

**STORMWATER MANAGEMENT PLAN
For
Bay House Phase II
Newbury Street & Hancock Street
Portland, Maine**

I. Introduction

This Stormwater Management Plan has been prepared to address the potential impacts associated with this project due to the proposed modification in stormwater runoff characteristics. The stormwater management controls that are outlined in this plan have been designed based on commonly accepted engineering methods and to comply with applicable regulatory requirements.

II. Existing Conditions

The site is located on the north side of Newbury Street between India Street & Hancock Street in a commercial/Industrial area of the City. The site is currently used as a parking lot. The parking lot is currently sectioned-off by declining retaining /foundations walls. There are also remains of past building foundations. The surface is a combination of asphalt pavement, deteriorating/broken concrete slabs, and gravel pavement. Development area of the site has a moderate slope ranging from 2% to 7% toward Newbury Street. Stormwater from the site generally flows southwesterly down Newbury Street towards India Street.

III. Proposed Development

The Bay House Phase II is a four story structure fronting on Newbury Street. The building is a multi- family structure with 39 units, of which 7 are townhouse units on the ground level, with 32 flats situated on the upper floors. There are 42 parking spaces under and behind the building; a dumpster and bicycle racks are also located in this area. As a result of the proposed improvements, the site will include a development area of approximately 25,168 sf, of which 8,228 will be new pavement and 16,940 of new building roof area.

IV. Regulatory Requirements

Excerpt from Chapter 500 Stormwater Management Law:

B. General standards.

A project is eligible for an exception from the general standards as follows.

(e) "Stormwater Management Law project including redevelopment. For a project requiring a Stormwater Management Law permit that includes

redevelopment of impervious area that was in existence as of November 16, 2005 (the effective date of Chapter 500 revisions), the redevelopment of that impervious area is not required to meet General standards provided the department determines that the new use of the existing impervious area is not likely to increase stormwater impacts resulting from the proposed project's stormwater runoff beyond the level of impact already caused by the runoff from the existing impervious area".

We believe we are exempt, because this is a redevelopment site that was in existence prior to November 16, 2005, and the resulting development will not cause any additional stormwater runoff or deteriorate the water quality leaving the site. The actual water quality should improve because the project will be covered with 67% roof area.

VIII. Peak Flow Analysis

This section has been prepared to discuss the management of post-development peak stormwater flow rates. The model was generated to determine peak flows at the existing Drain Manhole at the intersection of Hancock Street and Middle Street.

A. Modeling Technique

To evaluate drainage characteristics in pre-development and post-development conditions, a quantitative analysis was performed to determine peak rates of runoff for the 2-yr, 10-yr, and 25-year storm events. Runoff calculations were performed following the methodology outlined in the United States Department of Agriculture (USDA) Soil Conservation Service's "Urban Hydrology for Small Watersheds, Technical Release #55" and HydroCAD Stormwater Modeling System software. A 24-hour, SCS Type III storm distribution was used for analysis.

The published 24-hour rainfall values for Cumberland County are as follows:

Storm Frequency Precipitation (in./24 hr)	
2-year	3.0
10-year	4.7
25-year	5.5

B. Drainage Characteristics (Pre-Development and Post-Development Watershed Delineation)

A single study point was utilized to evaluate and compare pre-development and post-development runoff conditions. The study point is located at an existing stormdrain manhole at the intersection Hancock Street & Middle Street. All pre-development and post-development subwatersheds are tributary to this study point.

Pre-development watershed includes all existing off-site subcatchments and detention provided (Stormtech Chambers) in Phase 1.

Post-development watershed includes redirecting phase 2 stormwater runoff through a storm drain to the study point at Hancock Street & Middle Street.

The pre & post development areas were assumed to be 98% impervious.

A direct entry of 5 minutes was used for a "Time-of-Concentration" for most subcatchments.

C. Comparison

The watershed delineations, tributary areas and times of concentration associated with the post-development watersheds are different from the pre-development conditions due to the proposed site development and grading. Table-1 summarizes the results of the hydrologic analysis and compares pre-development to post-development conditions.

	2-year	10-year	25-year
	Peak Flow (cfs)	Peak Flow (cfs)	Peak Flow (cfs)
Pre-development PH-1	8.17	12.65	14.74
Post-development	9.82	15.25	17.79
PH-2	+1.65	+2.6	+3.05

The result from the table above indicates that the peak rates of runoff in the post-developed condition will increase. This is a result of us redirecting phase 2 stormwater runoff to Hancock Street as an alternative given to us by the City.

The existing stormdrain system (24" pipe) in Hancock Street appears to have adequate capacity in a 25yr Storm Event.

IX. Conclusions

This Stormwater Management Plan has been designed with erosion and sedimentation controls, inspection and maintenance procedures and general housekeeping requirements to prevent unreasonable impacts to the surrounding environment and to provide a long-term plan for management of stormwater runoff from the site. Stormwater runoff should be adequately managed for the project if carried out in accordance with the design plans.

