WOODARD & CURRAN
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CORPORATE OFFICES: Maine, Massachusetts, New Hampshire, Connecticut, Florida
Operational offices throughout the U.S.

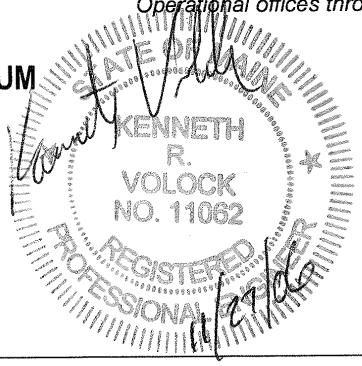
MEMORANDUM

TO: Barry Sheff, P.E.

FROM: Kenneth Volock, P.E.

DATE: November 27, 2006

RE: Hancock Street Stormwater Collection System



At the request of Eric Labelle, City Engineer, the purpose of this memorandum is to investigate the impacts that runoff from the Greater Hancock Street Watershed will have on the stormwater conveyance and treatment measures that have been constructed as part of the Ocean Gateway Project. Runoff from this area would ideally be collected in the City stormwater collection system then pass through a stormwater treatment unit, identified on the Ocean Gateway Drawings as Stormwater Treatment Unit 2 (Unit 2). The Greater Hancock Street Watershed is the study area for the purpose of this evaluation and is shown on Figure 1, attached to this memorandum.

A stormwater runoff model was developed by combining the areas of the Ocean Gateway and Longfellow Projects for which runoff is collected and passed through Unit 2. The model was then modified to include areas that could be collected as a result of the proposed upper Hancock Street project (including Hancock Street from Fore Street to Newbury Street and a small section of Fore Street from Hancock Street to the western entrance of the Hamilton Marine building). The model was modified again to include all the streets and the properties within the Greater Hancock Street Watershed.

Peak runoff capacities for Unit 2 and results of the model runs for each project are summarized in Table 1 below. Capacities are provided for 60% TSS Removal based on the 1-year storm and the peak flow rate through the unit based on the 25-year storm. Supporting HydroCAD data has been attached to this Memorandum for reference.

Table 1: Runoff Summary for Greater Hancock Street Watershed

COLLECTION AREA	PEAK RUNOFF 1 Year (CFS)	PEAK RUNOFF 25 Year (CFS)
Ocean Gateway Stormwater Treatment Unit #2 Capacity	12.85 [A]	30.81 [B]
Ocean Gateway and Longfellow Projects as currently proposed	9.74	22.95
Ocean Gateway, Longfellow and Hancock Street Projects	11.39	26.77
Ocean Gateway, Longfellow and Hancock Street Projects with all Streets within Greater Hancock Street Watershed	14.92	34.62
Greater Hancock Street Watershed, as shown on Figure 1	27.72	61.84

[A] - Peak runoff rate for the 1-year storm to achieve 60% TSS removal as approved by the Maine Department of Environmental Protection.

[B] - Peak runoff rates for the 25-year storm as indicated by the manufacturer in the attached Memorandum.

As shown in Table 1, the peak runoff rate through the stormwater treatment unit will exceed the capacity of Unit 2 if all of Hancock Street, Fore Street, Middle Street, Newbury Street and Federal Street within the Greater Hancock Street Watershed are included without any method of detention (e.g. hydrobraking).

Table 2 indicates the capacities of Unit 2, the peak runoff rates with the sections of Fore Street and Middle Street between Hancock and India Streets added, and the resulting allowable contribution from surrounding properties. The allowable contribution is defined as the peak runoff rate for a specific sub-watershed which, when modeled, suggests peak runoff rates within the capacity of Unit 2 and the pipe network. Given the streets that will be included in this collection area, the surrounding properties will include the Village Café Site and the Shipyard Site.

Table 2: Runoff Summary for Recommended Hancock Street Collection Area

COLLECTION AREA	PEAK RUNOFF 1 Year (CFS)	PEAK RUNOFF 25 Year (CFS)
Ocean Gateway Stormwater Treatment Unit #2 Capacity	12.85 [A]	30.81 [B]
Ocean Gateway, Longfellow and Hancock Street Projects with Streets within Recommended Collection Area, as shown on Figure 1	12.67	29.62
Allowable Increase at Unit #2 due to Flow from Village Café and Shipyard Sites	0.18	1.19

[A] - Peak runoff rate for the 1-year storm to achieve 60% TSS removal as approved by the Maine Department of Environmental Protection.

[B] - Peak runoff rates for the 25-year storm as indicated by the manufacturer in the attached Memorandum.

As shown in Table 2, the areas collected as a result of currently proposed projects, as well as the sections of Fore Street and Middle Street between Hancock and India Streets can be collected in the Hancock Street collection system and passed through Unit 2; however, significant decreases from anticipated peak runoff rates are required for the Village Café and Shipyard sites. The allowable peak runoff rate assigned to each site has been based upon the area of each parcel, as shown in Table 3.

Table 3: Allowable Peak Runoff

SITE	AREA (acres)	AREA (% of Total)	PEAK RUNOFF 1 Year (CFS)	PEAK RUNOFF 25 Year (CFS)
Shipyard Site	2.31	59%	0.11	0.70
Village Café Site	1.62	41%	0.07	0.49
TOTAL	**3.93**		**0.18**	**1.19**

It should be noted that the allowable peak runoff rates above consider only conventional detention, most likely a subsurface structure such as a StormTech or RainStore system. Another option that developers at the Shipyard and Village Café sites may consider is extended detention, whereby runoff would be detained and released once peak discharges in the rest of the Hancock Street collection area have subsided. This would allow for much higher flow rates from each site, but would require larger storage capacity for the initial detention.

Conclusion

In order to avoid exceeding the capacity of the Ocean Gateway Stormwater Treatment Unit 2, the Hancock Street stormwater collection area should be limited to the areas and peak runoff flow rates indicated on Figure 1, attached to this memorandum, and in Table 3 above. This area includes: the Ocean Gateway Project (currently under construction); the Longfellow Project (recently approved by the Planning Board); Hancock Street up to Newbury Street; Fore Street from India Street to the western entrance of the Hamilton Marine building; Middle Street from Hancock Street to India Street; and the Village Café and Shipyard sites.

KRV/
203848.41

Attachments

cc: File

RECOMMENDED COLLECTION AREA

SHIPYARD SITE

VILLAGE CAFE SITE

Mountfort Street

Federal Street

East Newbury Street

Hancock Street

Middle Street

India Street

Fore Street

Commercial Street

Portla

FeE
PEAK (EX)
1 YR = 1.07 CFS
25 YR = 2.40 CFS

NE
PEAK (EX)
1 YR = 0.71 CFS
25 YR = 1.58 CFS

Res
PEAK (EX)
1 YR = 2.92 CFS
25 YR = 6.52 CFS

SY
PEAK (EX)
1 YR = 5.43 CFS
25 YR = 12.15 CFS
ALLOWABLE
1 YR = 0.11 CFS
25 YR = 0.70 CFS

Hn3
PEAK (EX)
1 YR = 0.61 CFS
25 YR = 1.37 CFS

Hn2
PEAK (EX)
1 YR = 0.74 CFS
25 YR = 1.65 CFS

Hn1
PEAK (P)
1 YR = 0.84 CFS
25 YR = 1.88 CFS

Dev
PEAK (EX)
1 YR = 1.18 CFS
25 YR = 2.63 CFS

Vil
PEAK (EX)
1 YR = 3.81 CFS
25 YR = 8.52 CFS
ALLOWABLE
1 YR = 0.07 CFS
25 YR = 0.49 CFS

1AP
PEAK (P)
1 YR = 0.00 CFS
25 YR = 0.29 CFS

1BP
PEAK (P)
(VIA SSD)
1 YR = 1.06 CFS
25 YR = 2.28 CFS

FoE
PEAK (EX)
1 YR = 0.29 CFS
25 YR = 0.64 CFS

FoW
PEAK (EX)
1 YR = 0.81 CFS
25 YR = 1.81 CFS

5AOG
PEAK (EX)
1 YR = 3.73 CFS
25 YR = 8.35 CFS

5BP
(SEE 5CP)

5AP
(SEE 5CP)

3P
PEAK (P)
1 YR = 0.47 CFS
25 YR = 1.18 CFS

4P
PEAK (EX)
1 YR = 0.00 CFS
25 YR = 0.01 CFS

8OG
PEAK (P)
1 YR = 0.35 CFS
25 YR = 1.62 CFS

6OG
PEAK (P)
1 YR = 3.25 CFS
25 YR = 7.70 CFS

5CP
PEAK (P)
(VIA SSD)
1 YR = 2.33 CFS
25 YR = 5.66 CFS

3OG
PEAK (P)
1 YR = 1.25 CFS
25 YR = 3.13 CFS

LEGEND:

PEAK (EX)	=	PEAK RUNOFF RATES, EXISTING CONDITION
PEAK (P)	=	PEAK RUNOFF RATES, RESULTING FROM PROJECTS CURRENTLY PROPOSED OR UNDER CONSTRUCTION
ALLOWABLE	=	ALLOWABLE PEAK RUNOFF RATE
SSD	=	SUBSURFACE DETENTION
⬡	=	SUB-WATERSHED
– – –	=	RECOMMENDED COLLECTION AREA
— · —	=	WATERSHED BOUNDARY

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PORTLAND, MAINE 800-426-4262

GREATER HANCOCK STREET WATERSHED

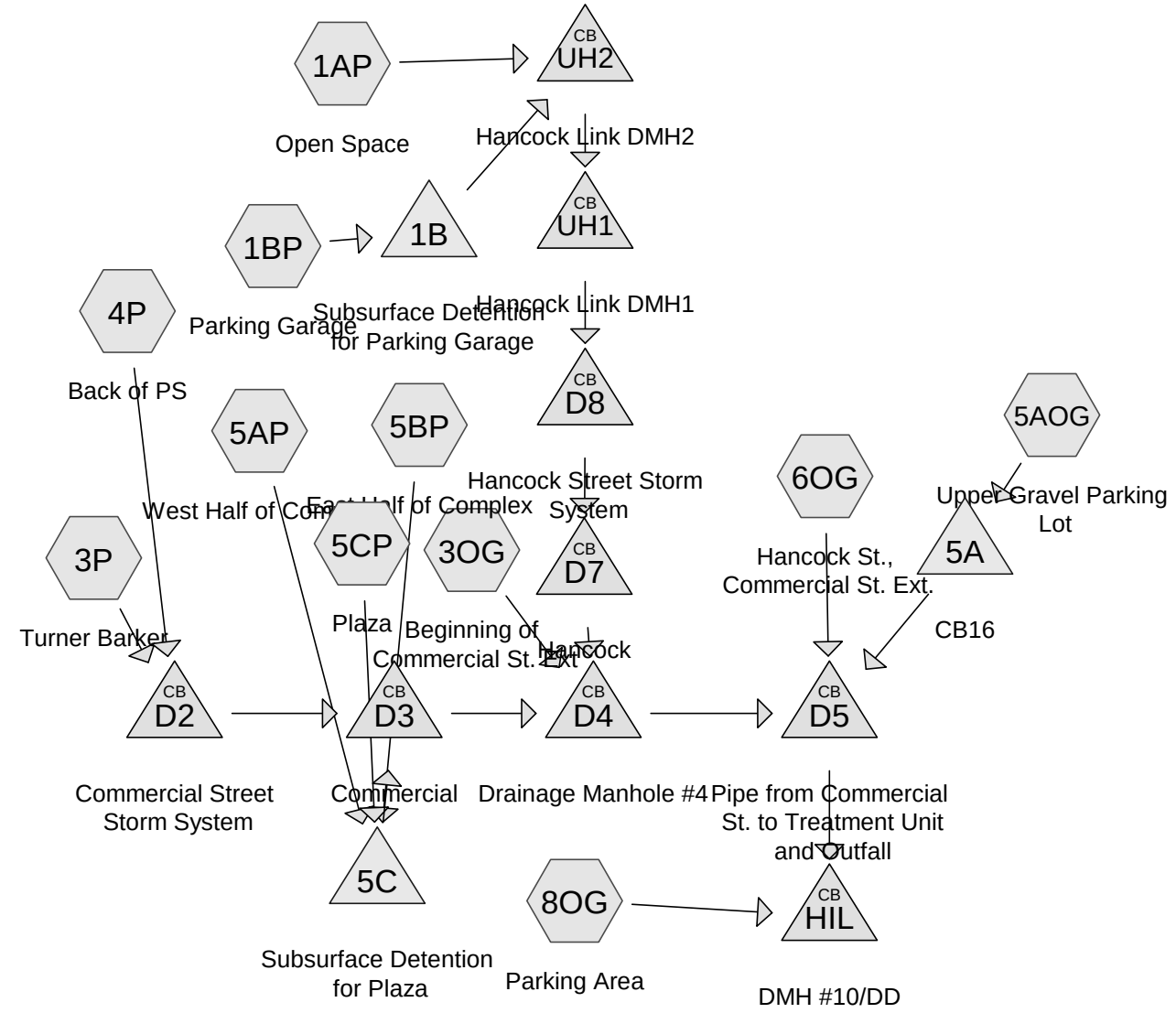
DESIGNED BY: KRV
DRAWN BY: KRV/JBC/DAS
CHECKED BY: KRV/BSS
203848.41–U001.dwg

CITY OF PORTLAND
PORTLAND, MAINE

HANCOCK STREET STORMWATER – IMPACTS ON OCEAN GATEWAY STORMWATER MEASURES

JOB NO: 203848.41
DATE: NOVEMBER 2006
SCALE: 1" = 100'

