gate valves should be added between each building's connection to the existing 12" cast iron water main in King Street. This will allow for individual buildings to remain in service if there is an issue (such as a water main break) with the water main in King Street.

We appreciate the opportunity to assist the Department of Public Services in this matter. Please contact me at 978-532-1900 or adamsb@wseinc.com should you have any questions or require further support.

Sincerely,

WESTON & SAMPSON ENGINEERS, INC.

Bruce W. Adams, PE
Vice President

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The Proposed Multi-Family Housing Project, 15 King Street – Downstream Sewer Capacity Peer Review

TO: William Paulitz, PE, City Engineer

FROM: Janet Moonan, PE, Heidi Baird, and Meghan White, Tighe & Bond

THROUGH: David Murphy, PE, Tighe & Bond

DATE: January 29, 2021

Introduction

Tighe & Bond was hired by the City of Peabody to perform an evaluation of:

1. The proposed wastewater generation estimates for the proposed multi-family housing Project to be located at 15 King Street ("Proposed Development"); and

2. Whether there is adequate available capacity in the City's sewer system to accommodate anticipated flows from the Proposed Development and other development/redevelopment projects recently evaluated by Tighe & Bond that contribute to the City's sewer system "downstream" of the Proposed Development.

Figure 1 in Attachment A shows the location of the Proposed Development and the downstream collection system evaluated in this memorandum.

This technical memorandum summarizes the results of this evaluation.

Information Gathering and Data Review

To complete the evaluation, Tighe & Bond reviewed the following information:

- The 15 King Street City of Peabody Comprehensive Permit Application prepared by The Panos Law Group, Design Consultants Inc., Khalsa Design Inc., and dated May 4, 2020;
- The Proposed Condominium Complex King's Residences 15 King Street drawings, prepared by DCI consultants and Khalsa architects, March 16, 2020, Sheets 1 through 8;
- The City's Sewer System Map as of 10/29/1996 and the City's GIS mapping;
- As-built drawings of the collection system:
    - Lowell St. to Ellsworth Rd. drawing Sewer prepared by F.A. Barbour, Engineer and dated July 1907.

Understanding of Project

Based on our review of the documents provided for the Proposed Development, we understand the following:

- HDG King Street LLC is planning to construct three residential buildings. The proposed redevelopment consists of 133 housing units including 59 one-bedroom, 60 two-bedroom, and 14 three-bedroom units with 213 interior and exterior parking spaces.

The proposed units will be split between three buildings: two buildings with 44 units each and one building with 45 units and an underground parking garage.

- The total estimated average daily wastewater flow was not identified in the application but has been estimated by Tighe & Bond based on Title 5 guidelines to be 24,310 gallons per day.

- Sanitary discharge from the buildings will flow by gravity and connect to the existing 8" and 6" sanitary lines on King Street at three locations. No on-site pump station is proposed and therefore our analysis does not include evaluation of such a structure.

An evaluation is required to assess the proposed project's wastewater generation and collection, and to determine if there is sufficient capacity within the downstream collection system to accommodate the wastewater flows. Based on the information provided in the Chapter 40B Comprehensive Permit Application and subsequent discussions with City staff, Tighe & Bond used the City's existing mapping to identify the downstream sanitary sewer that will convey sewage from the proposed development. The map in Attachment A shows the downstream sewer route evaluated (highlighted in blue). The increased flow will not pass through a City-owned pump station.

Estimated Wastewater Flows from the 15 King Street Development

The Comprehensive Permit Application states that based on Title 5 flows, the total water usage will be 26,741 gpd, however, no backup calculations are provided, and therefore this number cannot be confirmed.

The Multifamily Housing project at 15 King Street will consist of 133 housing units with 59 one-bedroom, 60 two-bedroom, and 14 three-bedroom apartments, as noted earlier in this memorandum. The flows were calculated based on the residential unit flow rate recommended by Title 5 of 110 gpd per bedroom:

110 gpd/bedroom x 221 bedrooms = 24,310 gpd

Note that, as stated in Title 5, the value of 110 gpd per bedroom is "equivalent to estimated generated flow for the proposed use plus a factor representing flow variations."

