

STORMWATER CALCULATIONS

NHRMC EMPLOYEE PARKING DECK PEDESTRIAN BRIDGE

2120 S. 17th Street (Deck Side)

Wilmington, North Carolina

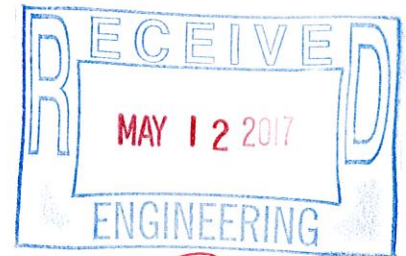
For

New Hanover Regional Medical Center

P.O. Box 9000

Wilmington, NC 28402

(910) 343-2788



*Final SW Calcs
SWP 2017019R1
6/21/17
fac*

May 2017

Prepared by:

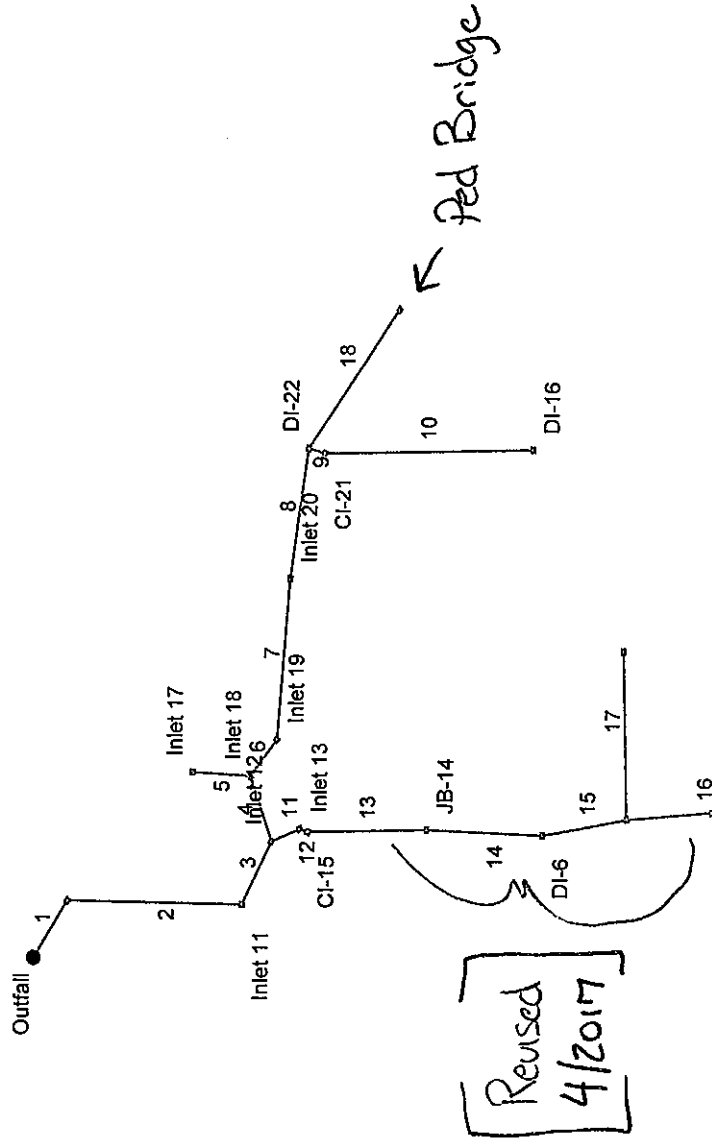
NORRIS & TUNSTALL CONSULTING ENGINEERS, P.C.