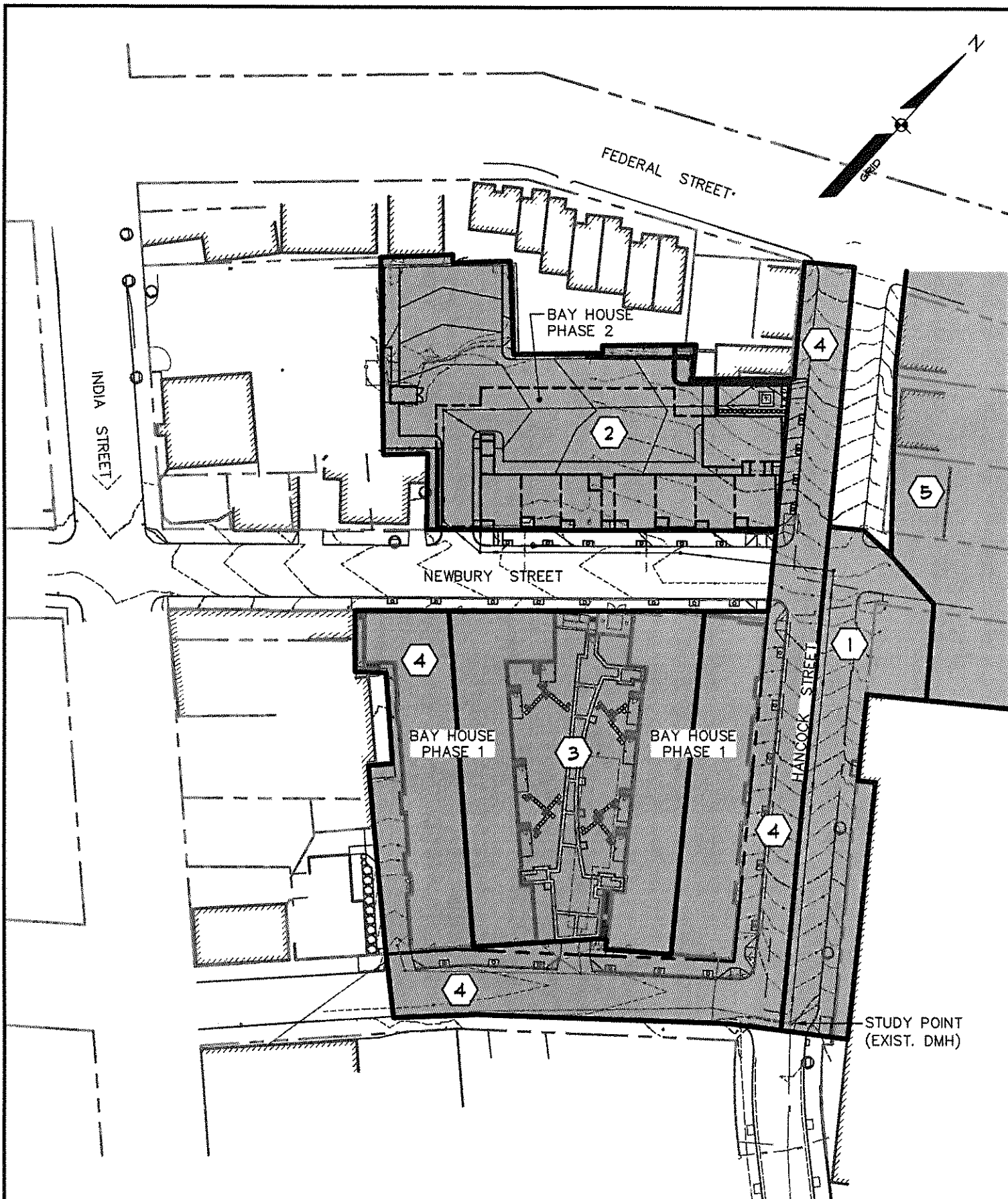
Prepared by,

SEBAGO TECHNICS, INC.



Steven A. Groves, CPSWQ
Project Engineer

SAG:sag/jsf
July 29, 2013



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WATERSHED MAP
OF: THE BAY HOUSE, PHASE II

LOCATION:
NEWBURY/HANCOCK ST.
PORTLAND, MAINE

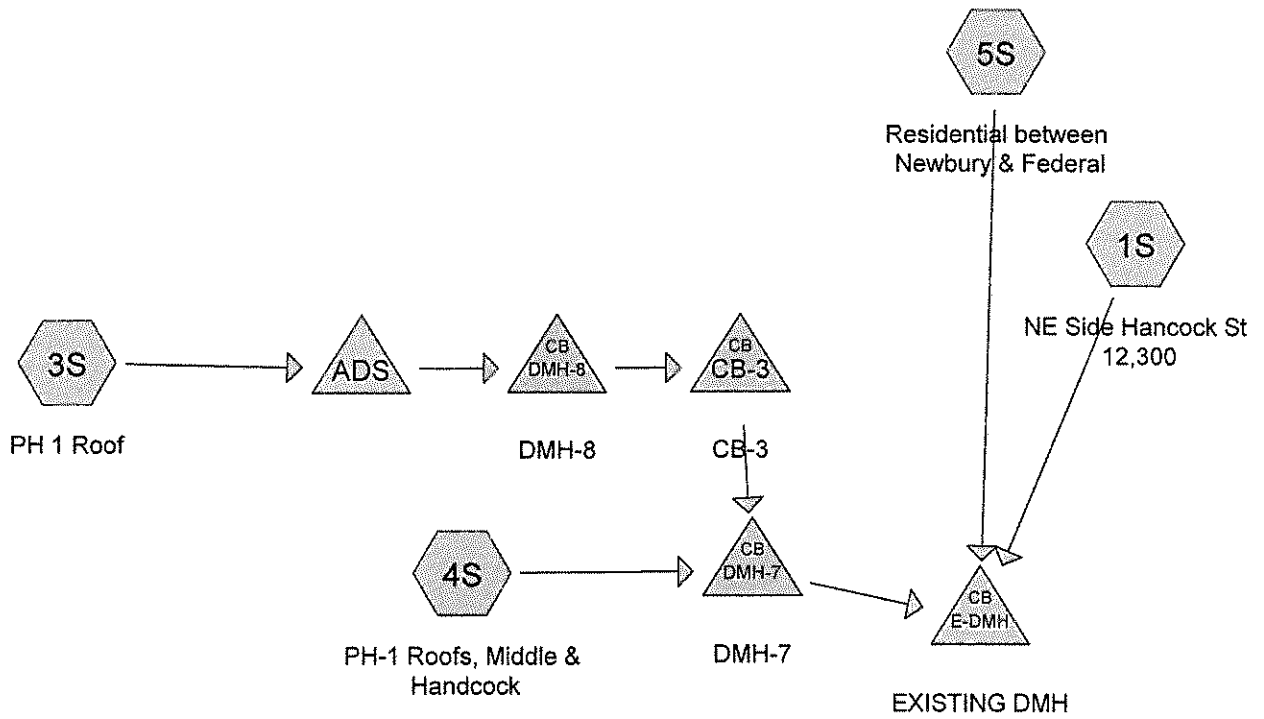
FOR:
113 NEWBURY ST., LLC
BOSTON, MA

SCALE: 1" = 80'

DATE: 07-29-13

SHEET:
1 OF 1

Pre Development



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Area Listing (all nodes)

<u>Area (acres)</u>	<u>CN</u>	<u>Description (subcats)</u>
1.033	98	(4S)
1.929	98	Paved parking & roofs (3S,5S)
0.282	98	Paved roads w/curbs & sewers (1S)
<hr/>		
3.244		

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Type III 24-hr 2-YEAR Rainfall=3.00"

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Subcatchment 1S: NE Side Hancock St 12,300

Runoff = 0.83 cfs @ 12.07 hrs, Volume= 0.061 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.00"

Area (sf)	CN	Description
12,300	98	Paved roads w/curbs & sewers
12,300		Impervious Area

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

Subcatchment 3S: PH 1 Roof

Runoff = 2.02 cfs @ 12.07 hrs, Volume= 0.149 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.00"

Area (sf)	CN	Description
30,000	98	Paved parking & roofs
30,000		Impervious Area

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

Subcatchment 4S: PH-1 Roofs, Middle & Hancock

Runoff = 3.02 cfs @ 12.07 hrs, Volume= 0.223 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.00"

Area (sf)	CN	Description
45,000	98	
45,000		Impervious Area

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

Subcatchment 5S: Residential between Newbury & Federal

Runoff = 3.52 cfs @ 12.09 hrs, Volume= 0.268 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.00"

Area (ac)	CN	Description
1.240	98	Paved parking & roofs
1.240		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	420	0.0278	1.55		Lag/CN Method, Contour Length= 1,500' Interval= 1'
1.5					Direct Entry,
6.0	420	Total			

Pond ADS:

Inflow Area = 0.689 ac, Inflow Depth > 2.59" for 2-YEAR event
 Inflow = 2.02 cfs @ 12.07 hrs, Volume= 0.149 af
 Outflow = 0.97 cfs @ 12.22 hrs, Volume= 0.149 af, Atten= 52%, Lag= 9.0 min
 Primary = 0.97 cfs @ 12.22 hrs, Volume= 0.149 af
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 23.65' @ 12.22 hrs Surf.Area= 934 sf Storage= 801 cf
 Flood Elev= 25.50' Surf.Area= 0 sf Storage= 2,262 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 4.2 min (742.6 - 738.5)

Volume	Invert	Avail.Storage	Storage Description
#1	22.50'	2,262 cf	36.0"D x 20.00'L Horizontal Cylinder x 16

Device	Routing	Invert	Outlet Devices
#1	Primary	22.15'	12.0" x 11.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 22.00' S= 0.0136 1/' Cc= 0.900 n= 0.012
#2	Device 1	25.50'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) 5.0' Crest Height
#3	Device 1	22.15'	4.0" Vert. Orifice/Grate X 2.00 C= 0.600
#4	Secondary	27.10'	24.0" Horiz. Orifice/Grate Limited to weir flow C= 0.600