Figure 1



Subcat Reach Pond Link

Drainage Diagram for Ocean Gateway and The Longfellow-Residences and Garage-SC

Prepared by Woodard & Curran 11/22/2006

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1AP: Open Space Runoff Area=13,340 sf Runoff Depth>0.03"
Flow Length=165' Tc=6.1 min CN=52 Runoff=0.00 cfs 0.001 af

Subcatchment 1BP: Parking Garage Runoff Area=33,985 sf Runoff Depth>2.13"
Tc=6.0 min CN=98 Runoff=1.83 cfs 0.139 af

Subcatchment 3OG: Beginning of Commercial St. Ext Runoff Area=0.600 ac Runoff Depth>1.68"
Flow Length=456' Tc=4.8 min CN=93 Runoff=1.25 cfs 0.084 af

Subcatchment 3P: Turner Barker Runoff Area=9,230 sf Runoff Depth>1.68"
Flow Length=100' Slope=0.0100 '/' Tc=1.7 min CN=93 Runoff=0.47 cfs 0.030 af

Subcatchment 4P: Back of PS Runoff Area=3,655 sf Runoff Depth=0.00"
Flow Length=110' Slope=0.0300 '/' Tc=8.7 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 5AOG: Upper Gravel Parking Lot Runoff Area=1.950 ac Runoff Depth>2.13"
Flow Length=445' Tc=13.2 min CN=98 Runoff=3.73 cfs 0.346 af

Subcatchment 5AP: West Half of Complex Runoff Area=14,410 sf Runoff Depth>2.13"
Tc=6.0 min CN=98 Runoff=0.78 cfs 0.059 af

Subcatchment 5BP: East Half of Complex Runoff Area=38,510 sf Runoff Depth>2.13"
Tc=6.0 min CN=98 Runoff=2.08 cfs 0.157 af

Subcatchment 5CP: Plaza Runoff Area=4,995 sf Runoff Depth>2.13"
Flow Length=75' Slope=0.0125 '/' Tc=1.2 min CN=98 Runoff=0.31 cfs 0.020 af

Subcatchment 6OG: Hancock St., Commercial St. Ext. Runoff Area=1.350 ac Runoff Depth>1.86"
Flow Length=550' Tc=2.8 min CN=95 Runoff=3.25 cfs 0.209 af

Subcatchment 8OG: Parking Area Runoff Area=0.800 ac Runoff Depth>0.62"
Flow Length=125' Tc=27.5 min CN=76 Runoff=0.35 cfs 0.042 af

Pond 1B: Subsurface Detention for Parking Ga Peak Elev=20.22' Storage=917 cf Inflow=1.83 cfs 0.139 af
Outflow=1.06 cfs 0.137 af

Pond 5A: CB16 Peak Elev=13.19' Storage=1,170 cf Inflow=3.73 cfs 0.346 af
Outflow=3.40 cfs 0.344 af

Pond 5C: Subsurface Detention for Plaza Peak Elev=11.05' Storage=682 cf Inflow=3.06 cfs 0.236 af
Outflow=2.64 cfs 0.235 af

Pond D2: Commercial Street Storm System Peak Elev=9.56' Inflow=0.47 cfs 0.030 af
15.0" x 192.0' Culvert Outflow=0.47 cfs 0.030 af

Pond D3: Commercial Peak Elev=9.56' Inflow=2.89 cfs 0.265 af
15.0" x 192.0' Culvert Outflow=2.89 cfs 0.265 af

Pond D4: Drainage Manhole #4 Peak Elev=9.08' Inflow=4.93 cfs 0.487 af
36.0" x 250.0' Culvert Outflow=4.93 cfs 0.487 af

Pond D5: Pipe from Commercial St. to Treatment Unit and Outf Peak Elev=8.53' Inflow=9.64 cfs 1.039 af
36.0" x 137.0' Culvert Outflow=9.64 cfs 1.039 af

Pond D7: Hancock Peak Elev=9.10' Inflow=1.06 cfs 0.138 af
30.0" x 36.0' Culvert Outflow=1.06 cfs 0.138 af

Pond D8: Hancock Street Storm System Peak Elev=10.22' Inflow=1.06 cfs 0.138 af
24.0" x 196.0' Culvert Outflow=1.06 cfs 0.138 af

Pond HIL: DMH #10/DD Peak Elev=8.08' Inflow=9.74 cfs 1.081 af
36.0" x 102.0' Culvert Outflow=9.74 cfs 1.081 af

Pond UH1: Hancock Link DMH1 Peak Elev=12.05' Inflow=1.06 cfs 0.138 af
24.0" x 125.0' Culvert Outflow=1.06 cfs 0.138 af

Pond UH2: Hancock Link DMH2 Peak Elev=16.81' Inflow=1.06 cfs 0.138 af
24.0" x 106.0' Culvert Outflow=1.06 cfs 0.138 af

Total Runoff Area = 7.412 ac Runoff Volume = 1.085 af Average Runoff Depth = 1.76"
12.05% Pervious Area = 0.893 ac 87.95% Impervious Area = 6.519 ac

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1AP: Open Space Runoff Area=13,340 sf Runoff Depth>0.92"
Flow Length=165' Tc=6.1 min CN=52 Runoff=0.29 cfs 0.024 af

Subcatchment 1BP: Parking Garage Runoff Area=33,985 sf Runoff Depth>4.87"
Tc=6.0 min CN=98 Runoff=4.10 cfs 0.317 af

Subcatchment 3OG: Beginning of Commercial St. Ext Runoff Area=0.600 ac Runoff Depth>4.43"
Flow Length=456' Tc=4.8 min CN=93 Runoff=3.13 cfs 0.221 af

Subcatchment 3P: Turner Barker Runoff Area=9,230 sf Runoff Depth>4.43"
Flow Length=100' Slope=0.0100 '/' Tc=1.7 min CN=93 Runoff=1.18 cfs 0.078 af

Subcatchment 4P: Back of PS Runoff Area=3,655 sf Runoff Depth>0.25"
Flow Length=110' Slope=0.0300 '/' Tc=8.7 min CN=39 Runoff=0.01 cfs 0.002 af

Subcatchment 5AOG: Upper Gravel Parking Lot Runoff Area=1.950 ac Runoff Depth>4.87"
Flow Length=445' Tc=13.2 min CN=98 Runoff=8.35 cfs 0.792 af

Subcatchment 5AP: West Half of Complex Runoff Area=14,410 sf Runoff Depth>4.87"
Tc=6.0 min CN=98 Runoff=1.74 cfs 0.134 af

Subcatchment 5BP: East Half of Complex Runoff Area=38,510 sf Runoff Depth>4.87"
Tc=6.0 min CN=98 Runoff=4.65 cfs 0.359 af

Subcatchment 5CP: Plaza Runoff Area=4,995 sf Runoff Depth>4.87"
Flow Length=75' Slope=0.0125 '/' Tc=1.2 min CN=98 Runoff=0.68 cfs 0.047 af

Subcatchment 6OG: Hancock St., Commercial St. Ext. Runoff Area=1.350 ac Runoff Depth>4.62"
Flow Length=550' Tc=2.8 min CN=95 Runoff=7.70 cfs 0.520 af

Subcatchment 8OG: Parking Area Runoff Area=0.800 ac Runoff Depth>2.73"
Flow Length=125' Tc=27.5 min CN=76 Runoff=1.62 cfs 0.182 af

Pond 1B: Subsurface Detention for Parking G Peak Elev=21.24' Storage=2,187 cf Inflow=4.10 cfs 0.317 af
Outflow=2.28 cfs 0.315 af

Pond 5A: CB16 Peak Elev=13.39' Storage=2,048 cf Inflow=8.35 cfs 0.792 af
Outflow=7.87 cfs 0.789 af

Pond 5C: Subsurface Detention for Plaza Peak Elev=13.06' Storage=1,801 cf Inflow=6.84 cfs 0.540 af
Outflow=5.31 cfs 0.539 af

Pond D2: Commercial Street Storm System Peak Elev=11.38' Inflow=1.18 cfs 0.080 af
15.0" x 192.0' Culvert Outflow=1.18 cfs 0.080 af

Pond D3: Commercial Peak Elev=11.37' Inflow=5.87 cfs 0.619 af
15.0" x 192.0' Culvert Outflow=5.87 cfs 0.619 af

Pond D4: Drainage Manhole #4 Peak Elev=10.00' Inflow=10.91 cfs 1.178 af
36.0" x 250.0' Culvert Outflow=10.91 cfs 1.178 af

Pond D5: Pipe from Commercial St. to Treatment Unit and Out Peak Elev=9.62' Inflow=22.66 cfs 2.487 af
36.0" x 137.0' Culvert Outflow=22.66 cfs 2.487 af

Pond D7: Hancock Peak Elev=10.02' Inflow=2.49 cfs 0.338 af
30.0" x 36.0' Culvert Outflow=2.49 cfs 0.338 af

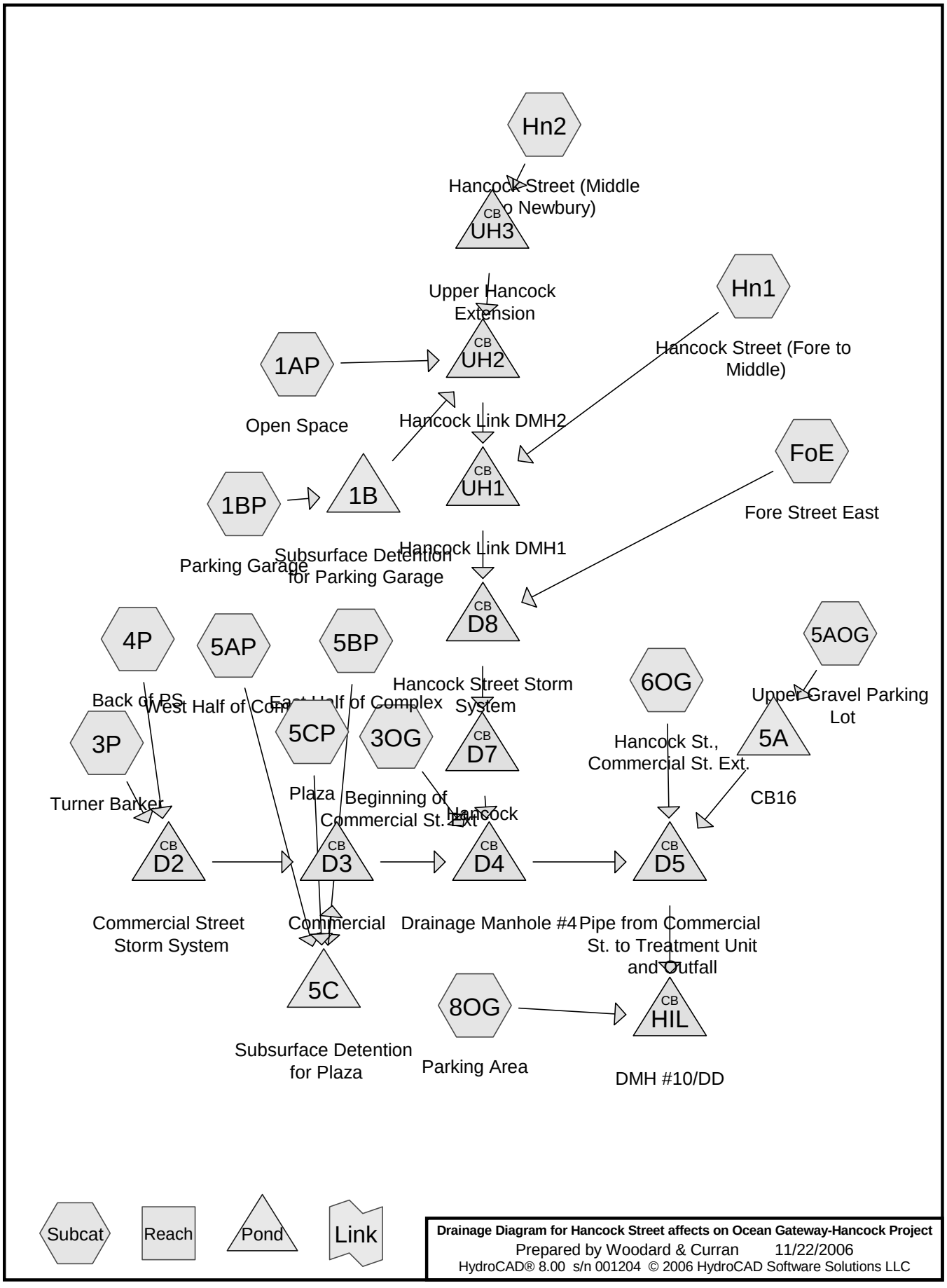
Pond D8: Hancock Street Storm System Peak Elev=10.61' Inflow=2.49 cfs 0.338 af
24.0" x 196.0' Culvert Outflow=2.49 cfs 0.338 af