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N&T Project No. 16077-1

DECK SD'S 2

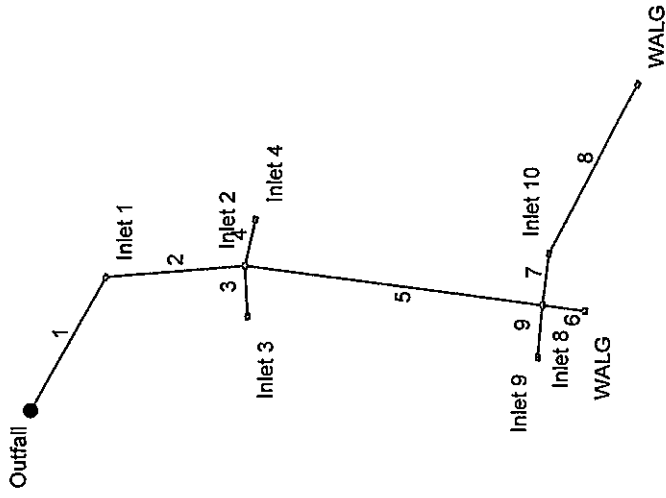


Revised May 2017

Tracts A and B - NHRMC Employee Parking Deck

Drainage Area	Total Area		Impervious Area		'C'		
	(SF)	(AC)	(SF)	(AC)			
DA-1	1333	0.03	1333	0.03	0.95	---	Inlet 1
DA-2	5388	0.12	4556	0.10	0.84	---	Inlet 2
DA-3	4065	0.09	4065	0.09	0.95	---	Inlet 3
DA-4	1135	0.03	1135	0.03	0.95	---	Inlet 4
DA-5	1800	0.04	1800	0.04	0.95	---	Inlet 4
DA-6	7816	0.18	7816	0.18	0.95	---	DI-6
DA-7	2900	0.07	2900	0.07	0.95	---	DI-7
DA-8	8670	0.20	5618	0.13	0.70	---	Inlet 8
DA-9	7777	0.18	7777	0.18	0.95	---	Inlet 9
DA-10	7021	0.16	4620	0.11	0.71	---	Inlet 10
DA-11	1528	0.04	1528	0.04	0.95	---	Inlet 11
DA-12	7571	0.17	4535	0.10	0.67	---	Inlet 12
					0.00		
DA-14	1300	0.03	1000	0.02	0.79	---	C-15
DA-15	5545	0.13	5000	0.11	0.88	---	C-15
DA-16	24500	0.56	24500	0.56	0.95	---	DI-16
DA-17	3392	0.08	3392	0.08	0.95	---	Inlet 17
DA-18	6830	0.16	5554	0.13	0.82	---	Inlet 18
DA-19	7775	0.18	6782	0.16	0.86	---	DI-19
DA-20	3200	0.07	2660	0.06	0.83	---	DI-20
DA-21	745	0.02	745	0.02	0.95	---	CI-21
DA-22	2675	0.06	145	0.00	0.29	---	DI-22
DA-24	7900	0.18	7900	0.18	0.95	---	DI-24
DA-25	5130	0.12	5130	0.12	0.95	---	DI-25
DA-B1	1660	0.04	1660	0.04	0.95	-->	to DA-22
	*** Adding the Bridge						

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Storm Sewer Tabulation

Station Line To Line	Len (ft)	Drng Area (ac)		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
		Incr	Total		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	80	0.03	2.67	0.95	0.03	2.47	5.0	16.1	5.5	13.55	41.78	5.34	24	3.41	23.50	26.23	25.30	27.55	24.00	32.47	INLET 1
2	84	0.12	2.64	0.84	0.10	2.44	5.0	15.8	5.5	13.49	26.69	5.53	24	1.39	26.23	27.40	27.85	28.72	32.47	34.03	INLET 2
3	25	0.09	0.09	0.95	0.09	0.09	5.0	5.0	7.2	0.62	32.67	1.45	18	9.68	27.40	29.82	29.30	30.11	34.03	36.48	INLET 3
4	24	0.03	0.03	0.95	0.03	0.03	5.0	5.0	7.2	0.21	6.78	0.12	18	0.42	27.40	27.50	29.30	29.30	34.03	34.04	INLET 4
5	181	0.20	2.40	0.70	0.14	2.23	15.0	15.0	5.6	12.51	21.92	5.22	24	0.94	27.40	29.10	29.06	30.37	34.03	34.10	INLET 8
6	26	0.90	0.90	0.95	0.86	0.86	5.0	5.0	7.2	6.18	15.55	4.32	18	2.19	29.10	29.67	30.73	30.63	34.10	36.07	WALG
7	26	0.16	1.12	0.95	0.15	1.06	5.0	11.5	6.1	6.46	5.45	3.66	18	0.27	29.10	29.17	30.71	30.81	34.10	33.96	INLET 10
8	100	0.96	0.96	0.95	0.91	0.91	11.0	11.0	6.2	5.61	9.57	3.64	18	0.83	29.17	30.00	30.86	31.09	33.96	37.00	WALG
9	26	0.18	0.18	0.95	0.17	0.17	5.0	5.0	7.2	1.24	15.55	0.75	18	2.19	29.10	29.67	30.90	30.90	34.10	36.07	Inlet 9