Primary OutFlow Max=0.97 cfs @ 12.22 hrs HW=23.65' (Free Discharge)

- ↑ 1=Culvert (Passes 0.97 cfs of 2.98 cfs potential flow)
- ↑ 2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- ↑ 3=Orifice/Grate (Orifice Controls 0.97 cfs @ 5.55 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=22.50' (Free Discharge)

- ↑ 4=Orifice/Grate (Controls 0.00 cfs)

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Type III 24-hr 2-YEAR Rainfall=3.00"

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Pond CB-3: CB-3

Inflow Area = 0.689 ac, Inflow Depth > 2.59" for 2-YEAR event
 Inflow = 0.97 cfs @ 12.22 hrs, Volume= 0.149 af
 Outflow = 0.97 cfs @ 12.22 hrs, Volume= 0.149 af, Atten= 0%, Lag= 0.0 min
 Primary = 0.97 cfs @ 12.22 hrs, Volume= 0.149 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 21.80' @ 12.22 hrs
 Flood Elev= 25.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	21.30'	18.0" x 13.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 21.10' S= 0.0154 '/ Cc= 0.900 n= 0.012

Primary OutFlow Max=0.97 cfs @ 12.22 hrs HW=21.80' (Free Discharge)

↳1=Culvert (Inlet Controls 0.97 cfs @ 1.89 fps)

Pond DMH-7: DMH-7

Inflow Area = 1.722 ac, Inflow Depth > 2.59" for 2-YEAR event
 Inflow = 3.85 cfs @ 12.08 hrs, Volume= 0.372 af
 Outflow = 3.85 cfs @ 12.08 hrs, Volume= 0.372 af, Atten= 0%, Lag= 0.0 min
 Primary = 3.85 cfs @ 12.08 hrs, Volume= 0.372 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 21.85' @ 12.08 hrs
 Flood Elev= 25.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	20.90'	24.0" x 45.0' long Culvert CMP, projecting, no headwall, Ke= 0.900 Outlet Invert= 19.60' S= 0.0289 '/ Cc= 0.900 n= 0.012

Primary OutFlow Max=3.75 cfs @ 12.08 hrs HW=21.84' (Free Discharge)

↳1=Culvert (Inlet Controls 3.75 cfs @ 2.60 fps)

Pond DMH-8: DMH-8

Inflow Area = 0.689 ac, Inflow Depth > 2.59" for 2-YEAR event
 Inflow = 0.97 cfs @ 12.22 hrs, Volume= 0.149 af
 Outflow = 0.97 cfs @ 12.22 hrs, Volume= 0.149 af, Atten= 0%, Lag= 0.0 min
 Primary = 0.97 cfs @ 12.22 hrs, Volume= 0.149 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 22.50' @ 12.22 hrs
 Flood Elev= 26.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	22.00'	18.0" x 80.0' long Culvert CMP, projecting, no headwall, Ke= 0.900 Outlet Invert= 21.60' S= 0.0050 '/ Cc= 0.900 n= 0.012

Primary OutFlow Max=0.97 cfs @ 12.22 hrs HW=22.50' (Free Discharge)

└1=Culvert (Barrel Controls 0.97 cfs @ 2.77 fps)

Pond E-DMH: EXISTING DMH

Inflow Area = 3.244 ac, Inflow Depth > 2.59" for 2-YEAR event
 Inflow = 8.17 cfs @ 12.08 hrs, Volume= 0.700 af
 Outflow = 8.17 cfs @ 12.08 hrs, Volume= 0.700 af, Atten= 0%, Lag= 0.0 min
 Primary = 8.17 cfs @ 12.08 hrs, Volume= 0.700 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 19.98' @ 12.08 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	18.50'	24.0" x 20.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 17.90' S= 0.0300 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=7.95 cfs @ 12.08 hrs HW=19.96' (Free Discharge)

└1=Culvert (Inlet Controls 7.95 cfs @ 3.24 fps)

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Type III 24-hr 10-YEAR Rainfall=4.70"

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Subcatchment 1S: NE Side Hancock St 12,300

Runoff = 1.31 cfs @ 12.07 hrs, Volume= 0.098 af, Depth> 4.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.70"

Area (sf)	CN	Description
12,300	98	Paved roads w/curbs & sewers
12,300		Impervious Area

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

Subcatchment 3S: PH 1 Roof

Runoff = 3.18 cfs @ 12.07 hrs, Volume= 0.238 af, Depth> 4.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.70"

Area (sf)	CN	Description
30,000	98	Paved parking & roofs
30,000		Impervious Area

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

Subcatchment 4S: PH-1 Roofs, Middle & Hancock

Runoff = 4.78 cfs @ 12.07 hrs, Volume= 0.357 af, Depth> 4.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.70"

Area (sf)	CN	Description
45,000	98	
45,000		Impervious Area

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

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Type III 24-hr 10-YEAR Rainfall=4.70"

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Subcatchment 5S: Residential between Newbury & Federal

Runoff = 5.56 cfs @ 12.09 hrs, Volume= 0.428 af, Depth> 4.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.70"

Area (ac)	CN	Description
1.240	98	Paved parking & roofs
1.240		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	420	0.0278	1.55		Lag/CN Method, Contour Length= 1,500' Interval= 1'
1.5					Direct Entry,
6.0	420	Total			

Pond ADS:

Inflow Area = 0.689 ac, Inflow Depth > 4.15" for 10-YEAR event
 Inflow = 3.18 cfs @ 12.07 hrs, Volume= 0.238 af
 Outflow = 1.28 cfs @ 12.27 hrs, Volume= 0.238 af, Atten= 60%, Lag= 12.2 min
 Primary = 1.28 cfs @ 12.27 hrs, Volume= 0.238 af
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 24.62' @ 12.27 hrs Surf.Area= 873 sf Storage= 1,712 cf
 Flood Elev= 25.50' Surf.Area= 0 sf Storage= 2,262 cf

Plug-Flow detention time= 7.7 min calculated for 0.238 af (100% of inflow)
 Center-of-Mass det. time= 7.6 min (742.3 - 734.8)

Volume	Invert	Avail.Storage	Storage Description
#1	22.50'	2,262 cf	36.0"D x 20.00'L Horizontal Cylinder x 16

Device	Routing	Invert	Outlet Devices
#1	Primary	22.15'	12.0" x 11.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 22.00' S= 0.0136 1' Cc= 0.900 n= 0.012
#2	Device 1	25.50'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) 5.0' Crest Height
#3	Device 1	22.15'	4.0" Vert. Orifice/Grate X 2.00 C= 0.600
#4	Secondary	27.10'	24.0" Horiz. Orifice/Grate Limited to weir flow C= 0.600

Primary OutFlow Max=1.28 cfs @ 12.27 hrs HW=24.62' (Free Discharge)

- 1=Culvert (Passes 1.28 cfs of 4.19 cfs potential flow)
- 2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 3=Orifice/Grate (Orifice Controls 1.28 cfs @ 7.31 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=22.50' (Free Discharge)

- 4=Orifice/Grate (Controls 0.00 cfs)