Pond HIL: DMH #10/DD Peak Elev=9.01' Inflow=22.95 cfs 2.669 af
36.0" x 102.0' Culvert Outflow=22.95 cfs 2.669 af

Pond UH1: Hancock Link DMH1 Peak Elev=12.29' Inflow=2.49 cfs 0.338 af
24.0" x 125.0' Culvert Outflow=2.49 cfs 0.338 af

Pond UH2: Hancock Link DMH2 Peak Elev=17.05' Inflow=2.49 cfs 0.338 af
24.0" x 106.0' Culvert Outflow=2.49 cfs 0.338 af

Total Runoff Area = 7.412 ac Runoff Volume = 2.676 af Average Runoff Depth = 4.33"
12.05% Pervious Area = 0.893 ac 87.95% Impervious Area = 6.519 ac



Drainage Diagram for Hancock Street affects on Ocean Gateway-Hancock Project

Prepared by Woodard & Curran 11/22/2006

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1AP: Open Space Runoff Area=13,340 sf Runoff Depth>0.03"
Flow Length=165' Tc=6.1 min CN=52 Runoff=0.00 cfs 0.001 af

Subcatchment 1BP: Parking Garage Runoff Area=33,985 sf Runoff Depth>2.13"
Tc=6.0 min CN=98 Runoff=1.83 cfs 0.139 af

Subcatchment 3OG: Beginning of Commercial St. Ext Runoff Area=0.600 ac Runoff Depth>1.68"
Flow Length=456' Tc=4.8 min CN=93 Runoff=1.25 cfs 0.084 af

Subcatchment 3P: Turner Barker Runoff Area=9,230 sf Runoff Depth>1.68"
Flow Length=100' Slope=0.0100 '/' Tc=1.7 min CN=93 Runoff=0.47 cfs 0.030 af

Subcatchment 4P: Back of PS Runoff Area=3,655 sf Runoff Depth=0.00"
Flow Length=110' Slope=0.0300 '/' Tc=8.7 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 5AOG: Upper Gravel Parking Lot Runoff Area=1.950 ac Runoff Depth>2.13"
Flow Length=445' Tc=13.2 min CN=98 Runoff=3.73 cfs 0.346 af

Subcatchment 5AP: West Half of Complex Runoff Area=14,410 sf Runoff Depth>2.13"
Tc=6.0 min CN=98 Runoff=0.78 cfs 0.059 af

Subcatchment 5BP: East Half of Complex Runoff Area=38,510 sf Runoff Depth>2.13"
Tc=6.0 min CN=98 Runoff=2.08 cfs 0.157 af

Subcatchment 5CP: Plaza Runoff Area=4,995 sf Runoff Depth>2.13"
Flow Length=75' Slope=0.0125 '/' Tc=1.2 min CN=98 Runoff=0.31 cfs 0.020 af

Subcatchment 6OG: Hancock St., Commercial St. Ext. Runoff Area=1.350 ac Runoff Depth>1.86"
Flow Length=550' Tc=2.8 min CN=95 Runoff=3.25 cfs 0.209 af

Subcatchment 8OG: Parking Area Runoff Area=0.800 ac Runoff Depth>0.62"
Flow Length=125' Tc=27.5 min CN=76 Runoff=0.35 cfs 0.042 af

Subcatchment FoE: Fore Street East Runoff Area=0.110 ac Runoff Depth>2.13"
Flow Length=160' Slope=0.0200 '/' Tc=1.6 min CN=98 Runoff=0.29 cfs 0.020 af

Subcatchment Hn1: Hancock Street (Fore to Middle) Runoff Area=0.320 ac Runoff Depth>2.13"
Flow Length=250' Slope=0.0440 '/' Tc=1.5 min CN=98 Runoff=0.84 cfs 0.057 af

Subcatchment Hn2: Hancock Street (Middle to Newbury) Runoff Area=0.280 ac Runoff Depth>2.13"
Flow Length=275' Slope=0.0650 '/' Tc=1.4 min CN=98 Runoff=0.74 cfs 0.050 af

Pond 1B: Subsurface Detention for Parking Ga Peak Elev=20.22' Storage=917 cf Inflow=1.83 cfs 0.139 af
Outflow=1.06 cfs 0.137 af

Pond 5A: CB16 Peak Elev=13.19' Storage=1,170 cf Inflow=3.73 cfs 0.346 af
Outflow=3.40 cfs 0.344 af

Pond 5C: Subsurface Detention for Plaza Peak Elev=11.05' Storage=682 cf Inflow=3.06 cfs 0.236 af
Outflow=2.64 cfs 0.235 af

Pond D2: Commercial Street Storm System Peak Elev=9.65' Inflow=0.47 cfs 0.030 af
15.0" x 192.0' Culvert Outflow=0.47 cfs 0.030 af

Pond D3: Commercial Peak Elev=9.64' Inflow=2.89 cfs 0.265 af
15.0" x 192.0' Culvert Outflow=2.89 cfs 0.265 af

Pond D4: Drainage Manhole #4 Peak Elev=9.22' Inflow=6.25 cfs 0.613 af
36.0" x 250.0' Culvert Outflow=6.25 cfs 0.613 af

Pond D5: Pipe from Commercial St. to Treatment Unit and Out Peak Elev=8.66' Inflow=11.30 cfs 1.166 af
36.0" x 137.0' Culvert Outflow=11.30 cfs 1.166 af

Pond D7: Hancock Peak Elev=9.26' Inflow=2.57 cfs 0.264 af
30.0" x 36.0' Culvert Outflow=2.57 cfs 0.264 af

Pond D8: Hancock Street Storm System Peak Elev=10.45' Inflow=2.57 cfs 0.264 af
24.0" x 196.0' Culvert Outflow=2.57 cfs 0.264 af

Pond HIL: DMH #10/DD Peak Elev=8.22' Inflow=11.39 cfs 1.207 af
36.0" x 102.0' Culvert Outflow=11.39 cfs 1.207 af

Pond UH1: Hancock Link DMH1 Peak Elev=12.26' Inflow=2.29 cfs 0.244 af
24.0" x 125.0' Culvert Outflow=2.29 cfs 0.244 af

Pond UH2: Hancock Link DMH2 Peak Elev=16.89' Inflow=1.47 cfs 0.188 af
24.0" x 106.0' Culvert Outflow=1.47 cfs 0.188 af

Pond UH3: Upper Hancock Extension Peak Elev=19.36' Inflow=0.74 cfs 0.050 af
24.0" x 84.0' Culvert Outflow=0.74 cfs 0.050 af

Total Runoff Area = 8.122 ac Runoff Volume = 1.211 af Average Runoff Depth = 1.79"
11.00% Pervious Area = 0.893 ac 89.00% Impervious Area = 7.229 ac

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1AP: Open Space Runoff Area=13,340 sf Runoff Depth>0.92"
Flow Length=165' Tc=6.1 min CN=52 Runoff=0.29 cfs 0.024 af

Subcatchment 1BP: Parking Garage Runoff Area=33,985 sf Runoff Depth>4.87"
Tc=6.0 min CN=98 Runoff=4.10 cfs 0.317 af

Subcatchment 3OG: Beginning of Commercial St. Ext Runoff Area=0.600 ac Runoff Depth>4.43"
Flow Length=456' Tc=4.8 min CN=93 Runoff=3.13 cfs 0.221 af

Subcatchment 3P: Turner Barker Runoff Area=9,230 sf Runoff Depth>4.43"
Flow Length=100' Slope=0.0100 '/' Tc=1.7 min CN=93 Runoff=1.18 cfs 0.078 af

Subcatchment 4P: Back of PS Runoff Area=3,655 sf Runoff Depth>0.25"
Flow Length=110' Slope=0.0300 '/' Tc=8.7 min CN=39 Runoff=0.01 cfs 0.002 af

Subcatchment 5AOG: Upper Gravel Parking Lot Runoff Area=1.950 ac Runoff Depth>4.87"
Flow Length=445' Tc=13.2 min CN=98 Runoff=8.35 cfs 0.792 af

Subcatchment 5AP: West Half of Complex Runoff Area=14,410 sf Runoff Depth>4.87"
Tc=6.0 min CN=98 Runoff=1.74 cfs 0.134 af

Subcatchment 5BP: East Half of Complex Runoff Area=38,510 sf Runoff Depth>4.87"
Tc=6.0 min CN=98 Runoff=4.65 cfs 0.359 af

Subcatchment 5CP: Plaza Runoff Area=4,995 sf Runoff Depth>4.87"
Flow Length=75' Slope=0.0125 '/' Tc=1.2 min CN=98 Runoff=0.68 cfs 0.047 af

Subcatchment 6OG: Hancock St., Commercial St. Ext. Runoff Area=1.350 ac Runoff Depth>4.62"
Flow Length=550' Tc=2.8 min CN=95 Runoff=7.70 cfs 0.520 af

Subcatchment 8OG: Parking Area Runoff Area=0.800 ac Runoff Depth>2.73"
Flow Length=125' Tc=27.5 min CN=76 Runoff=1.62 cfs 0.182 af

Subcatchment FoE: Fore Street East Runoff Area=0.110 ac Runoff Depth>4.87"
Flow Length=160' Slope=0.0200 '/' Tc=1.6 min CN=98 Runoff=0.64 cfs 0.045 af

Subcatchment Hn1: Hancock Street (Fore to Middle) Runoff Area=0.320 ac Runoff Depth>4.87"
Flow Length=250' Slope=0.0440 '/' Tc=1.5 min CN=98 Runoff=1.88 cfs 0.130 af

Subcatchment Hn2: Hancock Street (Middle to Newbury) Runoff Area=0.280 ac Runoff Depth>4.87"
Flow Length=275' Slope=0.0650 '/' Tc=1.4 min CN=98 Runoff=1.65 cfs 0.114 af

Pond 1B: Subsurface Detention for Parking G Peak Elev=21.24' Storage=2,187 cf Inflow=4.10 cfs 0.317 af
Outflow=2.28 cfs 0.315 af

Pond 5A: CB16 Peak Elev=13.39' Storage=2,048 cf Inflow=8.35 cfs 0.792 af
Outflow=7.87 cfs 0.789 af

Pond 5C: Subsurface Detention for Plaza Peak Elev=13.19' Storage=1,855 cf Inflow=6.84 cfs 0.540 af
Outflow=5.07 cfs 0.539 af

Pond D2: Commercial Street Storm System Peak Elev=11.57' Inflow=1.18 cfs 0.080 af
15.0" x 192.0' Culvert Outflow=1.18 cfs 0.080 af

Pond D3: Commercial Peak Elev=11.56' Inflow=5.66 cfs 0.619 af
15.0" x 192.0' Culvert Outflow=5.66 cfs 0.619 af

Pond D4: Drainage Manhole #4 Peak Elev=10.25' Inflow=14.10 cfs 1.467 af
36.0" x 250.0' Culvert Outflow=14.10 cfs 1.467 af

Pond D5: Pipe from Commercial St. to Treatment Unit and Out Peak Elev=9.87' Inflow=26.14 cfs 2.776 af
36.0" x 137.0' Culvert Outflow=26.14 cfs 2.776 af

Pond D7: Hancock Peak Elev=10.29' Inflow=5.86 cfs 0.627 af
30.0" x 36.0' Culvert Outflow=5.86 cfs 0.627 af

Pond D8: Hancock Street Storm System Peak Elev=10.88' Inflow=5.86 cfs 0.627 af
24.0" x 196.0' Culvert Outflow=5.86 cfs 0.627 af