As a check on the average daily flow estimate shown above using information from Title 5, and the value presented in the Comprehensive Permit Application, we also estimated the project proponent's average daily wastewater flow by multiplying the projected number of occupants by a typical average daily flow per occupant of 70 gpd. This unit flow rate is suggested as a minimum value if actual flow data cannot be obtained per the guidance manual titled *TR-16 Guides for the Design of Wastewater Treatment Works* (TR-16 Guidelines), published by the New England Interstate Water Pollution Control Commission (NEIWPCC), 2011 edition, as revised in 2016. A total number of 354 occupants was estimated assuming 2 individuals in the first bedroom of each unit and 1 individual added for each additional bedroom per unit.

354 occupants x 70 gpd/occupant = 24,780 gpd

The estimated average daily flow using the number of occupants is within 2% of the average daily flow estimated using Title 5. Based on this comparison, we conclude that the average daily flow estimate Tighe & Bond calculated using Title 5 is reasonably conservative.

An additional 500 gpd was added to the proposed wastewater flow for the Proposed Development to account for infiltration and inflow (I/I). Note that an infiltration allowance between 250 and 500 gallons per day per inch of sewer diameter per mile of sewer length is typically used in hydraulic calculations, and therefore, based on the short length of sewer piping anticipated within the Proposed Development, this value is sufficiently conservative for this site.

Because this project is a redevelopment, we also considered existing water use data as an indication of recent wastewater flows from the site. There are four water meters that serve 15 King Street, three of which have not been billed since March 2018 and one of which had 90 hundred cubic feet used between March 5, 2018 and June 21, 2018, which translates to about 500 gpd of wastewater, an insignificant amount compared to the collection system flow on King Street and even more insignificant compared to the wastewater flow on Lowell Street per the data from meter 18. The Spring 2018 East Peabody I/I Study metering program was completed from April 23, 2018 through July 24, 2018, which captured wastewater conditions after this facility had largely closed operations. Therefore, for the evaluation of the City's downstream collection system, the total average daily flow of 24,810 gpd (total flow anticipated from the Proposed Development plus the I/I estimate), is utilized.

Evaluation of City's Downstream Collection System

Tighe & Bond utilized the above information to evaluate the Proposed Development's wastewater discharge impact on the City's downstream wastewater collection system (from the Proposed Development to the intersection of Central Street and Walnut Street). Manhole numbering used in this evaluation is consistent with the 1996 Sewer Maps and the City's GIS. Pipe segments are identified based on manhole numbering. Figure 1 in Attachment A shows the location of this development.

A pipe segment-by-pipe segment approach was used to evaluate the hydraulic capacity of the downstream sewer system to accommodate existing and proposed wastewater flows from the Proposed Development. We utilized the as-built drawings cited previously in this memorandum to prepare the pipe segment-by-pipe segment evaluation included in Attachment B. Assumptions made regarding sewer attributes are also cited in Attachment B. Manning's equation was used to calculate the full-pipe capacity of the sewers evaluated downstream of the Proposed Development. Because the existing gravity sewers downstream of the Proposed Development are largely reinforced concrete (RC) pipe, with one segment of vitrified clay, we used a roughness coefficient of 0.014.[1]

The following data were used to estimate impacts to the downstream portion of the City's sewer system:

- Water use records from the City (2018, 2019, 2020) for the parcels contributing to the sewer system on King Street were used to estimate existing average daily wastewater flow. We assumed 80% of the water used would become wastewater.
- Infiltration was assumed to impact King Street. The quantity of infiltration was calculated using inch-diameter-miles of sewer pipe on King Street plus sewers upstream of King Street (based on the GIS mapping), along with the peak infiltration measured during the Spring 2018 East Peabody I/I Study recorded by meter 18,

[1] https://www.ejprescott.com/media/reference/ManningEqua&TableofNR-15.pdf

normalized to the sewer sub area by inch-diameter-miles (2,900 gpd/IDM, see Table 4-1 of 2018 East Peabody I/I Study).