Pond CB-3: CB-3

Inflow Area = 0.689 ac, Inflow Depth > 4.15" for 10-YEAR event
 Inflow = 1.28 cfs @ 12.27 hrs, Volume= 0.238 af
 Outflow = 1.28 cfs @ 12.27 hrs, Volume= 0.238 af, Atten= 0%, Lag= 0.0 min
 Primary = 1.28 cfs @ 12.27 hrs, Volume= 0.238 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 21.88' @ 12.27 hrs
 Flood Elev= 25.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	21.30'	18.0" x 13.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 21.10' S= 0.0154 '/ Cc= 0.900 n= 0.012

Primary OutFlow Max=1.27 cfs @ 12.27 hrs HW=21.88' (Free Discharge)
 ↑**1=Culvert** (Inlet Controls 1.27 cfs @ 2.04 fps)

Pond DMH-7: DMH-7

Inflow Area = 1.722 ac, Inflow Depth > 4.15" for 10-YEAR event
 Inflow = 5.86 cfs @ 12.07 hrs, Volume= 0.595 af
 Outflow = 5.86 cfs @ 12.07 hrs, Volume= 0.595 af, Atten= 0%, Lag= 0.0 min
 Primary = 5.86 cfs @ 12.07 hrs, Volume= 0.595 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 22.11' @ 12.07 hrs
 Flood Elev= 25.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	20.90'	24.0" x 45.0' long Culvert CMP, projecting, no headwall, Ke= 0.900 Outlet Invert= 19.60' S= 0.0289 '/ Cc= 0.900 n= 0.012

Primary OutFlow Max=5.67 cfs @ 12.07 hrs HW=22.09' (Free Discharge)
 ↑**1=Culvert** (Inlet Controls 5.67 cfs @ 2.93 fps)

Pond DMH-8: DMH-8

Inflow Area = 0.689 ac, Inflow Depth > 4.15" for 10-YEAR event
 Inflow = 1.28 cfs @ 12.27 hrs, Volume= 0.238 af
 Outflow = 1.28 cfs @ 12.27 hrs, Volume= 0.238 af, Atten= 0%, Lag= 0.0 min
 Primary = 1.28 cfs @ 12.27 hrs, Volume= 0.238 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 22.59' @ 12.27 hrs
 Flood Elev= 26.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	22.00'	18.0" x 80.0' long Culvert CMP, projecting, no headwall, Ke= 0.900 Outlet Invert= 21.60' S= 0.0050 '/ Cc= 0.900 n= 0.012

Primary OutFlow Max=1.27 cfs @ 12.27 hrs HW=22.59' (Free Discharge)

↑1=Culvert (Barrel Controls 1.27 cfs @ 2.96 fps)

Pond E-DMH: EXISTING DMH

Inflow Area = 3.244 ac, Inflow Depth > 4.15" for 10-YEAR event
 Inflow = 12.65 cfs @ 12.08 hrs, Volume= 1.121 af
 Outflow = 12.65 cfs @ 12.08 hrs, Volume= 1.121 af, Atten= 0%, Lag= 0.0 min
 Primary = 12.65 cfs @ 12.08 hrs, Volume= 1.121 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 20.61' @ 12.08 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	18.50'	24.0" x 20.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 17.90' S= 0.0300 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=12.29 cfs @ 12.08 hrs HW=20.56' (Free Discharge)

↑1=Culvert (Inlet Controls 12.29 cfs @ 3.91 fps)

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Type III 24-hr 25-YEAR Rainfall=5.50"

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Subcatchment 1S: NE Side Hancock St 12,300

Runoff = 1.53 cfs @ 12.07 hrs, Volume= 0.115 af, Depth> 4.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
12,300	98	Paved roads w/curbs & sewers
12,300		Impervious Area

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

Subcatchment 3S: PH 1 Roof

Runoff = 3.73 cfs @ 12.07 hrs, Volume= 0.280 af, Depth> 4.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
30,000	98	Paved parking & roofs
30,000		Impervious Area

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

Subcatchment 4S: PH-1 Roofs, Middle & Hancock

Runoff = 5.60 cfs @ 12.07 hrs, Volume= 0.420 af, Depth> 4.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
45,000	98	
45,000		Impervious Area

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

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Type III 24-hr 25-YEAR Rainfall=5.50"

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Subcatchment 5S: Residential between Newbury & Federal

Runoff = 6.52 cfs @ 12.09 hrs, Volume= 0.504 af, Depth> 4.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (ac)	CN	Description
1.240	98	Paved parking & roofs
1.240		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	420	0.0278	1.55		Lag/CN Method, Contour Length= 1,500' Interval= 1'
1.5					Direct Entry,
6.0	420	Total			

Pond ADS:

Inflow Area = 0.689 ac, Inflow Depth > 4.87" for 25-YEAR event
 Inflow = 3.73 cfs @ 12.07 hrs, Volume= 0.280 af
 Outflow = 1.44 cfs @ 12.29 hrs, Volume= 0.280 af, Atten= 61%, Lag= 13.1 min
 Primary = 1.44 cfs @ 12.29 hrs, Volume= 0.280 af
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 25.25' @ 12.29 hrs Surf.Area= 531 sf Storage= 2,172 cf
 Flood Elev= 25.50' Surf.Area= 0 sf Storage= 2,262 cf

Plug-Flow detention time= 9.1 min calculated for 0.279 af (100% of inflow)
 Center-of-Mass det. time= 9.0 min (742.9 - 733.9)

Volume	Invert	Avail. Storage	Storage Description
#1	22.50'	2,262 cf	36.0"D x 20.00'L Horizontal Cylinder x 16

Device	Routing	Invert	Outlet Devices
#1	Primary	22.15'	12.0" x 11.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 22.00' S= 0.0136 1' Cc= 0.900 n= 0.012
#2	Device 1	25.50'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) 5.0' Crest Height
#3	Device 1	22.15'	4.0" Vert. Orifice/Grate X 2.00 C= 0.600
#4	Secondary	27.10'	24.0" Horiz. Orifice/Grate Limited to weir flow C= 0.600

Primary OutFlow Max=1.44 cfs @ 12.29 hrs HW=25.24' (Free Discharge)

1=Culvert (Passes 1.44 cfs of 4.81 cfs potential flow)
 2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
 3=Orifice/Grate (Orifice Controls 1.44 cfs @ 8.24 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=22.50' (Free Discharge)

4=Orifice/Grate (Controls 0.00 cfs)

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Type III 24-hr 25-YEAR Rainfall=5.50"

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Pond CB-3: CB-3

Inflow Area = 0.689 ac, Inflow Depth > 4.87" for 25-YEAR event
 Inflow = 1.44 cfs @ 12.29 hrs, Volume= 0.280 af
 Outflow = 1.44 cfs @ 12.29 hrs, Volume= 0.280 af, Atten= 0%, Lag= 0.0 min
 Primary = 1.44 cfs @ 12.29 hrs, Volume= 0.280 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 21.92' @ 12.29 hrs
 Flood Elev= 25.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	21.30'	18.0" x 13.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 21.10' S= 0.0154 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=1.44 cfs @ 12.29 hrs HW=21.91' (Free Discharge)
 ↑**1=Culvert** (Inlet Controls 1.44 cfs @ 2.11 fps)