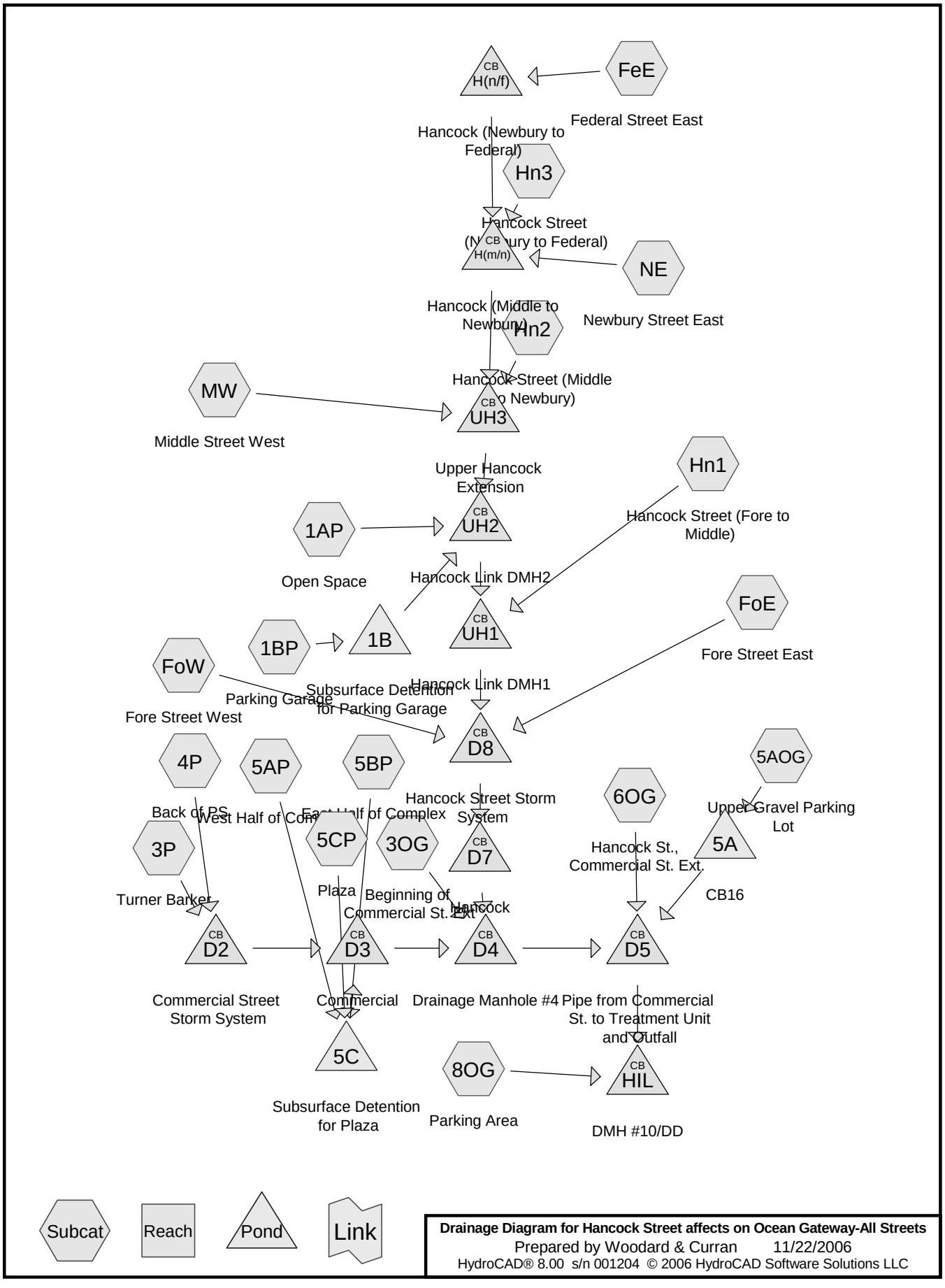
Pond HIL: DMH #10/DD Peak Elev=9.26' Inflow=26.77 cfs 2.958 af
36.0" x 102.0' Culvert Outflow=26.77 cfs 2.958 af

Pond UH1: Hancock Link DMH1 Peak Elev=12.62' Inflow=5.23 cfs 0.582 af
24.0" x 125.0' Culvert Outflow=5.23 cfs 0.582 af

Pond UH2: Hancock Link DMH2 Peak Elev=17.17' Inflow=3.45 cfs 0.452 af
24.0" x 106.0' Culvert Outflow=3.45 cfs 0.452 af

Pond UH3: Upper Hancock Extension Peak Elev=19.54' Inflow=1.65 cfs 0.114 af
24.0" x 84.0' Culvert Outflow=1.65 cfs 0.114 af

Total Runoff Area = 8.122 ac Runoff Volume = 2.964 af Average Runoff Depth = 4.38"
11.00% Pervious Area = 0.893 ac 89.00% Impervious Area = 7.229 ac


CB H(n/f)
FeE
Federal Street East
Hancock (Newbury to Federal)
Hn3
Hancock Street (Newbury to Federal)
CB H(m/n)
NE
Newbury Street East
Hancock (Middle to Newbury)
Hn2
Hancock Street (Middle to Newbury)
MW
CB UH3
Middle Street West
Upper Hancock Extension
Hn1
CB UH2
1AP
Hancock Street (Fore to Middle)
Open Space
Hancock Link DMH2
CB UH1
1BP
1B
FoE
Fore Street East
FoW
Hancock Link DMH1
Subsurface Detention for Parking Garage
Parking Garage
Fore Street West
CB D8
4P
5AP
5BP
5AOG
Hancock Street Storm System
6OG
Upper Gravel Parking Lot
Back of PS
West Half of Com
East Half of Complex
3P
5CP
3OG
CB D7
5A
Hancock St., Commercial St. Ext.
Plaza
Beginning of Commercial St. Ext
Hancock
CB16
Turner Barker
CB D2
CB D3
CB D4
CB D5
Commercial Street Storm System
Commercial
Drainage Manhole #4
Pipe from Commercial St. to Treatment Unit and Outfall
5C
8OG
CB HIL
Subsurface Detention for Plaza
Parking Area
DMH #10/DD
Subcat
Reach
Pond
Link
Drainage Diagram for Hancock Street affects on Ocean Gateway-All Streets
Prepared by Woodard & Curran 11/22/2006
HydroCAD® 8.00 s/n 001204 © 2006 HydroCAD Software Solutions LLC

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1AP: Open Space Runoff Area=13,340 sf Runoff Depth>0.03"
Flow Length=165' Tc=6.1 min CN=52 Runoff=0.00 cfs 0.001 af

Subcatchment 1BP: Parking Garage Runoff Area=33,985 sf Runoff Depth>2.13"
Tc=6.0 min CN=98 Runoff=1.83 cfs 0.139 af

Subcatchment 3OG: Beginning of Commercial St. Ext Runoff Area=0.600 ac Runoff Depth>1.68"
Flow Length=456' Tc=4.8 min CN=93 Runoff=1.25 cfs 0.084 af

Subcatchment 3P: Turner Barker Runoff Area=9,230 sf Runoff Depth>1.68"
Flow Length=100' Slope=0.0100 '/' Tc=1.7 min CN=93 Runoff=0.47 cfs 0.030 af

Subcatchment 4P: Back of PS Runoff Area=3,655 sf Runoff Depth=0.00"
Flow Length=110' Slope=0.0300 '/' Tc=8.7 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 5AOG: Upper Gravel Parking Lot Runoff Area=1.950 ac Runoff Depth>2.13"
Flow Length=445' Tc=13.2 min CN=98 Runoff=3.73 cfs 0.346 af

Subcatchment 5AP: West Half of Complex Runoff Area=14,410 sf Runoff Depth>2.13"
Tc=6.0 min CN=98 Runoff=0.78 cfs 0.059 af

Subcatchment 5BP: East Half of Complex Runoff Area=38,510 sf Runoff Depth>2.13"
Tc=6.0 min CN=98 Runoff=2.08 cfs 0.157 af

Subcatchment 5CP: Plaza Runoff Area=4,995 sf Runoff Depth>2.13"
Flow Length=75' Slope=0.0125 '/' Tc=1.2 min CN=98 Runoff=0.31 cfs 0.020 af

Subcatchment 6OG: Hancock St., Commercial St. Ext. Runoff Area=1.350 ac Runoff Depth>1.86"
Flow Length=550' Tc=2.8 min CN=95 Runoff=3.25 cfs 0.209 af

Subcatchment 8OG: Parking Area Runoff Area=0.800 ac Runoff Depth>0.62"
Flow Length=125' Tc=27.5 min CN=76 Runoff=0.35 cfs 0.042 af

Subcatchment FeE: Federal Street East Runoff Area=0.410 ac Runoff Depth>2.13"
Flow Length=410' Tc=2.3 min CN=98 Runoff=1.07 cfs 0.073 af

Subcatchment FoE: Fore Street East Runoff Area=0.110 ac Runoff Depth>2.13"
Flow Length=160' Slope=0.0200 '/' Tc=1.6 min CN=98 Runoff=0.29 cfs 0.020 af

Subcatchment FoW: Fore Street West Runoff Area=0.310 ac Runoff Depth>2.13"
Flow Length=375' Tc=2.6 min CN=98 Runoff=0.81 cfs 0.055 af

Subcatchment Hn1: Hancock Street (Fore to Middle) Runoff Area=0.320 ac Runoff Depth>2.13"
Flow Length=250' Slope=0.0440 '/' Tc=1.5 min CN=98 Runoff=0.84 cfs 0.057 af

Subcatchment Hn2: Hancock Street (Middle to Newbury) Runoff Area=0.280 ac Runoff Depth>2.13"
Flow Length=275' Slope=0.0650 '/' Tc=1.4 min CN=98 Runoff=0.74 cfs 0.050 af

Subcatchment Hn3: Hancock Street (Newbury to Federal) Runoff Area=0.230 ac Runoff Depth>2.13"
Flow Length=185' Tc=1.1 min CN=98 Runoff=0.61 cfs 0.041 af

Subcatchment MW: Middle Street West Runoff Area=0.200 ac Runoff Depth>2.13"
Flow Length=300' Slope=0.0100 '/' Tc=3.3 min CN=98 Runoff=0.52 cfs 0.036 af

Subcatchment NE: Newbury Street East Runoff Area=0.270 ac Runoff Depth>2.13"
Flow Length=425' Tc=2.3 min CN=98 Runoff=0.71 cfs 0.048 af

Pond 1B: Subsurface Detention for Parking Ga Peak Elev=20.22' Storage=917 cf Inflow=1.83 cfs 0.139 af
Outflow=1.06 cfs 0.137 af

Pond 5A: CB16 Peak Elev=13.19' Storage=1,170 cf Inflow=3.73 cfs 0.346 af
Outflow=3.40 cfs 0.344 af

Pond 5C: Subsurface Detention for Plaza Peak Elev=11.05' Storage=682 cf Inflow=3.06 cfs 0.236 af
Outflow=2.64 cfs 0.235 af

Pond D2: Commercial Street Storm System Peak Elev=9.86' Inflow=0.47 cfs 0.030 af
15.0" x 192.0' Culvert Outflow=0.47 cfs 0.030 af

Pond D3: Commercial Peak Elev=9.86' Inflow=2.89 cfs 0.265 af
15.0" x 192.0' Culvert Outflow=2.89 cfs 0.265 af

Pond D4: Drainage Manhole #4 Peak Elev=9.52' Inflow=9.80 cfs 0.865 af
36.0" x 250.0' Culvert Outflow=9.80 cfs 0.865 af

Pond D5: Pipe from Commercial St. to Treatment Unit and Out Peak Elev=8.95' Inflow=14.84 cfs 1.418 af
36.0" x 137.0' Culvert Outflow=14.84 cfs 1.418 af

Pond D7: Hancock Peak Elev=9.62' Inflow=6.25 cfs 0.516 af
30.0" x 36.0' Culvert Outflow=6.25 cfs 0.516 af

Pond D8: Hancock Street Storm System Peak Elev=10.87' Inflow=6.25 cfs 0.516 af
24.0" x 196.0' Culvert Outflow=6.25 cfs 0.516 af

Pond H(m/n): Hancock (Middle to Newbury) Peak Elev=38.64' Inflow=2.36 cfs 0.162 af
24.0" x 290.0' Culvert Outflow=2.36 cfs 0.162 af

Pond H(n/f): Hancock (Newbury to Federal) Peak Elev=52.46' Inflow=1.07 cfs 0.073 af
18.0" x 180.0' Culvert Outflow=1.07 cfs 0.073 af

Pond HIL: DMH #10/DD Peak Elev=8.48' Inflow=14.92 cfs 1.459 af
36.0" x 102.0' Culvert Outflow=14.92 cfs 1.459 af

Pond UH1: Hancock Link DMH1 Peak Elev=12.61' Inflow=5.16 cfs 0.442 af
24.0" x 125.0' Culvert Outflow=5.16 cfs 0.442 af

Pond UH2: Hancock Link DMH2 Peak Elev=17.28' Inflow=4.33 cfs 0.385 af
24.0" x 106.0' Culvert Outflow=4.33 cfs 0.385 af

Pond UH3: Upper Hancock Extension Peak Elev=19.81' Inflow=3.59 cfs 0.247 af
24.0" x 84.0' Culvert Outflow=3.59 cfs 0.247 af

Total Runoff Area = 9.542 ac Runoff Volume = 1.463 af Average Runoff Depth = 1.84"
9.36% Pervious Area = 0.893 ac 90.64% Impervious Area = 8.649 ac

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1AP: Open Space Runoff Area=13,340 sf Runoff Depth>0.92"
Flow Length=165' Tc=6.1 min CN=52 Runoff=0.29 cfs 0.024 af

Subcatchment 1BP: Parking Garage Runoff Area=33,985 sf Runoff Depth>4.87"
Tc=6.0 min CN=98 Runoff=4.10 cfs 0.317 af

Subcatchment 3OG: Beginning of Commercial St. Ext Runoff Area=0.600 ac Runoff Depth>4.43"
Flow Length=456' Tc=4.8 min CN=93 Runoff=3.13 cfs 0.221 af

Subcatchment 3P: Turner Barker Runoff Area=9,230 sf Runoff Depth>4.43"
Flow Length=100' Slope=0.0100 '/' Tc=1.7 min CN=93 Runoff=1.18 cfs 0.078 af