Project File: SD Network 5-1-17.stm

Number of lines: 9

Run Date: 5/3/17

NOTES: Intensity = 121.80 / (Inlet time + 23.50) ^ 0.84; Return period = Yrs. 10 ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station Line	To Line	Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
			Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	80	0.03	2.67	0.95	0.03	2.47	5.0	15.9	6.3	15.57	41.78	5.74	24	3.41	23.50	26.23	25.70	27.65	24.00	32.47	INLET 1
2	1	84	0.12	2.64	0.84	0.10	2.44	5.0	15.7	6.3	15.48	26.69	5.97	24	1.39	26.23	27.40	27.93	28.82	32.47	34.03	INLET 2
3	2	25	0.09	0.09	0.95	0.09	0.09	5.0	5.0	8.1	0.70	32.67	1.52	18	9.68	27.40	29.82	29.47	30.13	34.03	36.48	INLET 3
4	2	24	0.03	0.03	0.95	0.03	0.03	5.0	5.0	8.1	0.23	6.78	0.13	18	0.42	27.40	27.50	29.47	29.47	34.03	34.04	INLET 4
5	2	181	0.20	2.40	0.70	0.14	2.23	15.0	15.0	6.4	14.32	21.92	5.60	24	0.94	27.40	29.10	29.15	30.46	34.03	34.10	INLET 8
6	5	26	0.90	0.90	0.95	0.86	0.86	5.0	5.0	8.1	6.97	15.55	4.29	18	2.19	29.10	29.67	30.83	30.86	34.10	36.07	WALG
7	5	26	0.16	1.12	0.95	0.15	1.06	5.0	11.5	6.9	7.38	5.45	4.18	18	0.27	29.10	29.17	30.80	30.93	34.10	33.96	INLET 10
8	7	100	0.96	0.96	0.95	0.91	0.91	11.0	11.0	7.0	6.39	9.57	3.75	18	0.83	29.17	30.00	31.00	31.32	33.96	37.00	WALG
9	5	26	0.18	0.18	0.95	0.17	0.17	5.0	5.0	8.1	1.39	15.55	0.80	18	2.19	29.10	29.67	31.06	31.06	34.10	36.07	Inlet 9

Project File: SD Network 5-1-17.stm

Number of lines: 9

Run Date: 5/3/17

NOTES: Intensity = 155.43 / (inlet time + 26.20) ^ 0.86; Return period = Yrs. 25 ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station Line	To Line	Len (ft)	Drng Area (ac)		Rnoff coeff (C)	Area x C		Tc (min)		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev (ft)		HGL Elev (ft)		Grnd / Rm Elev (ft)		Line ID
			Incr	Total		Incr	Total	Inlet	Syst					Slope (%)	Size (in)	Dn	Up	Dn	Up	Dn	Up	
1	End	80	0.03	2.67	0.95	0.03	2.47	5.0	15.8	7.6	18.70	41.78	6.54	24	3.41	23.50	26.23	27.00	27.79	24.00	32.47	INLET 1
2	1	84	0.12	2.64	0.84	0.10	2.44	5.0	15.6	7.6	18.57	26.69	6.67	24	1.39	26.23	27.40	28.03	28.95	32.47	34.03	INLET 2
3	2	25	0.09	0.09	0.95	0.09	0.09	5.0	5.0	9.6	0.82	32.67	1.61	18	9.68	27.40	29.82	29.73	30.16	34.03	36.48	INLET 3
4	2	24	0.03	0.03	0.95	0.03	0.03	5.0	5.0	9.6	0.27	6.78	0.15	18	0.42	27.40	27.50	29.74	29.74	34.03	34.04	INLET 4
5	2	181	0.20	2.40	0.70	0.14	2.23	15.0	15.0	7.7	17.12	21.92	6.21	24	0.94	27.40	29.10	29.27	30.59	34.03	34.10	INLET 8
6	5	26	0.90	0.90	0.95	0.86	0.86	5.0	5.0	9.6	8.21	15.55	5.24	18	2.19	29.10	29.67	30.78	30.78	34.10	36.07	WALG
7	5	26	0.16	1.12	0.95	0.15	1.06	5.0	11.4	8.3	8.80	5.45	4.98	18	0.27	29.10	29.17	30.93	31.11	34.10	33.96	INLET 10
8	7	100	0.96	0.96	0.95	0.91	0.91	11.0	11.0	8.3	7.61	9.57	4.30	18	0.83	29.17	30.00	31.21	31.73	33.96	37.00	WALG
9	5	26	0.18	0.18	0.95	0.17	0.17	5.0	5.0	9.6	1.64	15.55	0.93	18	2.19	29.10	29.67	31.30	31.31	34.10	36.07	Inlet 9