Pond DMH-7: DMH-7

Inflow Area = 1.722 ac, Inflow Depth > 4.87" for 25-YEAR event
 Inflow = 6.78 cfs @ 12.07 hrs, Volume= 0.699 af
 Outflow = 6.78 cfs @ 12.07 hrs, Volume= 0.699 af, Atten= 0%, Lag= 0.0 min
 Primary = 6.78 cfs @ 12.07 hrs, Volume= 0.699 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 22.22' @ 12.07 hrs
 Flood Elev= 25.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	20.90'	24.0" x 45.0' long Culvert CMP, projecting, no headwall, Ke= 0.900 Outlet Invert= 19.60' S= 0.0289 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=6.56 cfs @ 12.07 hrs HW=22.19' (Free Discharge)
 ↑**1=Culvert** (Inlet Controls 6.56 cfs @ 3.06 fps)

Pond DMH-8: DMH-8

Inflow Area = 0.689 ac, Inflow Depth > 4.87" for 25-YEAR event
 Inflow = 1.44 cfs @ 12.29 hrs, Volume= 0.280 af
 Outflow = 1.44 cfs @ 12.29 hrs, Volume= 0.280 af, Atten= 0%, Lag= 0.0 min
 Primary = 1.44 cfs @ 12.29 hrs, Volume= 0.280 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 22.63' @ 12.29 hrs
 Flood Elev= 26.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	22.00'	18.0" x 80.0' long Culvert CMP, projecting, no headwall, Ke= 0.900 Outlet Invert= 21.60' S= 0.0050 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=1.44 cfs @ 12.29 hrs HW=22.63' (Free Discharge)

↑1=Culvert (Barrel Controls 1.44 cfs @ 3.04 fps)

Pond E-DMH: EXISTING DMH

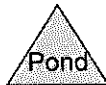
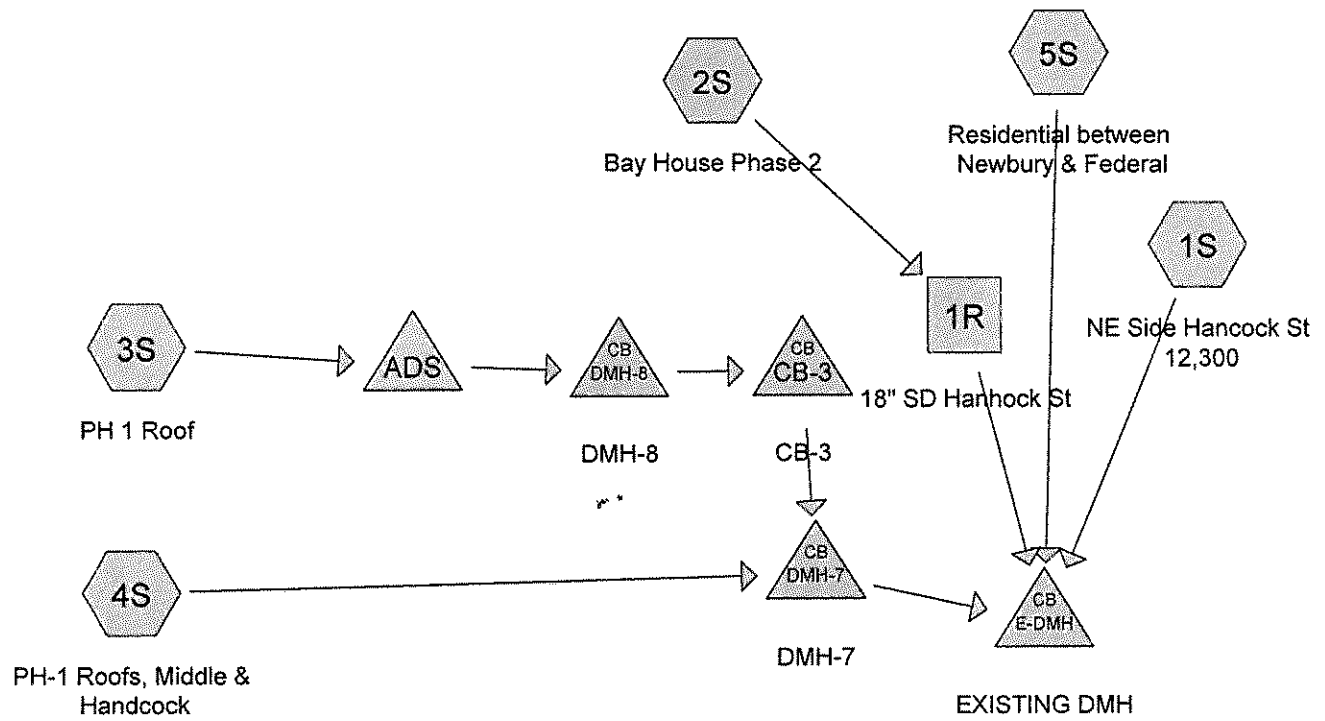
Inflow Area = 3.244 ac, Inflow Depth > 4.87" for 25-YEAR event
 Inflow = 14.74 cfs @ 12.08 hrs, Volume= 1.318 af
 Outflow = 14.74 cfs @ 12.08 hrs, Volume= 1.318 af, Atten= 0%, Lag= 0.0 min
 Primary = 14.74 cfs @ 12.08 hrs, Volume= 1.318 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 21.02' @ 12.08 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	18.50'	24.0' x 20.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 17.90' S= 0.0300 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=14.32 cfs @ 12.08 hrs HW=20.94' (Free Discharge)

↑1=Culvert (Inlet Controls 14.32 cfs @ 4.56 fps)



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Area Listing (all nodes)

<u>Area (acres)</u>	<u>CN</u>	<u>Description (subcats)</u>
1.033	98	(4S)
2.506	98	Paved parking & roofs (2S,3S,5S)
0.282	98	Paved roads w/curbs & sewers (1S)
<hr/>		
3.822		

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Type III 24-hr 2-YEAR Rainfall=3.00"

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Subcatchment 1S: NE Side Hancock St 12,300

Runoff = 0.83 cfs @ 12.07 hrs, Volume= 0.061 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.00"

Area (sf)	CN	Description
12,300	98	Paved roads w/curbs & sewers
12,300		Impervious Area

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

Subcatchment 2S: Bay House Phase 2

Runoff = 1.69 cfs @ 12.07 hrs, Volume= 0.125 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.00"

Area (sf)	CN	Description
25,168	98	Paved parking & roofs
25,168		Impervious Area

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

Subcatchment 3S: PH 1 Roof

Runoff = 2.02 cfs @ 12.07 hrs, Volume= 0.149 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.00"

Area (sf)	CN	Description
30,000	98	Paved parking & roofs
30,000		Impervious Area

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

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Type III 24-hr 2-YEAR Rainfall=3.00"

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Subcatchment 4S: PH-1 Roofs, Middle & Hancock

Runoff = 3.02 cfs @ 12.07 hrs, Volume= 0.223 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.00"

Area (sf)	CN	Description
45,000	98	
45,000		Impervious Area

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

Subcatchment 5S: Residential between Newbury & Federal

Runoff = 3.52 cfs @ 12.09 hrs, Volume= 0.268 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-YEAR Rainfall=3.00"

Area (ac)	CN	Description
1.240	98	Paved parking & roofs
1.240		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	420	0.0278	1.55		Lag/CN Method, Contour Length= 1,500' Interval= 1'
1.5					Direct Entry,
6.0	420	Total			

Reach 1R: 18" SD Hancock St

Inflow Area = 0.578 ac, Inflow Depth > 2.59" for 2-YEAR event
 Inflow = 1.69 cfs @ 12.07 hrs, Volume= 0.125 af
 Outflow = 1.65 cfs @ 12.09 hrs, Volume= 0.125 af, Atten= 2%, Lag= 1.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Max. Velocity= 9.61 fps, Min. Travel Time= 0.5 min
 Avg. Velocity = 3.62 fps, Avg. Travel Time= 1.3 min