Subcatchment 4P: Back of PS Runoff Area=3,655 sf Runoff Depth>0.25"
Flow Length=110' Slope=0.0300 '/' Tc=8.7 min CN=39 Runoff=0.01 cfs 0.002 af

Subcatchment 5AOG: Upper Gravel Parking Lot Runoff Area=1.950 ac Runoff Depth>4.87"
Flow Length=445' Tc=13.2 min CN=98 Runoff=8.35 cfs 0.792 af

Subcatchment 5AP: West Half of Complex Runoff Area=14,410 sf Runoff Depth>4.87"
Tc=6.0 min CN=98 Runoff=1.74 cfs 0.134 af

Subcatchment 5BP: East Half of Complex Runoff Area=38,510 sf Runoff Depth>4.87"
Tc=6.0 min CN=98 Runoff=4.65 cfs 0.359 af

Subcatchment 5CP: Plaza Runoff Area=4,995 sf Runoff Depth>4.87"
Flow Length=75' Slope=0.0125 '/' Tc=1.2 min CN=98 Runoff=0.68 cfs 0.047 af

Subcatchment 6OG: Hancock St., Commercial St. Ext. Runoff Area=1.350 ac Runoff Depth>4.62"
Flow Length=550' Tc=2.8 min CN=95 Runoff=7.70 cfs 0.520 af

Subcatchment 8OG: Parking Area Runoff Area=0.800 ac Runoff Depth>2.73"
Flow Length=125' Tc=27.5 min CN=76 Runoff=1.62 cfs 0.182 af

Subcatchment FeE: Federal Street East Runoff Area=0.410 ac Runoff Depth>4.87"
Flow Length=410' Tc=2.3 min CN=98 Runoff=2.40 cfs 0.167 af

Subcatchment FoE: Fore Street East Runoff Area=0.110 ac Runoff Depth>4.87"
Flow Length=160' Slope=0.0200 '/' Tc=1.6 min CN=98 Runoff=0.64 cfs 0.045 af

Subcatchment FoW: Fore Street West Runoff Area=0.310 ac Runoff Depth>4.87"
Flow Length=375' Tc=2.6 min CN=98 Runoff=1.81 cfs 0.126 af

Subcatchment Hn1: Hancock Street (Fore to Middle) Runoff Area=0.320 ac Runoff Depth>4.87"
Flow Length=250' Slope=0.0440 '/' Tc=1.5 min CN=98 Runoff=1.88 cfs 0.130 af

Subcatchment Hn2: Hancock Street (Middle to Newbury) Runoff Area=0.280 ac Runoff Depth>4.87"
Flow Length=275' Slope=0.0650 '/' Tc=1.4 min CN=98 Runoff=1.65 cfs 0.114 af

Subcatchment Hn3: Hancock Street (Newbury to Federal) Runoff Area=0.230 ac Runoff Depth>4.87"
Flow Length=185' Tc=1.1 min CN=98 Runoff=1.37 cfs 0.093 af

Subcatchment MW: Middle Street West Runoff Area=0.200 ac Runoff Depth>4.87"
Flow Length=300' Slope=0.0100 '/' Tc=3.3 min CN=98 Runoff=1.16 cfs 0.081 af

Subcatchment NE: Newbury Street East Runoff Area=0.270 ac Runoff Depth>4.87"
Flow Length=425' Tc=2.3 min CN=98 Runoff=1.58 cfs 0.110 af

Pond 1B: Subsurface Detention for Parking G Peak Elev=21.24' Storage=2,187 cf Inflow=4.10 cfs 0.317 af
Outflow=2.28 cfs 0.315 af

Pond 5A: CB16 Peak Elev=13.39' Storage=2,048 cf Inflow=8.35 cfs 0.792 af
Outflow=7.87 cfs 0.789 af

Pond 5C: Subsurface Detention for Plaza Peak Elev=13.53' Storage=1,972 cf Inflow=6.84 cfs 0.540 af
Outflow=4.77 cfs 0.539 af

Pond D2: Commercial Street Storm System Peak Elev=12.12' Inflow=1.18 cfs 0.080 af
15.0" x 192.0' Culvert Outflow=1.18 cfs 0.080 af

Pond D3: Commercial Peak Elev=12.11' Inflow=5.47 cfs 0.619 af
15.0" x 192.0' Culvert Outflow=5.47 cfs 0.619 af

Pond D4: Drainage Manhole #4 Peak Elev=10.95' Inflow=22.04 cfs 2.044 af
36.0" x 250.0' Culvert Outflow=22.04 cfs 2.044 af

Pond D5: Pipe from Commercial St. to Treatment Unit and O Peak Elev=10.57' Inflow=34.02 cfs 3.352 af
36.0" x 137.0' Culvert Outflow=34.02 cfs 3.352 af

Pond D7: Hancock Peak Elev=11.05' Inflow=14.08 cfs 1.204 af
30.0" x 36.0' Culvert Outflow=14.08 cfs 1.204 af

Pond D8: Hancock Street Storm System Peak Elev=11.71' Inflow=14.08 cfs 1.204 af
24.0" x 196.0' Culvert Outflow=14.08 cfs 1.204 af

Pond H(m/n): Hancock (Middle to Newbury) Peak Elev=38.99' Inflow=5.28 cfs 0.370 af
24.0" x 290.0' Culvert Outflow=5.28 cfs 0.370 af

Pond H(n/f): Hancock (Newbury to Federal) Peak Elev=52.72' Inflow=2.40 cfs 0.167 af
18.0" x 180.0' Culvert Outflow=2.40 cfs 0.167 af

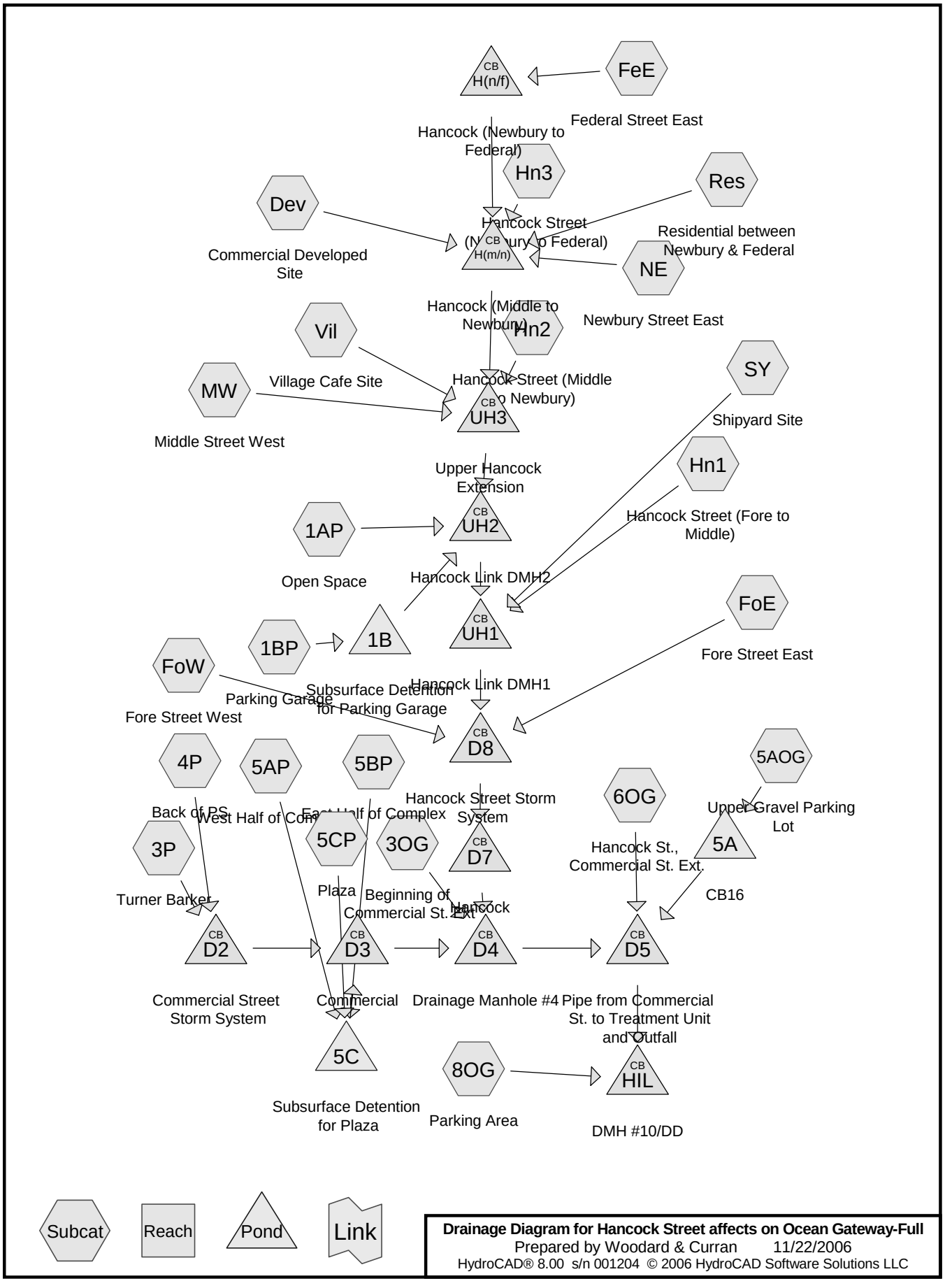
Pond HIL: DMH #10/DD Peak Elev=9.76' Inflow=34.62 cfs 3.534 af
36.0" x 102.0' Culvert Outflow=34.62 cfs 3.534 af

Pond UH1: Hancock Link DMH1 Peak Elev=13.23' Inflow=11.64 cfs 1.033 af
24.0" x 125.0' Culvert Outflow=11.64 cfs 1.033 af

Pond UH2: Hancock Link DMH2 Peak Elev=17.82' Inflow=9.81 cfs 0.903 af
24.0" x 106.0' Culvert Outflow=9.81 cfs 0.903 af

Pond UH3: Upper Hancock Extension Peak Elev=20.28' Inflow=8.02 cfs 0.565 af
24.0" x 84.0' Culvert Outflow=8.02 cfs 0.565 af

Total Runoff Area = 9.542 ac Runoff Volume = 3.541 af Average Runoff Depth = 4.45"
9.36% Pervious Area = 0.893 ac 90.64% Impervious Area = 8.649 ac



Drainage Diagram for Hancock Street affects on Ocean Gateway-Full
Prepared by Woodard & Curran 11/22/2006

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1AP: Open Space Runoff Area=13,340 sf Runoff Depth>0.03"
Flow Length=165' Tc=6.1 min CN=52 Runoff=0.00 cfs 0.001 af

Subcatchment 1BP: Parking Garage Runoff Area=33,985 sf Runoff Depth>2.13"
Tc=6.0 min CN=98 Runoff=1.83 cfs 0.139 af

Subcatchment 3OG: Beginning of Commercial St. Ext Runoff Area=0.600 ac Runoff Depth>1.68"
Flow Length=456' Tc=4.8 min CN=93 Runoff=1.25 cfs 0.084 af

Subcatchment 3P: Turner Barker Runoff Area=9,230 sf Runoff Depth>1.68"
Flow Length=100' Slope=0.0100 '/' Tc=1.7 min CN=93 Runoff=0.47 cfs 0.030 af

Subcatchment 4P: Back of PS Runoff Area=3,655 sf Runoff Depth=0.00"
Flow Length=110' Slope=0.0300 '/' Tc=8.7 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 5AOG: Upper Gravel Parking Lot Runoff Area=1.950 ac Runoff Depth>2.13"
Flow Length=445' Tc=13.2 min CN=98 Runoff=3.73 cfs 0.346 af

Subcatchment 5AP: West Half of Complex Runoff Area=14,410 sf Runoff Depth>2.13"
Tc=6.0 min CN=98 Runoff=0.78 cfs 0.059 af

Subcatchment 5BP: East Half of Complex Runoff Area=38,510 sf Runoff Depth>2.13"
Tc=6.0 min CN=98 Runoff=2.08 cfs 0.157 af

Subcatchment 5CP: Plaza Runoff Area=4,995 sf Runoff Depth>2.13"
Flow Length=75' Slope=0.0125 '/' Tc=1.2 min CN=98 Runoff=0.31 cfs 0.020 af

Subcatchment 6OG: Hancock St., Commercial St. Ext. Runoff Area=1.350 ac Runoff Depth>1.86"
Flow Length=550' Tc=2.8 min CN=95 Runoff=3.25 cfs 0.209 af

Subcatchment 8OG: Parking Area Runoff Area=0.800 ac Runoff Depth>0.62"
Flow Length=125' Tc=27.5 min CN=76 Runoff=0.35 cfs 0.042 af

Subcatchment Dev: Commercial Developed Site Runoff Area=0.500 ac Runoff Depth>2.13"
Flow Length=220' Slope=0.0468 '/' Tc=6.0 min CN=98 Runoff=1.18 cfs 0.089 af

Subcatchment FeE: Federal Street East Runoff Area=0.410 ac Runoff Depth>2.13"
Flow Length=410' Tc=2.3 min CN=98 Runoff=1.07 cfs 0.073 af