- The estimated average wastewater flows from the Proposed Development, as described in the previous section of this Memorandum. Peak hour wastewater flows from the Proposed Development were calculated by multiplying average daily flow by 4.18 (this is the observed peaking factor based on data collected as part of the Spring 2018 East Peabody I/I Study from meter 18), in lieu of theoretical peak hour flows using peaking factors from TR-16 Guidelines.
- Wastewater flow data from meters 18 and 12, installed as part of Spring 2018 East Peabody I/I Study, were used to estimate existing average daily flow of the sewers on Lowell Street and Central Street. Data from these meters was also used to estimate peak hourly flows, in lieu of theoretical peak hour flows using peaking factors from TR-16 Guidelines. These values include infiltration and inflow, and therefore the method employed for King Street infiltration was not applicable on these segments.

Note that we concluded our pipe segment-by-pipe segment evaluation of the available sewer system capacity downstream of the Proposed Development where the system transitions to the 30" diameter, because the additional wastewater flows from the Proposed Development are less than 1% of the capacity of a 30" diameter pipe. Sewer segments downstream of this point of evaluation have diameters of the same size or larger.

Our spreadsheet model indicates that the existing sewers downstream of the proposed development can accommodate the estimated average daily flow from the Proposed Development. **However, our model also indicates that while the existing sewers downstream can generally accommodate the estimated peak hourly flows, the first two 8" diameter segments on Lowell Street are theoretically over capacity by 15,000 gpd and 73,000 gpd, respectively. Note that the peak hour wastewater flow from the proposed development totals 101,616 gpd (24,310 gpd x 4.18 peaking factor).**

The results for the sewer segments reviewed are documented in Attachment B. A summary of the results for the sewer segments reviewed is presented below in Table 1 and is detailed in Attachment B. The applicable rows are highlighted in Attachment B.

TABLE 1
Hydraulic Analysis Summary

Segment	Hydraulic Capacity (mgd)[1]	Avg Daily Flow (mgd) [2]	Peak Hourly Flow with Development (mgd)	Surplus Capacity Available (Y/N)
King Street	0.658	0.036	0.169	Y
Lowell Street	0.613	0.170	0.686	N
Central Street	10.653	0.363	1.556	Y

[1] Based on the sewer with the lowest hydraulic capacity along the segment which correlates to "Full-Pipe Flow Capacity" in Attachment B.
[2] Correlates to Attachment B, including the existing, proposed, and infiltration flows, for the lowest capacity sewer along the segment, which correlates to "Existing + Proposed + Infiltration Average Day Flow (MGD)" in Attachment B.

There are some considerations for the City to balance in allowing the additional flow to connect to the City's wastewater system:

1. Peak hour flows are not typically a sustained condition, but a SSO including a basement backup caused by the City's system may occur with only a brief period of surcharge. However, there have only been two sewer backups on Lowell Street between King Street and the intersection with Central Street, one in 2010 and one in 2020, both of which were caused by grease (per City records). No SSOs occurred during the Spring 2018 wastewater metering program.

2. The next upstream segments have sufficient capacity to allow the sewer to backup up stream. However, a hydraulic model of this area has not been prepared and was not part of this scope of work.

3. Title 5 flows from the proposed development are a conservative value with respect to residential wastewater flows. In addition, water conservation required in new buildings often reduces discharge of wastewater even further than planning or historical values observed.

4. The highest flow segment on Lowell Street, shown on Table 1 above, was identified as having infiltration flows of 4,000 to 10,000 gpd per inch-diameter mile (idm) during the 2020 I/I flow isolation and manhole inspection program. The next downstream segments also were found to have infiltration flows over 2,000 gpd per idm during this program. Upstream of the proposed development there is a high infiltration (>10,000 gpd/idm) segment. See image provided below.