Project File: SD Network 5-1-17.stm

Number of lines: 9

Run Date: 5/3/17

NOTES: Intensity = 198.56 / (Inlet time + 28.80) ^ 0.86; Return period = Yrs. 100 ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station Line	To Line	Len (ft)	Drng Area (ac)		Rnoff coeff (C)	Area x C		Tc (min)		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev (ft)		HGL Elev (ft)		Grnd / Rim Elev (ft)		Line ID
			Incr	Total		Incr	Total	Inlet	Syst					Size (in)	Slope (%)	Dn	Up	Dn	Up	Dn	Up	
1	End	35	0.10	2.19	0.95	0.10	1.94	5.0	9.2	6.4	12.47	27.03	5.06	24	1.43	23.50	24.00	25.30	28.00	28.70	Inlet 11	
2	1	105	0.04	2.09	0.95	0.04	1.84	5.0	8.8	6.5	11.99	7.96	3.82	24	0.12	24.00	24.13	26.00	28.70	28.37	Inlet 11	
3	2	36	0.17	2.05	0.67	0.11	1.80	5.0	8.6	6.5	11.79	9.97	3.75	24	0.19	24.13	24.20	26.30	28.37	28.59	Inlet 12	
4	3	35	0.16	1.17	0.82	0.13	1.03	5.0	8.3	6.6	6.76	32.66	2.31	24	2.09	24.20	24.93	26.55	28.59	28.97	Inlet 18	
5	4	35	0.08	0.08	0.95	0.08	0.08	5.0	5.0	7.2	0.55	0.00	0.17	24	-0.89	24.93	24.62	26.93	28.97	28.12	Inlet 17	
6	4	24	0.18	0.93	0.86	0.15	0.82	5.0	7.0	6.8	5.59	23.87	4.07	18	5.17	24.93	26.17	26.56	28.97	32.67	DI-19	
7	6	81	0.07	0.75	0.83	0.06	0.66	5.0	6.5	6.9	4.60	20.04	3.85	18	3.64	26.17	29.12	27.36	32.67	34.50	Inlet 20	
8	7	66	0.06	0.68	0.29	0.02	0.61	5.0	6.0	7.0	4.25	18.86	3.84	18	3.23	29.12	31.25	30.19	34.50	37.00	DI-22	
9	8	10	0.02	0.58	0.95	0.02	0.55	5.0	5.7	7.1	3.91	10.50	3.70	18	1.00	31.25	31.35	32.28	37.00	37.70	CI-21	
10	9	124	0.56	0.56	0.95	0.53	0.53	5.0	5.0	7.2	3.85	9.44	4.37	15	2.14	31.35	34.00	32.25	37.00	37.50	DI-16	
11	3	18	0.00	0.71	0.00	0.00	0.66	5.0	7.6	6.7	4.45	19.49	2.52	18	3.44	24.20	24.82	26.52	28.59	31.79	Inlet 13	
12	11	5	0.16	0.71	0.88	0.14	0.66	5.0	7.6	6.7	4.46	11.50	5.34	18	1.20	26.79	26.85	27.44	31.79	33.00	CI-15	
13	12	72	0.00	0.55	0.00	0.00	0.52	5.0	7.0	6.8	3.57	9.98	3.45	18	0.90	26.85	27.50	27.92	33.00	34.50	JB-14	
14	13	70	0.18	0.55	0.95	0.17	0.52	5.0	6.6	6.9	3.61	5.46	4.27	15	0.71	27.50	28.00	28.37	34.50	34.25	DI-6	
15	14	52	0.07	0.37	0.95	0.07	0.35	5.0	6.3	7.0	2.44	3.49	3.78	12	0.96	28.00	28.50	28.94	34.25	35.50	DI-7	
16	15	52	0.18	0.18	0.95	0.17	0.17	5.0	5.0	7.2	1.24	8.04	2.52	12	5.10	28.50	31.15	29.43	36.00	36.00	DI 24	
17	15	84	0.12	0.12	0.95	0.11	0.11	5.0	5.0	7.2	0.82	1.94	1.23	12	0.30	28.50	28.75	29.42	35.50	31.00	DI 25	
18	8	88	0.04	0.04	0.95	0.04	0.04	5.0	5.0	7.2	0.27	0.56	1.51	6	1.00	31.25	32.13	32.33	37.00	40.00	Bridge Outfall	