Subcatchment FoE: Fore Street East Runoff Area=0.110 ac Runoff Depth>2.13"
Flow Length=160' Slope=0.0200 '/' Tc=1.6 min CN=98 Runoff=0.29 cfs 0.020 af

Subcatchment FoW: Fore Street West Runoff Area=0.310 ac Runoff Depth>2.13"
Flow Length=375' Tc=2.6 min CN=98 Runoff=0.81 cfs 0.055 af

Subcatchment Hn1: Hancock Street (Fore to Middle) Runoff Area=0.320 ac Runoff Depth>2.13"
Flow Length=250' Slope=0.0440 '/' Tc=1.5 min CN=98 Runoff=0.84 cfs 0.057 af

Subcatchment Hn2: Hancock Street (Middle to Newbury) Runoff Area=0.280 ac Runoff Depth>2.13"
Flow Length=275' Slope=0.0650 '/' Tc=1.4 min CN=98 Runoff=0.74 cfs 0.050 af

Subcatchment Hn3: Hancock Street (Newbury to Federal) Runoff Area=0.230 ac Runoff Depth>2.13"
Flow Length=185' Tc=1.1 min CN=98 Runoff=0.61 cfs 0.041 af

Subcatchment MW: Middle Street West Runoff Area=0.200 ac Runoff Depth>2.13"
Flow Length=300' Slope=0.0100 '/' Tc=3.3 min CN=98 Runoff=0.52 cfs 0.036 af

Subcatchment NE: Newbury Street East Runoff Area=0.270 ac Runoff Depth>2.13"
Flow Length=425' Tc=2.3 min CN=98 Runoff=0.71 cfs 0.048 af

Subcatchment Res: Residential between Newbury & Federal Runoff Area=1.240 ac Runoff Depth>2.13"
Flow Length=420' Slope=0.0278 '/' Tc=6.0 min CN=98 Runoff=2.92 cfs 0.220 af

Subcatchment SY: Shipyard Site Runoff Area=2.310 ac Runoff Depth>2.13"
Flow Length=500' Slope=0.0229 '/' Tc=6.0 min CN=98 Runoff=5.43 cfs 0.410 af

Subcatchment Vil: Village Cafe Site Runoff Area=1.620 ac Runoff Depth>2.13"
Flow Length=240' Slope=0.0425 '/' Tc=6.0 min CN=98 Runoff=3.81 cfs 0.288 af

Pond 1B: Subsurface Detention for Parking Ga Peak Elev=20.22' Storage=917 cf Inflow=1.83 cfs 0.139 af
Outflow=1.06 cfs 0.137 af

Pond 5A: CB16 Peak Elev=13.19' Storage=1,170 cf Inflow=3.73 cfs 0.346 af
Outflow=3.40 cfs 0.344 af

Pond 5C: Subsurface Detention for Plaza Peak Elev=11.19' Storage=768 cf Inflow=3.06 cfs 0.236 af
Outflow=2.31 cfs 0.235 af

Pond D2: Commercial Street Storm System Peak Elev=10.83' Inflow=0.47 cfs 0.030 af
15.0" x 192.0' Culvert Outflow=0.47 cfs 0.030 af

Pond D3: Commercial Peak Elev=10.83' Inflow=2.60 cfs 0.265 af
15.0" x 192.0' Culvert Outflow=2.60 cfs 0.265 af

Pond D4: Drainage Manhole #4 Peak Elev=10.59' Inflow=22.59 cfs 1.872 af
36.0" x 250.0' Culvert Outflow=22.59 cfs 1.872 af

Pond D5: Pipe from Commercial St. to Treatment Unit and Out Peak Elev=9.95' Inflow=27.64 cfs 2.424 af
36.0" x 137.0' Culvert Outflow=27.64 cfs 2.424 af

Pond D7: Hancock Peak Elev=10.98' Inflow=18.82 cfs 1.523 af
30.0" x 36.0' Culvert Outflow=18.82 cfs 1.523 af

Pond D8: Hancock Street Storm System Peak Elev=12.33' Inflow=18.82 cfs 1.523 af
24.0" x 196.0' Culvert Outflow=18.82 cfs 1.523 af

Pond H(m/n): Hancock (Middle to Newbury) Peak Elev=39.08' Inflow=6.14 cfs 0.471 af
24.0" x 290.0' Culvert Outflow=6.14 cfs 0.471 af

Pond H(n/f): Hancock (Newbury to Federal) Peak Elev=52.46' Inflow=1.07 cfs 0.073 af
18.0" x 180.0' Culvert Outflow=1.07 cfs 0.073 af

Pond HIL: DMH #10/DD Peak Elev=9.32' Inflow=27.72 cfs 2.466 af
36.0" x 102.0' Culvert Outflow=27.72 cfs 2.466 af

Pond UH1: Hancock Link DMH1 Peak Elev=14.01' Inflow=17.81 cfs 1.448 af
24.0" x 125.0' Culvert Outflow=17.81 cfs 1.448 af

Pond UH2: Hancock Link DMH2 Peak Elev=18.01' Inflow=11.79 cfs 0.981 af
24.0" x 106.0' Culvert Outflow=11.79 cfs 0.981 af

Pond UH3: Upper Hancock Extension Peak Elev=20.55' Inflow=10.97 cfs 0.843 af
24.0" x 84.0' Culvert Outflow=10.97 cfs 0.843 af

Total Runoff Area = 15.212 ac Runoff Volume = 2.470 af Average Runoff Depth = 1.95"
5.87% Pervious Area = 0.893 ac 94.13% Impervious Area = 14.319 ac

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1AP: Open Space Runoff Area=13,340 sf Runoff Depth>0.92"
Flow Length=165' Tc=6.1 min CN=52 Runoff=0.29 cfs 0.024 af

Subcatchment 1BP: Parking Garage Runoff Area=33,985 sf Runoff Depth>4.87"
Tc=6.0 min CN=98 Runoff=4.10 cfs 0.317 af

Subcatchment 3OG: Beginning of Commercial St. Ext Runoff Area=0.600 ac Runoff Depth>4.43"
Flow Length=456' Tc=4.8 min CN=93 Runoff=3.13 cfs 0.221 af

Subcatchment 3P: Turner Barker Runoff Area=9,230 sf Runoff Depth>4.43"
Flow Length=100' Slope=0.0100 '/' Tc=1.7 min CN=93 Runoff=1.18 cfs 0.078 af

Subcatchment 4P: Back of PS Runoff Area=3,655 sf Runoff Depth>0.25"
Flow Length=110' Slope=0.0300 '/' Tc=8.7 min CN=39 Runoff=0.01 cfs 0.002 af

Subcatchment 5AOG: Upper Gravel Parking Lot Runoff Area=1.950 ac Runoff Depth>4.87"
Flow Length=445' Tc=13.2 min CN=98 Runoff=8.35 cfs 0.792 af

Subcatchment 5AP: West Half of Complex Runoff Area=14,410 sf Runoff Depth>4.87"
Tc=6.0 min CN=98 Runoff=1.74 cfs 0.134 af

Subcatchment 5BP: East Half of Complex Runoff Area=38,510 sf Runoff Depth>4.87"
Tc=6.0 min CN=98 Runoff=4.65 cfs 0.359 af

Subcatchment 5CP: Plaza Runoff Area=4,995 sf Runoff Depth>4.87"
Flow Length=75' Slope=0.0125 '/' Tc=1.2 min CN=98 Runoff=0.68 cfs 0.047 af

Subcatchment 6OG: Hancock St., Commercial St. Ext. Runoff Area=1.350 ac Runoff Depth>4.62"
Flow Length=550' Tc=2.8 min CN=95 Runoff=7.70 cfs 0.520 af

Subcatchment 8OG: Parking Area Runoff Area=0.800 ac Runoff Depth>2.73"
Flow Length=125' Tc=27.5 min CN=76 Runoff=1.62 cfs 0.182 af

Subcatchment Dev: Commercial Developed Site Runoff Area=0.500 ac Runoff Depth>4.87"
Flow Length=220' Slope=0.0468 '/' Tc=6.0 min CN=98 Runoff=2.63 cfs 0.203 af

Subcatchment FeE: Federal Street East Runoff Area=0.410 ac Runoff Depth>4.87"
Flow Length=410' Tc=2.3 min CN=98 Runoff=2.40 cfs 0.167 af

Subcatchment FoE: Fore Street East Runoff Area=0.110 ac Runoff Depth>4.87"
Flow Length=160' Slope=0.0200 '/' Tc=1.6 min CN=98 Runoff=0.64 cfs 0.045 af

Subcatchment FoW: Fore Street West Runoff Area=0.310 ac Runoff Depth>4.87"
Flow Length=375' Tc=2.6 min CN=98 Runoff=1.81 cfs 0.126 af

Subcatchment Hn1: Hancock Street (Fore to Middle) Runoff Area=0.320 ac Runoff Depth>4.87"
Flow Length=250' Slope=0.0440 '/' Tc=1.5 min CN=98 Runoff=1.88 cfs 0.130 af

Subcatchment Hn2: Hancock Street (Middle to Newbury) Runoff Area=0.280 ac Runoff Depth>4.87"
Flow Length=275' Slope=0.0650 '/' Tc=1.4 min CN=98 Runoff=1.65 cfs 0.114 af

Subcatchment Hn3: Hancock Street (Newbury to Federal) Runoff Area=0.230 ac Runoff Depth>4.87"
Flow Length=185' Tc=1.1 min CN=98 Runoff=1.37 cfs 0.093 af

Subcatchment MW: Middle Street West Runoff Area=0.200 ac Runoff Depth>4.87"
Flow Length=300' Slope=0.0100 '/' Tc=3.3 min CN=98 Runoff=1.16 cfs 0.081 af

Subcatchment NE: Newbury Street East Runoff Area=0.270 ac Runoff Depth>4.87"
Flow Length=425' Tc=2.3 min CN=98 Runoff=1.58 cfs 0.110 af

Subcatchment Res: Residential between Newbury & Federal Runoff Area=1.240 ac Runoff Depth>4.87"
Flow Length=420' Slope=0.0278 '/' Tc=6.0 min CN=98 Runoff=6.52 cfs 0.504 af

Subcatchment SY: Shipyard Site Runoff Area=2.310 ac Runoff Depth>4.87"
Flow Length=500' Slope=0.0229 '/' Tc=6.0 min CN=98 Runoff=12.15 cfs 0.938 af

Subcatchment Vil: Village Cafe Site Runoff Area=1.620 ac Runoff Depth>4.87"
Flow Length=240' Slope=0.0425 '/' Tc=6.0 min CN=98 Runoff=8.52 cfs 0.658 af

Pond 1B: Subsurface Detention for Parking G Peak Elev=22.74' Storage=3,711 cf Inflow=4.10 cfs 0.317 af
Outflow=3.49 cfs 0.315 af

Pond 5A: CB16 Peak Elev=13.86' Storage=4,024 cf Inflow=8.35 cfs 0.792 af
Outflow=11.31 cfs 0.789 af

Pond 5C: Subsurface Detention for Plaza Peak Elev=19.12' Storage=2,129 cf Inflow=6.84 cfs 0.540 af
Outflow=7.17 cfs 0.539 af

Pond D2: Commercial Street Storm System Peak Elev=18.79' Inflow=1.18 cfs 0.080 af
15.0" x 192.0' Culvert Outflow=1.18 cfs 0.080 af

Pond D3: Commercial Peak Elev=18.78' Inflow=7.71 cfs 0.619 af
15.0" x 192.0' Culvert Outflow=7.71 cfs 0.619 af

Pond D4: Drainage Manhole #4 Peak Elev=16.41' Inflow=49.90 cfs 4.347 af
36.0" x 250.0' Culvert Outflow=49.90 cfs 4.347 af

Pond D5: Pipe from Commercial St. to Treatment Unit and O Peak Elev=14.44' Inflow=61.23 cfs 5.655 af
36.0" x 137.0' Culvert Outflow=61.23 cfs 5.655 af

Pond D7: Hancock Peak Elev=17.80' Inflow=42.13 cfs 3.507 af
30.0" x 36.0' Culvert Outflow=42.13 cfs 3.507 af

Pond D8: Hancock Street Storm System Peak Elev=22.72' Inflow=42.13 cfs 3.507 af
24.0" x 196.0' Culvert Outflow=42.13 cfs 3.507 af

Pond H(m/n): Hancock (Middle to Newbury) Peak Elev=39.81' Inflow=13.74 cfs 1.076 af
24.0" x 290.0' Culvert Outflow=13.74 cfs 1.076 af

Pond H(n/f): Hancock (Newbury to Federal) Peak Elev=52.72' Inflow=2.40 cfs 0.167 af
18.0" x 180.0' Culvert Outflow=2.40 cfs 0.167 af