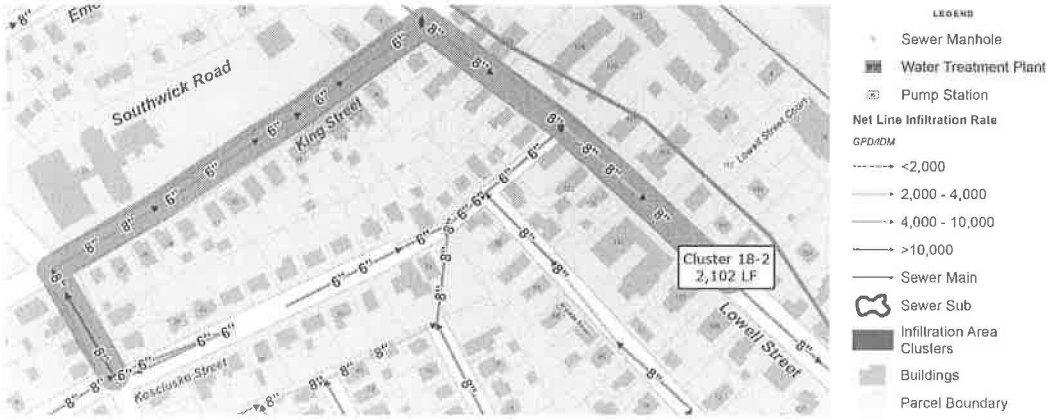

Image 1: Results of 2020 Flow Isolation.

Conclusions

Based on the evaluation completed as described above, our analysis suggests that the additional sewer flows that would be generated by the Proposed Development will impact sewer capacities being exceeded downstream in the City's system, creating a further potential for SSOs into the public roadway or abutting properties.

Prior to allowing the Proposed Project to proceed, the City should proceed with, at a minimum, video inspecting the cluster at an estimated cost of $5,000 to $10,000 (including some engineering review time) to determine needed work. The total budgetary cost for rehabilitation, with the information available at this time, is between $175,000 and $200,000 including lining of manholes, repair of laterals, CIPP lining of the sewer line, and includes

engineering and a contingency. Note that this fee does not include spot repairs or dig and replace work.

In addition, the City should be prepared that sewer on Lowell Street in this section will need repairs or even an upgrade due to any further upstream increase of flows.

Attachments

A – Figure 1: 15 King Street Development Downstream Piping

B – Sewer Capacity Analysis Review – Existing Conditions & Available Capacity

J:\P\P0224 Peabody Landfill\065- 15 King Street Sewer Peer Review\Report\15 King St Sewer Peer Review Memo 1-29-2021 to City.docx

Figure 1: 15 King Street Development Downstream Piping

Figure 1
Downstream Route

LEGEND

- Pump Station
- Sewer Manhole
- Collector
- Force Main
- Downstream Route
- Parcels
- City Boundary
- Water

LOCUS MAP

0 400
Feet

1 inch equals 200 feet

NOTES

GIS data provided by Peabody MA

Proposed Redevelopment
15 King Street
City of Peabody, Massachusetts

January 2021

Tighe&Bond

Sewer Capacity Analysis Review – Existing Conditions & Available Capacity

Attachment B: Sewer Capacity Analysis Review
Existing Conditions and Available Capacity