Peak Storage= 48 cf @ 12.08 hrs, Average Depth at Peak Storage= 0.23'
 Bank-Full Depth= 1.50', Capacity at Bank-Full= 32.45 cfs

18.0" Diameter Pipe, n= 0.010
 Length= 279.0' Slope= 0.0565 1/
 Inlet Invert= 34.36', Outlet Invert= 18.61'

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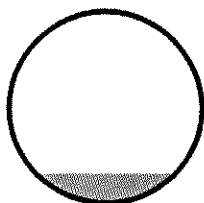
Type III 24-hr 2-YEAR Rainfall=3.00"

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Pond ADS:

Inflow Area = 0.689 ac, Inflow Depth > 2.59" for 2-YEAR event
 Inflow = 2.02 cfs @ 12.07 hrs, Volume= 0.149 af
 Outflow = 0.97 cfs @ 12.22 hrs, Volume= 0.149 af, Atten= 52%, Lag= 9.0 min
 Primary = 0.97 cfs @ 12.22 hrs, Volume= 0.149 af
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 23.65' @ 12.22 hrs Surf.Area= 934 sf Storage= 801 cf
 Flood Elev= 25.50' Surf.Area= 0 sf Storage= 2,262 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 4.2 min (742.6 - 738.5)

Volume	Invert	Avail.Storage	Storage Description
#1	22.50'	2,262 cf	36.0"D x 20.00'L Horizontal Cylinder x 16

Device	Routing	Invert	Outlet Devices
#1	Primary	22.15'	12.0" x 11.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 22.00' S= 0.0136 1/1' Cc= 0.900 n= 0.012
#2	Device 1	25.50'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) 5.0' Crest Height
#3	Device 1	22.15'	4.0" Vert. Orifice/Grate X 2.00 C= 0.600
#4	Secondary	27.10'	24.0" Horiz. Orifice/Grate Limited to weir flow C= 0.600

Primary OutFlow Max=0.97 cfs @ 12.22 hrs HW=23.65' (Free Discharge)

- 1=Culvert (Passes 0.97 cfs of 2.98 cfs potential flow)
- 2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 3=Orifice/Grate (Orifice Controls 0.97 cfs @ 5.55 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=22.50' (Free Discharge)

- 4=Orifice/Grate (Controls 0.00 cfs)

Pond CB-3: CB-3

Inflow Area = 0.689 ac, Inflow Depth > 2.59" for 2-YEAR event
 Inflow = 0.97 cfs @ 12.22 hrs, Volume= 0.149 af
 Outflow = 0.97 cfs @ 12.22 hrs, Volume= 0.149 af, Atten= 0%, Lag= 0.0 min
 Primary = 0.97 cfs @ 12.22 hrs, Volume= 0.149 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

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Type III 24-hr 2-YEAR Rainfall=3.00"

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Peak Elev= 21.80' @ 12.22 hrs
 Flood Elev= 25.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	21.30'	18.0" x 13.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 21.10' S= 0.0154 '/ Cc= 0.900 n= 0.012

Primary OutFlow Max=0.97 cfs @ 12.22 hrs HW=21.80' (Free Discharge)
 ↳ **1=Culvert** (Inlet Controls 0.97 cfs @ 1.89 fps)

Pond DMH-7: DMH-7

Inflow Area = 1.722 ac, Inflow Depth > 2.59" for 2-YEAR event
 Inflow = 3.85 cfs @ 12.08 hrs, Volume= 0.372 af
 Outflow = 3.85 cfs @ 12.08 hrs, Volume= 0.372 af, Atten= 0%, Lag= 0.0 min
 Primary = 3.85 cfs @ 12.08 hrs, Volume= 0.372 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 21.85' @ 12.08 hrs
 Flood Elev= 25.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	20.90'	24.0" x 45.0' long Culvert CMP, projecting, no headwall, Ke= 0.900 Outlet Invert= 19.60' S= 0.0289 '/ Cc= 0.900 n= 0.012

Primary OutFlow Max=3.75 cfs @ 12.08 hrs HW=21.84' (Free Discharge)
 ↳ **1=Culvert** (Inlet Controls 3.75 cfs @ 2.60 fps)

Pond DMH-8: DMH-8

Inflow Area = 0.689 ac, Inflow Depth > 2.59" for 2-YEAR event
 Inflow = 0.97 cfs @ 12.22 hrs, Volume= 0.149 af
 Outflow = 0.97 cfs @ 12.22 hrs, Volume= 0.149 af, Atten= 0%, Lag= 0.0 min
 Primary = 0.97 cfs @ 12.22 hrs, Volume= 0.149 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 22.50' @ 12.22 hrs
 Flood Elev= 26.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	22.00'	18.0" x 80.0' long Culvert CMP, projecting, no headwall, Ke= 0.900 Outlet Invert= 21.60' S= 0.0050 '/ Cc= 0.900 n= 0.012

Primary OutFlow Max=0.97 cfs @ 12.22 hrs HW=22.50' (Free Discharge)
 ↳ **1=Culvert** (Barrel Controls 0.97 cfs @ 2.77 fps)

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Type III 24-hr 2-YEAR Rainfall=3.00"

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Pond E-DMH: EXISTING DMH

Inflow Area = 3.822 ac, Inflow Depth > 2.59" for 2-YEAR event
 Inflow = 9.82 cfs @ 12.08 hrs, Volume= 0.825 af
 Outflow = 9.82 cfs @ 12.08 hrs, Volume= 0.825 af, Atten= 0%, Lag= 0.0 min
 Primary = 9.82 cfs @ 12.08 hrs, Volume= 0.825 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 20.18' @ 12.08 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	18.50'	24.0" x 20.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 17.90' S= 0.0300 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=9.55 cfs @ 12.08 hrs HW=20.15' (Free Discharge)
 ←1=Culvert (Inlet Controls 9.55 cfs @ 3.45 fps)

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Type III 24-hr 10-YEAR Rainfall=4.70"

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Subcatchment 1S: NE Side Hancock St 12,300

Runoff = 1.31 cfs @ 12.07 hrs, Volume= 0.098 af, Depth> 4.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.70"

Area (sf)	CN	Description
12,300	98	Paved roads w/curbs & sewers
12,300		Impervious Area

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

Subcatchment 2S: Bay House Phase 2

Runoff = 2.67 cfs @ 12.07 hrs, Volume= 0.200 af, Depth> 4.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.70"

Area (sf)	CN	Description
25,168	98	Paved parking & roofs
25,168		Impervious Area

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

Subcatchment 3S: PH 1 Roof

Runoff = 3.18 cfs @ 12.07 hrs, Volume= 0.238 af, Depth> 4.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.70"

Area (sf)	CN	Description
30,000	98	Paved parking & roofs
30,000		Impervious Area

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

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Type III 24-hr 10-YEAR Rainfall=4.70"

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Subcatchment 4S: PH-1 Roofs, Middle & Hancock

Runoff = 4.78 cfs @ 12.07 hrs, Volume= 0.357 af, Depth> 4.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.70"

Area (sf)	CN	Description
45,000	98	
45,000		Impervious Area

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

Subcatchment 5S: Residential between Newbury & Federal

Runoff = 5.56 cfs @ 12.09 hrs, Volume= 0.428 af, Depth> 4.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-YEAR Rainfall=4.70"