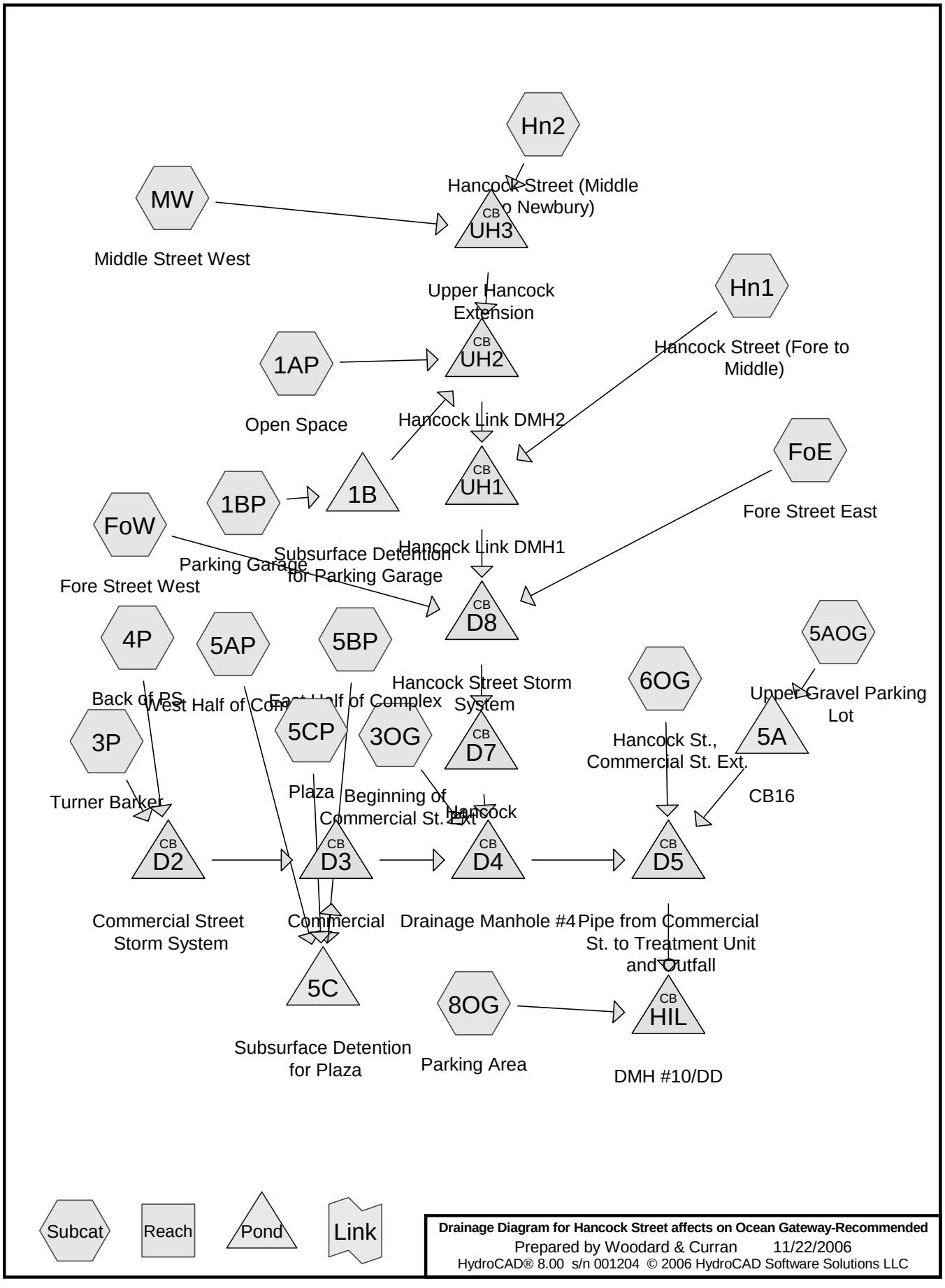
Pond HIL: DMH #10/DD Peak Elev=11.89' Inflow=61.84 cfs 5.837 af
36.0" x 102.0' Culvert Outflow=61.84 cfs 5.837 af

Pond UH1: Hancock Link DMH1 Peak Elev=28.05' Inflow=39.84 cfs 3.336 af
24.0" x 125.0' Culvert Outflow=39.84 cfs 3.336 af

Pond UH2: Hancock Link DMH2 Peak Elev=29.30' Inflow=26.42 cfs 2.268 af
24.0" x 106.0' Culvert Outflow=26.42 cfs 2.268 af

Pond UH3: Upper Hancock Extension Peak Elev=30.06' Inflow=24.54 cfs 1.929 af
24.0" x 84.0' Culvert Outflow=24.54 cfs 1.929 af

Total Runoff Area = 15.212 ac Runoff Volume = 5.844 af Average Runoff Depth = 4.61"
5.87% Pervious Area = 0.893 ac 94.13% Impervious Area = 14.319 ac



Drainage Diagram for Hancock Street affects on Ocean Gateway-Recommended

Prepared by Woodard & Curran 11/22/2006

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1AP: Open Space Runoff Area=13,340 sf Runoff Depth>0.03"
Flow Length=165' Tc=6.1 min CN=52 Runoff=0.00 cfs 0.001 af

Subcatchment 1BP: Parking Garage Runoff Area=33,985 sf Runoff Depth>2.13"
Tc=6.0 min CN=98 Runoff=1.83 cfs 0.139 af

Subcatchment 3OG: Beginning of Commercial St. Ext Runoff Area=0.600 ac Runoff Depth>1.68"
Flow Length=456' Tc=4.8 min CN=93 Runoff=1.25 cfs 0.084 af

Subcatchment 3P: Turner Barker Runoff Area=9,230 sf Runoff Depth>1.68"
Flow Length=100' Slope=0.0100 '/' Tc=1.7 min CN=93 Runoff=0.47 cfs 0.030 af

Subcatchment 4P: Back of PS Runoff Area=3,655 sf Runoff Depth=0.00"
Flow Length=110' Slope=0.0300 '/' Tc=8.7 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 5AOG: Upper Gravel Parking Lot Runoff Area=1.950 ac Runoff Depth>2.13"
Flow Length=445' Tc=13.2 min CN=98 Runoff=3.73 cfs 0.346 af

Subcatchment 5AP: West Half of Complex Runoff Area=14,410 sf Runoff Depth>2.13"
Tc=6.0 min CN=98 Runoff=0.78 cfs 0.059 af

Subcatchment 5BP: East Half of Complex Runoff Area=38,510 sf Runoff Depth>2.13"
Tc=6.0 min CN=98 Runoff=2.08 cfs 0.157 af

Subcatchment 5CP: Plaza Runoff Area=4,995 sf Runoff Depth>2.13"
Flow Length=75' Slope=0.0125 '/' Tc=1.2 min CN=98 Runoff=0.31 cfs 0.020 af

Subcatchment 6OG: Hancock St., Commercial St. Ext. Runoff Area=1.350 ac Runoff Depth>1.86"
Flow Length=550' Tc=2.8 min CN=95 Runoff=3.25 cfs 0.209 af

Subcatchment 8OG: Parking Area Runoff Area=0.800 ac Runoff Depth>0.62"
Flow Length=125' Tc=27.5 min CN=76 Runoff=0.35 cfs 0.042 af

Subcatchment FoE: Fore Street East Runoff Area=0.110 ac Runoff Depth>2.13"
Flow Length=160' Slope=0.0200 '/' Tc=1.6 min CN=98 Runoff=0.29 cfs 0.020 af

Subcatchment FoW: Fore Street West Runoff Area=0.310 ac Runoff Depth>2.13"
Flow Length=375' Tc=2.6 min CN=98 Runoff=0.81 cfs 0.055 af

Subcatchment Hn1: Hancock Street (Fore to Middle) Runoff Area=0.320 ac Runoff Depth>2.13"
Flow Length=250' Slope=0.0440 '/' Tc=1.5 min CN=98 Runoff=0.84 cfs 0.057 af

Subcatchment Hn2: Hancock Street (Middle to Newbury) Runoff Area=0.280 ac Runoff Depth>2.13"
Flow Length=275' Slope=0.0650 '/' Tc=1.4 min CN=98 Runoff=0.74 cfs 0.050 af

Subcatchment MW: Middle Street West Runoff Area=0.200 ac Runoff Depth>2.13"
Flow Length=300' Slope=0.0100 '/' Tc=3.3 min CN=98 Runoff=0.52 cfs 0.036 af

Pond 1B: Subsurface Detention for Parking Ga Peak Elev=20.22' Storage=917 cf Inflow=1.83 cfs 0.139 af
Outflow=1.06 cfs 0.137 af

Pond 5A: CB16 Peak Elev=13.19' Storage=1,170 cf Inflow=3.73 cfs 0.346 af
Outflow=3.40 cfs 0.344 af

Pond 5C: Subsurface Detention for Plaza Peak Elev=11.05' Storage=682 cf Inflow=3.06 cfs 0.236 af
Outflow=2.64 cfs 0.235 af

Pond D2: Commercial Street Storm System Peak Elev=9.72' Inflow=0.47 cfs 0.030 af
15.0" x 192.0' Culvert Outflow=0.47 cfs 0.030 af

Pond D3: Commercial Peak Elev=9.72' Inflow=2.89 cfs 0.265 af
15.0" x 192.0' Culvert Outflow=2.89 cfs 0.265 af

Pond D4: Drainage Manhole #4 Peak Elev=9.33' Inflow=7.53 cfs 0.703 af
36.0" x 250.0' Culvert Outflow=7.53 cfs 0.703 af

Pond D5: Pipe from Commercial St. to Treatment Unit and Out Peak Elev=8.77' Inflow=12.59 cfs 1.256 af
36.0" x 137.0' Culvert Outflow=12.59 cfs 1.256 af

Pond D7: Hancock Peak Elev=9.39' Inflow=3.89 cfs 0.355 af
30.0" x 36.0' Culvert Outflow=3.89 cfs 0.355 af

Pond D8: Hancock Street Storm System Peak Elev=10.62' Inflow=3.89 cfs 0.355 af
24.0" x 196.0' Culvert Outflow=3.89 cfs 0.355 af

Pond HIL: DMH #10/DD Peak Elev=8.31' Inflow=12.67 cfs 1.298 af
36.0" x 102.0' Culvert Outflow=12.67 cfs 1.298 af

Pond UH1: Hancock Link DMH1 Peak Elev=12.33' Inflow=2.80 cfs 0.280 af
24.0" x 125.0' Culvert Outflow=2.80 cfs 0.280 af

Pond UH2: Hancock Link DMH2 Peak Elev=16.97' Inflow=1.99 cfs 0.223 af
24.0" x 106.0' Culvert Outflow=1.99 cfs 0.223 af

Pond UH3: Upper Hancock Extension Peak Elev=19.46' Inflow=1.23 cfs 0.085 af
24.0" x 84.0' Culvert Outflow=1.23 cfs 0.085 af

Total Runoff Area = 8.632 ac Runoff Volume = 1.302 af Average Runoff Depth = 1.81"
10.35% Pervious Area = 0.893 ac 89.65% Impervious Area = 7.739 ac

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1AP: Open Space Runoff Area=13,340 sf Runoff Depth>0.92"
Flow Length=165' Tc=6.1 min CN=52 Runoff=0.29 cfs 0.024 af

Subcatchment 1BP: Parking Garage Runoff Area=33,985 sf Runoff Depth>4.87"
Tc=6.0 min CN=98 Runoff=4.10 cfs 0.317 af

Subcatchment 3OG: Beginning of Commercial St. Ext Runoff Area=0.600 ac Runoff Depth>4.43"
Flow Length=456' Tc=4.8 min CN=93 Runoff=3.13 cfs 0.221 af

Subcatchment 3P: Turner Barker Runoff Area=9,230 sf Runoff Depth>4.43"
Flow Length=100' Slope=0.0100 '/' Tc=1.7 min CN=93 Runoff=1.18 cfs 0.078 af

Subcatchment 4P: Back of PS Runoff Area=3,655 sf Runoff Depth>0.25"
Flow Length=110' Slope=0.0300 '/' Tc=8.7 min CN=39 Runoff=0.01 cfs 0.002 af

Subcatchment 5AOG: Upper Gravel Parking Lot Runoff Area=1.950 ac Runoff Depth>4.87"
Flow Length=445' Tc=13.2 min CN=98 Runoff=8.35 cfs 0.792 af

Subcatchment 5AP: West Half of Complex Runoff Area=14,410 sf Runoff Depth>4.87"
Tc=6.0 min CN=98 Runoff=1.74 cfs 0.134 af

Subcatchment 5BP: East Half of Complex Runoff Area=38,510 sf Runoff Depth>4.87"
Tc=6.0 min CN=98 Runoff=4.65 cfs 0.359 af

Subcatchment 5CP: Plaza Runoff Area=4,995 sf Runoff Depth>4.87"
Flow Length=75' Slope=0.0125 '/' Tc=1.2 min CN=98 Runoff=0.68 cfs 0.047 af

Subcatchment 6OG: Hancock St., Commercial St. Ext. Runoff Area=1.350 ac Runoff Depth>4.62"
Flow Length=550' Tc=2.8 min CN=95 Runoff=7.70 cfs 0.520 af