Tighe&Bond

Sewer Pipeline [1]	Description/ Location	Pipe Dia. (in) [2]	Pipe Material [3]	Pipe Area (sf)	Pipe Length (ft) [2]	Invert Elevation (ft) [2]	Pipe Slope (ft/ft) [5]	Hydr. Radius (ft) [5]	Full-Pipe Velocity (fps) [5]	Full-Pipe Flow Capacity (cfs) [5]	Full-Pipe Flow Capacity (mgd) [5]	Existing Average Day Flow (gpd) [4]	Proposed Average Day Flow (gpd) [4]	Infiltration (gpd) [4]	Existing + Proposed + Infiltration Average Day Flow (MGD) [5]	Peak Hourly Flow with Development (MGD) [4]	Available Capacity Following Development (Estimated) (+/-) (MGD) [5]	Location Notes
Downstream Sewer Capacity																		
MH S074-015 884.0 MH	King Street	8	RCP	0.349	239	87.00	0.0082	0.17	2.92	1.02	0.658	4,603	24,310	5,977	0.036	0.169	0.490	
MH S074-016 640.0 MH						85.04												
MH S074-016 640.0 MH	King Street	8	RCP	0.349	98	85.04	0.0206	0.17	4.63	1.62	1.044	4,731	24,310	7,300	0.036	0.170	0.874	
MH S074-017 400.5 MH						83.02												
MH S074-017 400.5 MH	King Street	6	RCP	0.196	104	83.02	0.1059	0.13	8.66	1.70	1.098	5,301	24,310	7,643	0.037	0.173	0.925	
MH S074-018 200 MH						72.00												
MH S074-018 200 MH	King Street	6	RCP	0.196	200	72	0.0851	0.13	7.76	1.52	0.985	6,461	24,310	8,301	0.039	0.181	0.804	
MH S074-009 000 MH (MH2745.0)						55												
MH S074-009 000 MH (2745.0 MH)	Lowell Street	8	RCP	0.349	171	55.00	0.0085	0.17	2.97	1.04	0.671	145,500	24,310	500	0.170	0.686	-0.015	Intersection of King Street and Lowel Street
MH S047-010 2575.2 MH						53.55												
MH S074-010 2575.2 MH	Lowell Street	8	RCP	0.349	175	53.55	0.0071	0.17	2.72	0.95	0.613	145,500	24,310	500	0.170	0.686	-0.073	
MH S047-011 2400 MH						52.30												
MH S047-011 2400 MH	Lowell Street	8	VCP	0.349	219	52.30	0.0103	0.17	3.26	1.14	0.736	145,500	24,310	500	0.170	0.703	0.033	
MH S047-012 2179.0 MH						50.05												
MH S074-012 2179.0 MH	Lowell Street	8	RCP	0.349	229	50.05	0.0098	0.17	3.20	1.12	0.721	145,500	24,310	500	0.170	0.703	0.018	
MH S074-013 1950.0 MH						47.80												
MH S074-013 1950.0 MH	Lowell Street	8	RCP	0.349	249	47.80	0.0110	0.17	3.38	1.18	0.763	145,500	24,310	500	0.170	0.703	0.060	
MH S084-055 1700.2 MH						45.06												
MH S084-055 1700.2 MH	Lowell Street	8	RCP	0.349	240	45.06	0.0152	0.17	3.98	1.39	0.897	145,500	24,310	500	0.170	0.703	0.195	Meter 18
MH S084-056 1460 MH						41.4												
MH S084-056 1460 MH	Lowell Street	8	RCP	0.349	188	41.4	0.0345	0.17	5.98	2.09	1.349	145,500	24,310	500	0.170	0.703	0.646	
MH S085-098 1267.0 MH						34.91												
MH S085-098 1267.0 MH	Lowell Street	8	RCP	0.349	246	34.91	0.0381	0.17	6.29	2.20	1.418	145,500	24,310	500	0.170	0.703	0.716	
MH S085-097 1029.8 MH						25.53												
MH S085-097 1029.8 MH	Lowell Street	8	RCP	0.349	225	25.53	0.0155	0.17	4.01	1.40	0.905	145,500	24,310	500	0.170	0.703	0.202	
MH S085-096 800 MH						22.05												
MH S085-096 800 MH	Lowell Street	10	RCP	0.545	243	22.05	0.0140	0.21	4.43	2.41	1.559	145,500	24,310	500	0.170	0.703	0.856	
MH S085-095 557 MH						18.65												

Attachment B: Sewer Capacity Analysis Review
Existing Conditions and Available Capacity