Area (ac)	CN	Description
1.240	98	Paved parking & roofs
1.240		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	420	0.0278	1.55		Lag/CN Method, Contour Length= 1,500' Interval= 1'
1.5					Direct Entry,
6.0	420	Total			

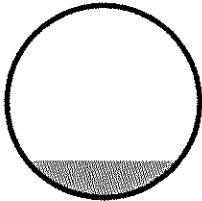
Reach 1R: 18" SD Hancock St

Inflow Area = 0.578 ac, Inflow Depth > 4.15" for 10-YEAR event
 Inflow = 2.67 cfs @ 12.07 hrs, Volume= 0.200 af
 Outflow = 2.61 cfs @ 12.09 hrs, Volume= 0.199 af, Atten= 2%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Max. Velocity= 10.99 fps, Min. Travel Time= 0.4 min
 Avg. Velocity = 4.19 fps, Avg. Travel Time= 1.1 min

Peak Storage= 67 cf @ 12.08 hrs, Average Depth at Peak Storage= 0.29'
 Bank-Full Depth= 1.50', Capacity at Bank-Full= 32.45 cfs

18.0" Diameter Pipe, n= 0.010
 Length= 279.0' Slope= 0.0565 '/'
 Inlet Invert= 34.36', Outlet Invert= 18.61'



Pond ADS:

Inflow Area = 0.689 ac, Inflow Depth > 4.15" for 10-YEAR event
 Inflow = 3.18 cfs @ 12.07 hrs, Volume= 0.238 af
 Outflow = 1.28 cfs @ 12.27 hrs, Volume= 0.238 af, Atten= 60%, Lag= 12.2 min
 Primary = 1.28 cfs @ 12.27 hrs, Volume= 0.238 af
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 24.62' @ 12.27 hrs Surf.Area= 873 sf Storage= 1,712 cf
 Flood Elev= 25.50' Surf.Area= 0 sf Storage= 2,262 cf

Plug-Flow detention time= 7.7 min calculated for 0.238 af (100% of inflow)
 Center-of-Mass det. time= 7.6 min (742.3 - 734.8)

Volume	Invert	Avail.Storage	Storage Description
#1	22.50'	2,262 cf	36.0"D x 20.0'L Horizontal Cylinder x 16

Device	Routing	Invert	Outlet Devices
#1	Primary	22.15'	12.0" x 11.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 22.00' S= 0.0136 1' Cc= 0.900 n= 0.012
#2	Device 1	25.50'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) 5.0' Crest Height
#3	Device 1	22.15'	4.0" Vert. Orifice/Grate X 2.00 C= 0.600
#4	Secondary	27.10'	24.0" Horiz. Orifice/Grate Limited to weir flow C= 0.600

Primary OutFlow Max=1.28 cfs @ 12.27 hrs HW=24.62' (Free Discharge)

- 1=Culvert (Passes 1.28 cfs of 4.19 cfs potential flow)
- 2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 3=Orifice/Grate (Orifice Controls 1.28 cfs @ 7.31 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=22.50' (Free Discharge)

- 4=Orifice/Grate (Controls 0.00 cfs)

Pond CB-3: CB-3

Inflow Area = 0.689 ac, Inflow Depth > 4.15" for 10-YEAR event
 Inflow = 1.28 cfs @ 12.27 hrs, Volume= 0.238 af
 Outflow = 1.28 cfs @ 12.27 hrs, Volume= 0.238 af, Atten= 0%, Lag= 0.0 min
 Primary = 1.28 cfs @ 12.27 hrs, Volume= 0.238 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

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Type III 24-hr 10-YEAR Rainfall=4.70"

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Peak Elev= 21.88' @ 12.27 hrs
 Flood Elev= 25.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	21.30'	18.0" x 13.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 21.10' S= 0.0154 ' /' Cc= 0.900 n= 0.012

Primary OutFlow Max=1.27 cfs @ 12.27 hrs HW=21.88' (Free Discharge)
 ↑**1=Culvert** (Inlet Controls 1.27 cfs @ 2.04 fps)

Pond DMH-7: DMH-7

Inflow Area = 1.722 ac, Inflow Depth > 4.15" for 10-YEAR event
 Inflow = 5.86 cfs @ 12.07 hrs, Volume= 0.595 af
 Outflow = 5.86 cfs @ 12.07 hrs, Volume= 0.595 af, Atten= 0%, Lag= 0.0 min
 Primary = 5.86 cfs @ 12.07 hrs, Volume= 0.595 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 22.11' @ 12.07 hrs
 Flood Elev= 25.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	20.90'	24.0" x 45.0' long Culvert CMP, projecting, no headwall, Ke= 0.900 Outlet Invert= 19.60' S= 0.0289 ' /' Cc= 0.900 n= 0.012

Primary OutFlow Max=5.67 cfs @ 12.07 hrs HW=22.09' (Free Discharge)
 ↑**1=Culvert** (Inlet Controls 5.67 cfs @ 2.93 fps)

Pond DMH-8: DMH-8

Inflow Area = 0.689 ac, Inflow Depth > 4.15" for 10-YEAR event
 Inflow = 1.28 cfs @ 12.27 hrs, Volume= 0.238 af
 Outflow = 1.28 cfs @ 12.27 hrs, Volume= 0.238 af, Atten= 0%, Lag= 0.0 min
 Primary = 1.28 cfs @ 12.27 hrs, Volume= 0.238 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 22.59' @ 12.27 hrs
 Flood Elev= 26.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	22.00'	18.0" x 80.0' long Culvert CMP, projecting, no headwall, Ke= 0.900 Outlet Invert= 21.60' S= 0.0050 ' /' Cc= 0.900 n= 0.012

Primary OutFlow Max=1.27 cfs @ 12.27 hrs HW=22.59' (Free Discharge)
 ↑**1=Culvert** (Barrel Controls 1.27 cfs @ 2.96 fps)

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Type III 24-hr 10-YEAR Rainfall=4.70"

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Pond E-DMH: EXISTING DMH

Inflow Area = 3.822 ac, Inflow Depth > 4.14" for 10-YEAR event
 Inflow = 15.25 cfs @ 12.08 hrs, Volume= 1.320 af
 Outflow = 15.25 cfs @ 12.08 hrs, Volume= 1.320 af, Atten= 0%, Lag= 0.0 min
 Primary = 15.25 cfs @ 12.08 hrs, Volume= 1.320 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 21.12' @ 12.08 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	18.50'	24.0" x 20.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 17.90' S= 0.0300 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=14.82 cfs @ 12.08 hrs HW=21.04' (Free Discharge)
 ↑**1=Culvert** (Inlet Controls 14.82 cfs @ 4.72 fps)

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Type III 24-hr 25-YEAR Rainfall=5.50"

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Subcatchment 1S: NE Side Hancock St 12,300

Runoff = 1.53 cfs @ 12.07 hrs, Volume= 0.115 af, Depth> 4.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
12,300	98	Paved roads w/curbs & sewers
12,300		Impervious Area

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

Subcatchment 2S: Bay House Phase 2

Runoff = 3.13 cfs @ 12.07 hrs, Volume= 0.235 af, Depth> 4.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
25,168	98	Paved parking & roofs
25,168		Impervious Area

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

Subcatchment 3S: PH 1 Roof

Runoff = 3.73 cfs @ 12.07 hrs, Volume= 0.280 af, Depth> 4.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
30,000	98	Paved parking & roofs
30,000		Impervious Area