Subcatchment 8OG: Parking Area Runoff Area=0.800 ac Runoff Depth>2.73"
Flow Length=125' Tc=27.5 min CN=76 Runoff=1.62 cfs 0.182 af

Subcatchment FoE: Fore Street East Runoff Area=0.110 ac Runoff Depth>4.87"
Flow Length=160' Slope=0.0200 '/' Tc=1.6 min CN=98 Runoff=0.64 cfs 0.045 af

Subcatchment FoW: Fore Street West Runoff Area=0.310 ac Runoff Depth>4.87"
Flow Length=375' Tc=2.6 min CN=98 Runoff=1.81 cfs 0.126 af

Subcatchment Hn1: Hancock Street (Fore to Middle) Runoff Area=0.320 ac Runoff Depth>4.87"
Flow Length=250' Slope=0.0440 '/' Tc=1.5 min CN=98 Runoff=1.88 cfs 0.130 af

Subcatchment Hn2: Hancock Street (Middle to Newbury) Runoff Area=0.280 ac Runoff Depth>4.87"
Flow Length=275' Slope=0.0650 '/' Tc=1.4 min CN=98 Runoff=1.65 cfs 0.114 af

Subcatchment MW: Middle Street West Runoff Area=0.200 ac Runoff Depth>4.87"
Flow Length=300' Slope=0.0100 '/' Tc=3.3 min CN=98 Runoff=1.16 cfs 0.081 af

Pond 1B: Subsurface Detention for Parking G Peak Elev=21.24' Storage=2,187 cf Inflow=4.10 cfs 0.317 af
Outflow=2.28 cfs 0.315 af

Pond 5A: CB16 Peak Elev=13.39' Storage=2,048 cf Inflow=8.35 cfs 0.792 af
Outflow=7.87 cfs 0.789 af

Pond 5C: Subsurface Detention for Plaza Peak Elev=13.31' Storage=1,897 cf Inflow=6.84 cfs 0.540 af
Outflow=4.94 cfs 0.539 af

Pond D2: Commercial Street Storm System Peak Elev=11.73' Inflow=1.18 cfs 0.080 af
15.0" x 192.0' Culvert Outflow=1.18 cfs 0.080 af

Pond D3: Commercial Peak Elev=11.72' Inflow=5.59 cfs 0.619 af
15.0" x 192.0' Culvert Outflow=5.59 cfs 0.619 af

Pond D4: Drainage Manhole #4 Peak Elev=10.47' Inflow=16.97 cfs 1.674 af
36.0" x 250.0' Culvert Outflow=16.97 cfs 1.674 af

Pond D5: Pipe from Commercial St. to Treatment Unit and O Peak Elev=10.07' Inflow=29.00 cfs 2.983 af
36.0" x 137.0' Culvert Outflow=29.00 cfs 2.983 af

Pond D7: Hancock Peak Elev=10.52' Inflow=8.82 cfs 0.834 af
30.0" x 36.0' Culvert Outflow=8.82 cfs 0.834 af

Pond D8: Hancock Street Storm System Peak Elev=11.19' Inflow=8.82 cfs 0.834 af
24.0" x 196.0' Culvert Outflow=8.82 cfs 0.834 af

Pond HIL: DMH #10/DD Peak Elev=9.44' Inflow=29.62 cfs 3.165 af
36.0" x 102.0' Culvert Outflow=29.62 cfs 3.165 af

Pond UH1: Hancock Link DMH1 Peak Elev=12.74' Inflow=6.38 cfs 0.663 af
24.0" x 125.0' Culvert Outflow=6.38 cfs 0.663 af

Pond UH2: Hancock Link DMH2 Peak Elev=17.31' Inflow=4.60 cfs 0.533 af
24.0" x 106.0' Culvert Outflow=4.60 cfs 0.533 af

Pond UH3: Upper Hancock Extension Peak Elev=19.70' Inflow=2.74 cfs 0.195 af
24.0" x 84.0' Culvert Outflow=2.74 cfs 0.195 af

Total Runoff Area = 8.632 ac Runoff Volume = 3.171 af Average Runoff Depth = 4.41"
10.35% Pervious Area = 0.893 ac 89.65% Impervious Area = 7.739 ac

Kenneth Volock

From: Mark R. Johnston [mjohnston@hil-tech.com]
Sent: Thursday, April 13, 2006 4:34 PM
To: Kenneth Volock
Cc: Scott Bois
Subject: Ocean Gateway Peak flow rate water level, resuspension

Hyd Calcs 30.81 cfs 04_13_06.p...

Ken,

We understand that Woodard and Curran is investigating the impacts that future development may have on the peak flow rate of the system and in one scenario the 25-yr storm flow may be approximately 30.81 cfs. We have revisited the hydraulic calculations for the online 10' dia Downstream Defender at that flow rate. At 30.81 cfs we have calculated an approximate water level at DMH 10 of 14.3' (refer to attached sketch and calculations). Flow velocities in the system are not excessive and we do not expect structural damage to occur to the Defender; however, the risk of sediment reintrainment increases with increasing flow rate. Keeping the unit on line at this flow rate is a judgment call dependent on frequency and duration of the peak storm events and the potential impacts downstream should reintrainment occur (is the receiving water body a critical or protected area?). As flow velocities in the system are less than 5 fps and the peak event is the 25-yr storm, we are not overly concerned with passing 30.81 cfs through the unit. If other scenarios indicate that flow rates will exceed 30.81 cfs we would recommend placing the unit off line. Doing it now may be more cost effective. Is this an option? The barrel section is scheduled to be fabricated on Monday, April 17, so, there is still time to build for an off line system if desired. Please let us know by Monday, if fabricating the unit for an off line configuration is desirable. Please call or email if you have questions.

Best regards,

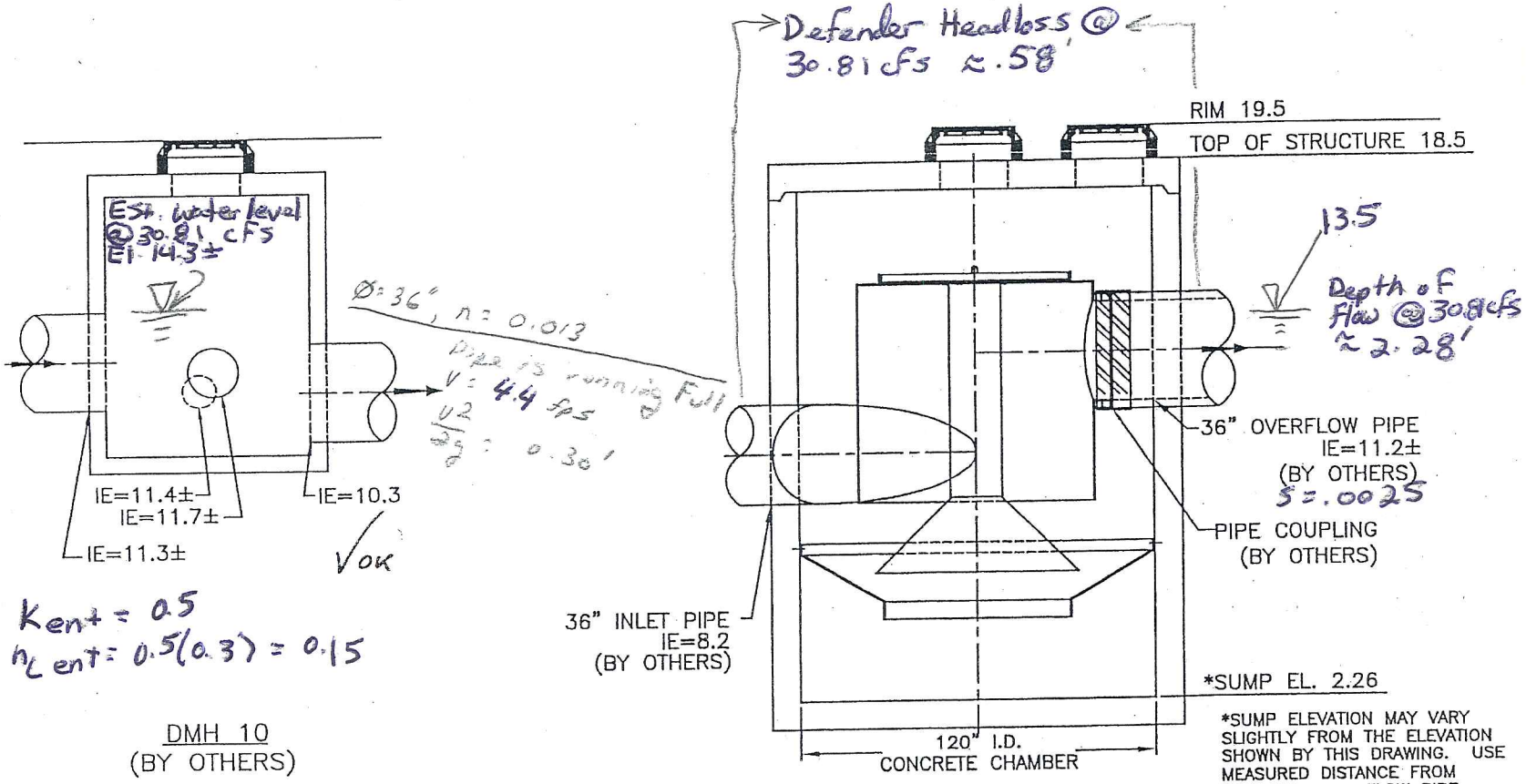
mj

Mark R. Johnston
E.I.T.
<<Hyd Calcs 30.81 cfs 04_13_06.pdf>>
Hydro International
94 Hutchins Dr.
Portland, ME 04102-1930
tel: (207) 756-6200 ext. 220
fax: (207) 756-6212
email: mjohnston@hil-tech.com

DEFENDER PIPE CONNECTIONS:
1. LARGE DIAMETER COUPLING REQUIRED TO CONNECT OVERFLOW PIPE TO OVERFLOW PIPE STUB. OVERFLOW PIPE STUB DIMENSIONS:
O.D.=TBD, I.D.=36", STUB LENGTH=6"
2. INLET PIPE ENTERS UNIT TANGENT TO INSIDE OF DEFENDER MANHOLE. CUT PIPE OFF AT 30° ANGLE. (SEE INSTALLATION INSTRUCTIONS.)
3. GROUT INLET AND OVERFLOW PIPES WITH NON-SHRINK GROUT TO ENSURE A WATERTIGHT CONNECTION.

$Q_{25} = 30.81$ cfs

Assumes: No tailwater elevation
Negligible head required to operate backflow preventer



*SUMP ELEVATION MAY VARY SLIGHTLY FROM THE ELEVATION SHOWN BY THIS DRAWING. USE MEASURED DISTANCE FROM SUMP TO OVERFLOW PIPE STUB WHEN SETTING DEFENDER MANHOLE.

DMH 10
(BY OTHERS)

DOWNSTREAM DEFENDER

$K_{ent} = 0.5$
$n_{Lent} = 0.5(0.3) = 0.15$

Water level @ DMH 10 @ 30.81 cfs

11.2 + 2.28 + 0.58 + .06 + .15 = 14.27'

- 11.2: D.D ie out
- 2.28: Depth of flow in outlet
- 0.58: Defender head loss
- .06: Inlet barrel friction
- .15: pipe entrance loss

	MRJ	03/03/06	FIRST ISSUE
Rev	By	Date	Description

Date 03/03/06	Scale 3/16"=1'
Drawn by MRJ	Checked Eng.
Checked Prod.	Approved by ✓

Title
10-FT
DOWNSTREAM DEFENDER

OCEAN GATEWAY
Portland, ME
STU 2

SECTION VIEW

Hydro International

94 Hutchins Drive
Portland, Maine 04102
tel: (207) 756-6200
fax: (207) 756-6212
email: hiltech@hil-tech.com

CAD Ref: GA3
Project No. 2003-428
Drawing No. GA3 Rev.

Ocean Gateway 36" Main
Worksheet for Circular Channel

Project Description	
Project File	c:\haestad\fmw\project2.fm2
Worksheet	Ocean Gateway 36" Main
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.002500	ft/ft
Diameter	36.00	in
Discharge	30.81	cfs

Results		
Depth	2.28	ft
Flow Area	5.75	ft²
Wetted Perimeter	6.34	ft
Top Width	2.57	ft
Critical Depth	1.80	ft
Percent Full	75.86	
Critical Slope	0.004733	ft/ft
Velocity	5.36	ft/s
Velocity Head	0.45	ft
Specific Energy	2.72	ft
Froude Number	0.63	
Maximum Discharge	35.87	cfs
Full Flow Capacity	33.35	cfs
Full Flow Slope	0.002134	ft/ft
Flow is subcritical.		

HRD LTD

Separator Head Loss Design Program Results

Project Details

Date:	13/4/06
Created by:	HRD Ltd
Wipe No:	Unknown
Client:	Unknown
Site:	Unknown

Site Details

Inflow rate:	13830	gal/min (US)
Inlet pipe diameter:	36	inches
Downstream water level:	0	ft
Upstream water level:	0.833	ft
Head loss (hf):	7	inches
Engineering range:	6 inches to	10 inches

Comments