Tighe&Bond

Sewer Pipeline [1]	Description/ Location	Pipe Dia. (in) [2]	Pipe Material [3]	Pipe Area (sf)	Pipe Length (ft) [2]	Invert Elevation (ft) [2]	Pipe Slope (ft/ft) [5]	Hydr. Radius (ft) [5]	Full-Pipe Velocity (fps) [5]	Full-Pipe Flow Capacity (cfs) [5]	Full-Pipe Flow Capacity (mgd) [5]	Existing Average Day Flow (gpd) [4]	Proposed Average Day Flow (gpd) [4]	Infiltration (gpd) [4]	Existing + Proposed + Infiltration Average Day Flow (MGD) [5]	Peak Hourly Flow with Development (MGD) [4]	Available Capacity Following Development (Estimated) (+/-) (MGD) [5]	Location Notes
MH S085-095 557 MH MH S085-094 354.1 MH	Lowell Street	10	RCP	0.545	208	18.65 17.20	0.0070	0.21	3.13	1.71	1.103	145,500	24,310	500	0.170	0.703	0.400	
MH S085-094 354.1 MH MH S085-093 215.8 MH	Lowell Street	12	RCP	0.785	132	17.20 16.94	0.0020	0.25	1.89	1.48	0.958	145,500	24,310	500	0.170	0.703	0.256	
MH S085-093 215.8 MH MH S085-079 65.7 MH (122.2 MH)	Lowell Street	12	RCP	0.785	152	16.94 16.64	0.0020	0.25	1.89	1.48	0.958	145,500	24,310	500	0.170	0.703	0.256	
MH S085-079 65.7 MH (122.2 MH) MH S085-080 396.0 MH	Central Street	24	RCP	3.142	73	16.64 12.70	0.0541	0.50	15.60	49.00	31.656	338,500	24,310	500	0.363	1.556	30.100	Meter 12
MH S085-080 396.0 MH MH S085-082 593.0 MH	Central Street	30	RCP	4.909	268	12.70 12.20	0.0019	0.63	3.36	16.49	10.653	338,500	24,310	500	0.363	1.556	9.097	All pipe segments on Central Street from transition of 24" to where 30" joins sewer on Walnut Street. This calculation is using data from the least sloped pipe on the run, which is less

[1] Manhole labels from the "Sewer System Map as of 10/29/96".
[2] Pipe diameter, length, and invert elevations taken from Record Drawings. Where unknown, GIS data were used.
[3] Material assumed as no information availabe in Record Drawings or GIS.
[4] Assumptions documented in Memorandum
[5] Calculated

Horsley Witten Group
Sustainable Environmental Solutions
112 Water Street • 6th Floor • Boston, MA 02109
857-263-8193 • horsleywitten.com

January 22, 2021

VIA EMAIL

William G. Paulitz, P.E.
City Engineer
City of Peabody
Department of Public Services
50 Farm Avenue
Peabody, MA 01960

Re: Peer Review of Comprehensive Permit Application
King's Residences
15 King Street, Peabody, MA

Dear Mr. Paulitz and Board Members:

The Horsley Witten Group, Inc. (HW) is pleased to provide the Peabody Zoning Board of Appeals with this letter report summarizing our initial technical peer review of the residential development proposed at 15 King Street, Peabody, Massachusetts. The Comprehensive Permit application for the King's Residences development was prepared by the Panos Law Group on behalf of the Applicant, HDG King Street, LLC. The proposed development includes three (3) multi-family, apartment style buildings with 135 residential condominium ownership units. The existing previously developed site is 3.12 acres and contains a vacant hospital building, a support building, and associated parking lot. It does not appear that the site contains any wetland resource areas or buffer zones to resource areas.

HW has received the following materials associated with the proposed development:

- Letter prepared by The Panos Law Group, Application for Comprehensive Permit, 15 King Street, Peabody, MA, dated May 4, 2020 (11 pages).
- Cover and Table of Contents (3 pages).
- Application for Comprehensive Permit, 15 King Street, Peabody, MA (17 pages).
- Appendix A: Site Approval Letter, dated April 30, 2020 (9 pages).
- Appendix B: Site Information (12 pages).
- Appendix C: Reduced Site Plans, prepared by Design Consultants Inc., dated March 16, 2020 (8 sheets).
- Appendix D: Surrounding Land Use/Amenities Plan, prepared by Design Consultants Inc., dated March 13, 2020 (1 sheet).
- Appendix E: Flood Insurance Rate Map (1 Sheet).