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

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Type III 24-hr 25-YEAR Rainfall=5.50"

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Subcatchment 4S: PH-1 Roofs, Middle & Hancock

Runoff = 5.60 cfs @ 12.07 hrs, Volume= 0.420 af, Depth> 4.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (sf)	CN	Description
45,000	98	
45,000		Impervious Area

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

Subcatchment 5S: Residential between Newbury & Federal

Runoff = 6.52 cfs @ 12.09 hrs, Volume= 0.504 af, Depth> 4.87"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-YEAR Rainfall=5.50"

Area (ac)	CN	Description
1.240	98	Paved parking & roofs
1.240		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	420	0.0278	1.55		Lag/CN Method, Contour Length= 1,500' Interval= 1'
1.5					Direct Entry,
6.0	420	Total			

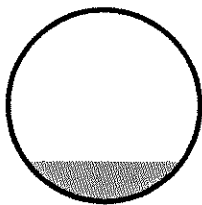
Reach 1R: 18" SD Hancock St

Inflow Area = 0.578 ac, Inflow Depth > 4.87" for 25-YEAR event
 Inflow = 3.13 cfs @ 12.07 hrs, Volume= 0.235 af
 Outflow = 3.06 cfs @ 12.08 hrs, Volume= 0.235 af, Atten= 2%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Max. Velocity= 11.51 fps, Min. Travel Time= 0.4 min
 Avg. Velocity = 4.40 fps, Avg. Travel Time= 1.1 min

Peak Storage= 75 cf @ 12.08 hrs, Average Depth at Peak Storage= 0.31'
 Bank-Full Depth= 1.50', Capacity at Bank-Full= 32.45 cfs

18.0" Diameter Pipe, n= 0.010
 Length= 279.0' Slope= 0.0565 '/'
 Inlet Invert= 34.36', Outlet Invert= 18.61'



Pond ADS:

Inflow Area = 0.689 ac, Inflow Depth > 4.87" for 25-YEAR event
 Inflow = 3.73 cfs @ 12.07 hrs, Volume= 0.280 af
 Outflow = 1.44 cfs @ 12.29 hrs, Volume= 0.280 af, Atten= 61%, Lag= 13.1 min
 Primary = 1.44 cfs @ 12.29 hrs, Volume= 0.280 af
 Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 25.25' @ 12.29 hrs Surf.Area= 531 sf Storage= 2,172 cf
 Flood Elev= 25.50' Surf.Area= 0 sf Storage= 2,262 cf

Plug-Flow detention time= 9.1 min calculated for 0.279 af (100% of inflow)
 Center-of-Mass det. time= 9.0 min (742.9 - 733.9)

Volume	Invert	Avail.Storage	Storage Description
#1	22.50'	2,262 cf	36.0"D x 20.00'L Horizontal Cylinder x 16

Device	Routing	Invert	Outlet Devices
#1	Primary	22.15'	12.0" x 11.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 22.00' S= 0.0136 '/' Cc= 0.900 n= 0.012
#2	Device 1	25.50'	5.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s) 5.0' Crest Height
#3	Device 1	22.15'	4.0" Vert. Orifice/Grate X 2.00 C= 0.600
#4	Secondary	27.10'	24.0" Horiz. Orifice/Grate Limited to weir flow C= 0.600

Primary OutFlow Max=1.44 cfs @ 12.29 hrs HW=25.24' (Free Discharge)

- 1=Culvert (Passes 1.44 cfs of 4.81 cfs potential flow)
- 2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
- 3=Orifice/Grate (Orifice Controls 1.44 cfs @ 8.24 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=22.50' (Free Discharge)

- 4=Orifice/Grate (Controls 0.00 cfs)

Pond CB-3: CB-3

Inflow Area = 0.689 ac, Inflow Depth > 4.87" for 25-YEAR event
 Inflow = 1.44 cfs @ 12.29 hrs, Volume= 0.280 af
 Outflow = 1.44 cfs @ 12.29 hrs, Volume= 0.280 af, Atten= 0%, Lag= 0.0 min
 Primary = 1.44 cfs @ 12.29 hrs, Volume= 0.280 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

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Type III 24-hr 25-YEAR Rainfall=5.50"

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Peak Elev= 21.92' @ 12.29 hrs

Flood Elev= 25.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	21.30'	18.0" x 13.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet Invert= 21.10' S= 0.0154 ' /' Cc= 0.900 n= 0.012

Primary OutFlow Max=1.44 cfs @ 12.29 hrs HW=21.91' (Free Discharge)↑**1=Culvert** (Inlet Controls 1.44 cfs @ 2.11 fps)**Pond DMH-7: DMH-7**

Inflow Area = 1.722 ac, Inflow Depth > 4.87" for 25-YEAR event
 Inflow = 6.78 cfs @ 12.07 hrs, Volume= 0.699 af
 Outflow = 6.78 cfs @ 12.07 hrs, Volume= 0.699 af, Atten= 0%, Lag= 0.0 min
 Primary = 6.78 cfs @ 12.07 hrs, Volume= 0.699 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 22.22' @ 12.07 hrs

Flood Elev= 25.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	20.90'	24.0" x 45.0' long Culvert CMP, projecting, no headwall, Ke= 0.900 Outlet Invert= 19.60' S= 0.0289 ' /' Cc= 0.900 n= 0.012

Primary OutFlow Max=6.56 cfs @ 12.07 hrs HW=22.19' (Free Discharge)↑**1=Culvert** (Inlet Controls 6.56 cfs @ 3.06 fps)**Pond DMH-8: DMH-8**

Inflow Area = 0.689 ac, Inflow Depth > 4.87" for 25-YEAR event
 Inflow = 1.44 cfs @ 12.29 hrs, Volume= 0.280 af
 Outflow = 1.44 cfs @ 12.29 hrs, Volume= 0.280 af, Atten= 0%, Lag= 0.0 min
 Primary = 1.44 cfs @ 12.29 hrs, Volume= 0.280 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Peak Elev= 22.63' @ 12.29 hrs

Flood Elev= 26.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	22.00'	18.0" x 80.0' long Culvert CMP, projecting, no headwall, Ke= 0.900 Outlet Invert= 21.60' S= 0.0050 ' /' Cc= 0.900 n= 0.012

Primary OutFlow Max=1.44 cfs @ 12.29 hrs HW=22.63' (Free Discharge)↑**1=Culvert** (Barrel Controls 1.44 cfs @ 3.04 fps)

Pond E-DMH: EXISTING DMH

Inflow Area = 3.822 ac, Inflow Depth > 4.87" for 25-YEAR event
 Inflow = 17.79 cfs @ 12.08 hrs, Volume= 1.552 af
 Outflow = 17.79 cfs @ 12.08 hrs, Volume= 1.552 af, Atten= 0%, Lag= 0.0 min
 Primary = 17.79 cfs @ 12.08 hrs, Volume= 1.552 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Peak Elev= 21.71' @ 12.08 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	18.50'	24.0" x 20.0' long Culvert CPP, projecting, no headwall, Ke= 0.900 Outlet invert= 17.90' S= 0.0300 '/' Cc= 0.900 n= 0.012

Primary OutFlow Max=17.29 cfs @ 12.08 hrs HW=21.60' (Free Discharge)
 ↑1=Culvert (Inlet Controls 17.29 cfs @ 5.50 fps)