DECK SDS 2

Number of lines: 18

Run Date: 5/3/17

NOTES: Intensity = 121.80 / (Inlet time + 23.50) ^ 0.84; Return period = Yrs. 10 ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station Line	To Line	Len (ft)	Drng Area (ac)		Rnoff coeff (C)	Area x C		Tc (min)		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev (ft)		HGL Elev (ft)		Grnd / Rim Elev (ft)		Line ID
			Incr	Total		Incr	Total	Inlet	Syst					Size (in)	Slope (%)	Dn	Up	Dn	Up	Dn	Up	
1	End	35	0.10	2.19	0.95	0.10	1.94	5.0	8.7	7.4	14.33	27.03	4.69	24	1.43	23.50	24.00	25.70	28.00	28.70	Inlet 11	
2	1	105	0.04	2.09	0.95	0.04	1.84	5.0	8.3	7.5	13.76	7.96	4.38	24	0.12	24.00	24.13	26.00	28.70	28.37	Inlet 11	
3	2	36	0.17	2.05	0.67	0.11	1.80	5.0	8.2	7.5	13.52	9.97	4.30	24	0.19	24.13	24.20	26.40	28.37	28.59	Inlet 12	
4	3	35	0.16	1.17	0.82	0.13	1.03	5.0	8.0	7.5	7.74	32.66	2.52	24	2.09	24.20	24.93	26.72	28.59	28.97	Inlet 18	
5	4	35	0.08	0.08	0.95	0.08	0.08	5.0	5.0	8.1	0.62	0.00	0.20	24	-0.89	24.93	24.62	26.93	28.97	28.12	Inlet 17	
6	4	24	0.18	0.93	0.86	0.15	0.82	5.0	6.8	7.8	6.36	23.87	4.42	18	5.17	24.93	26.17	26.75	28.97	32.67	DI-19	
7	6	81	0.07	0.75	0.83	0.06	0.66	5.0	6.3	7.9	5.22	20.04	4.07	18	3.64	26.17	29.12	27.43	34.50	34.50	Inlet 20	
8	7	66	0.06	0.68	0.29	0.02	0.61	5.0	5.9	7.9	4.82	18.86	4.04	18	3.23	29.12	31.25	30.25	37.00	37.00	DI-22	
9	8	10	0.02	0.58	0.95	0.02	0.55	5.0	5.6	8.0	4.42	10.50	3.89	18	1.00	31.25	31.35	32.34	37.00	37.70	CI-21	
10	9	124	0.56	0.56	0.95	0.53	0.53	5.0	5.0	8.1	4.33	9.44	4.66	15	2.14	31.35	34.00	32.29	37.00	37.50	DI-16	
11	3	18	0.00	0.71	0.00	0.00	0.66	5.0	7.3	7.7	5.08	19.49	2.88	18	3.44	24.20	24.82	26.69	37.00	31.79	Inlet 13	
12	11	5	0.16	0.71	0.88	0.14	0.66	5.0	7.3	7.7	5.09	11.50	5.56	18	1.20	26.79	26.85	27.49	33.00	33.00	CI-15	
13	12	72	0.00	0.55	0.00	0.00	0.52	5.0	6.8	7.8	4.06	9.98	3.62	18	0.90	26.85	27.50	27.99	33.00	34.50	JB-14	
14	13	70	0.18	0.55	0.95	0.17	0.52	5.0	6.4	7.8	4.10	5.46	4.56	15	0.71	27.50	28.00	28.40	34.50	34.25	DI-6	
15	14	52	0.07	0.37	0.95	0.07	0.35	5.0	6.2	7.9	2.77	3.49	4.09	12	0.96	28.00	28.50	28.98	34.25	35.50	DI-7	
16	15	52	0.18	0.18	0.95	0.17	0.17	5.0	5.0	8.1	1.39	8.04	2.67	12	5.10	28.50	31.15	29.50	36.00	36.00	DI 24	
17	15	84	0.12	0.12	0.95	0.11	0.11	5.0	5.0	8.1	0.93	1.94	1.28	12	0.30	28.50	28.75	29.50	35.50	31.00	DI 25	
18	8	86	0.04	0.04	0.95	0.04	0.04	5.0	5.0	8.1	0.31	0.56	1.58	6	1.00	31.25	32.13	32.40	37.00	40.00	Bridge Outfall	