- Appendix F: Reduced Site Architectural Plans, prepared by Khalsa, dated March 20, 2020 (30 Sheets).
- Appendix G: Traffic Impact Assessment, prepared by Vanasse & Associates, Inc., dated December 2019 (199 pages).
- Appendix H: Hydrant Flow Test Report, prepared by Allen & Major Associates, Inc., dated March 3, 2020 (6 pages).
- Appendix I: Environmental Report, prepared by RPS Group, Inc., dated January 2020 (84 pages).
- Appendix J: Waiver Requests and Zoning Exceptions (7 pages).
- Appendix K: Stormwater Management Plan, prepared by design Consultants Inc., dated March 6, 2020 (93 pages).
- Appendix L: Certified Abutter's List, stamped March 12, 2020 (3 pages).
- Appendix M: Filing Fee (1 page).
- Stormwater Management Plan, prepared by Design Consultants Inc., revised date January 12, 2021 (83 pages) including revised Grading and Drainage Plan, C-102.

Environmental Due Diligence Review: ASTM Phase I Report

HW conducted a peer review of the report titled *Phase I-Environmental Site Assessment, Vacant Kindred Hospital,* prepared by RPS Group, Inc. and dated January 2020 (the "2020 Phase I Report"). This peer review focused on determining the completeness of the 2020 Phase I Report regarding Recognized Environmental Conditions (RECs), Historical Recognized Conditions (HRECs) and Controlled Recognized Conditions (CRECs). ASTM E 1527-13 defines these as follows:

- REC: "the presence, or likely presence of any hazardous substances or petroleum products in, on or at a property: (1) due to release to the environment, (2) under conditions indicative of a release to the environment, or (3) under conditions that pose a material threat of a future release to the environment. De minimis conditions are not recognized environmental conditions."
- HREC: "a past release of any hazardous substances or petroleum products that has occurred in connection with the property and has been addressed to the satisfaction of the applicable regulatory authority or meeting unrestricted use criteria established a regulatory authority, without subjecting the property to any required controls (for example, property use restrictions, activity and use limitations, institutional controls, or engineering controls)."
- CREC: "a recognized environmental condition resulting from a past release of hazardous substances or petroleum products that has been addressed to the satisfaction of the applicable regulatory authority (for example, as evidenced by the issuance of a no further action letter or equivalent, or meeting risk-based criteria established by regulatory authority), with hazardous substances or petroleum products allowed to remain in place subject to the implementation of required controls (for example, property use restrictions, activity and use limitations, institutional controls, or engineering controls)."

The 2020 Phase I Report identified the following:

- At the time of reconnaissance, the 3.2-acre property was improved with two vacant

buildings (77,900 square foot [sf] three-story main building and 10,000 sf single story boiler building) that were formerly occupied by Kindred Hospital. Former operations at the Kindred Hospital included intensive care unit services, rehabilitation, dialysis, cardio-pulmonary services and a geriatric unit. The buildings were constructed between the 1930's (boiler building) and 1962 (main building).

- According to the 2020 Phase I Report *"The main building includes a basement that houses mechanical systems, two diesel fueled emergency generators, and a chiller. The first floor includes the lobby, kitchen, cafeteria, ventilator rooms, pulmonary rooms and high oxygen patient rooms. The second floor was utilized as an ICU, patient rooms, and nurses' stations. The third floor was primarily used for storage of out of use equipment and a pharmacy. Additional interior features include two traction elevators, and a freight elevator."*
- According to the 2020 Phase I Report *"The boiler building houses one diesel-fueled emergency generator, two natural-gas fired boilers and a back-up No. 2 heating oil-powered boiler. Based on observations during site reconnaissance, heater oil is used by the backup boiler is likely stored within an underground storage tank (UST) as described below. Three fill ports set in a concrete pad, located adjacent south of the boiler building, indicating the presence of a UST. The Commonwealth of Massachusetts Department of Fire Services Freedom of Information Act (FOIA) request showed issuance of a permit to store 2,000 gallons of diesel fuel and 10,500 gallons of No. 2 fuel oil. There is no basement in the boiler building."*
- According to the 2020 Phase I Report *"[o]n June 15, 2003, 50 gallons of No. 2 fuel oil was released to the concrete floor and a floor drain within the boiler building. Based on RPS' review of historical reports, the floor drains from the boiler building flow to the municipal sanitary sewer and indications of an oil release were not identified by the City of Peabody. Following the release, remedial measures were taken to collect released fuel. Soil borings were advanced beneath the concrete where staining was observed. Soil samples were collected, and field screened for Total Petroleum Hydrocarbons (TPH) and submitted for laboratory analysis of TPH. Analytical results indicated that constituents of concern were not detected above laboratory method /Project No. 207232.612 Vacant Kindred Hospital Confidential Peabody, Massachusetts iii detection limits. Groundwater was not encountered during the sampling activities. According to the Class A-1 Response Action Outcome (RAO) report, and as indicated by information reviewed by RPS in the MassDEP database, the remedial response measures taken were sufficient to achieve a condition of no significant risk, and impacts were reduced to background levels."*
- Diesel fuel is stored in three above ground storage tanks that are connected to generators. The ASTs range in size from 50-gallons to 500-gallons. According to the 2020 Phase I Report, *"no leaks, spills, stains or other evidence of releases were identified in connection with the ASTs."*
- According to the 2020 Phase I Report *"[a]t the time of the site reconnaissance, RPS observed three fill ports, set in concrete, located adjacent to the south of the boiler building, indicating the likely presence of a UST. No staining was noted in the area around the fill ports. RPS reviewed records from The Commonwealth of Massachusetts Department of Fire Services – Office of the State Fire Marshall and discovered a permit application for a tank containing 2,000-gallons of diesel fuel and 10,500 gallons of No. 2 fuel from April 2012. No removal records were included with the documents."*

- According to the 2020 Phase I Report, "[t]he site was listed on the Massachusetts Department of Environmental Protection (MassDEP) UST Program database. One 500-gallon, one 1,500-gallon, and one 10,000-gallon fuel oil USTs were installed at the site in 1973. According to the database search report, each of these USTs is listed as removed."
- According to the 2020 Phase I Report, "one 500-gallon, one 1,500-gallon, and one 10,000-gallon fuel oil USTs were installed at the site in 1973 and removed in 1998. Records received from the MassDEP also included the UST Tank Removal Closure Assessment from Vencor Inc., dated February 1999, that noted the removal of the 500-gallon and 10,000-gallon USTs of the site in August 1998. The report notes of the installation of a 560-gallon and 10,000-gallon tank to hold No. 2 fuel oil for the emergency generator and facility boiler at the same time of the former USTs removal. No tank removal records associated with these tanks were found.
- According to the 2020 Phase I Report, "RPS observed minor staining in the boiler room underneath the boiler around the floor drains. The observed area of staining during the site reconnaissance is considered to be de minimis."
- According to the 2020 Phase I Report "[a]pproximately 8-10 55-gallon drums were observed to be abandoned in the boiler building and exterior that contained waste oil and waste hydraulic fluid. No spills or stains were observed around the drums.

The 2020 Phase I Report concluded that no RECs or CREs were identified. The 2020 Phase I did identify the following HREC:

- *"On June 15, 2003, 50 gallons of No. 2 fuel oil was released to the concrete floor and a floor drain within the boiler building. Based on RPS' review of historical reports, the floor drains from the boiler building flow to the municipal sanitary sewer and indications of an oil release were not identified by the City of Peabody. Following the release, remedial measures were taken to collect released fuel. Soil borings were advanced beneath the concrete where staining was observed. Soil samples were collected, and field screened for Total Petroleum Hydrocarbons (TPH) and submitted for laboratory analysis of TPH. Analytical results indicated that constituents of concern were not detected above laboratory method /Project No. 207232.612 Vacant Kindred Hospital Confidential Peabody, Massachusetts iii detection limits. Groundwater was not encountered during the sampling activities. According to the Class A-1 Response Action Outcome (RAO) report, and as indicated by information reviewed by RPS in the MassDEP database, the remedial response measures taken were sufficient to achieve a condition of no significant risk, and impacts were reduced to background levels."*

HW offers the following conclusions regarding the 2020 Phase I Report:

- It is not clear in the 2020 Phase I Report if the three ASTs at the vacant property contained fuel oil. HW recommends that Applicant have its environmental consultant verify that the ASTs have not released No. 2 fuel oil to the environment while sitting idle