DECK SD'S 2

Number of lines: 18

Run Date: 5/3/17

NOTES: Intensity = 155.43 / (Inlet time + 26.20) ^ 0.86; Return period = Yrs. 25 ; c = cir e = ellip b = box

Storm Sewer Tabulation

Station Line	To Line	Len (ft)	Drng Area (ac)		Rnoff coeff (C)	Area x C		Tc (min)		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev (ft)		HGL Elev (ft)		Grnd / Rim Elev (ft)		Line ID
			Incr	Total		Incr	Total	Inlet	Syst					Size (in)	Slope (%)	Dn	Up	Dn	Up	Dn	Up	
1	End	35	0.10	2.19	0.95	0.10	1.94	5.0	8.2	8.9	17.21	27.03	5.48	24	1.43	23.50	24.00	27.00	27.20	28.00	28.70	Inlet 11
2	1	105	0.04	2.09	0.95	0.04	1.84	5.0	7.8	9.0	16.50	7.96	5.25	24	0.12	24.00	24.13	27.24	27.80	28.70	28.37	Inlet 11
3	2	36	0.17	2.05	0.67	0.11	1.80	5.0	7.7	9.0	16.20	9.97	5.16	24	0.19	24.13	24.20	27.81	28.00	28.37	28.59	Inlet 12
4	3	35	0.16	1.17	0.82	0.13	1.03	5.0	7.5	9.0	9.26	32.66	2.95	24	2.09	24.20	24.93	28.28	28.34	28.59	28.97	Inlet 18
5	4	35	0.08	0.08	0.95	0.08	0.08	5.0	5.0	9.6	0.73	0.00	0.23	24	-0.89	24.93	24.62	28.47	28.47	28.97	28.12	Inlet 17
6	4	24	0.18	0.93	0.86	0.15	0.82	5.0	6.5	9.2	7.57	23.87	4.29	18	5.17	24.93	26.17	28.34	28.46	28.97	32.67	DI-19
7	6	81	0.07	0.75	0.83	0.06	0.66	5.0	6.1	9.3	6.20	20.04	4.35	18	3.64	26.17	29.12	28.56	30.08	34.50	34.50	Inlet 20
8	7	66	0.06	0.68	0.29	0.02	0.61	5.0	5.8	9.4	5.71	18.86	4.37	18	3.23	29.12	31.25	30.34	32.17	37.00	37.00	DI-22
9	8	10	0.02	0.58	0.95	0.02	0.55	5.0	5.5	9.5	5.22	10.50	4.18	18	1.00	31.25	31.35	32.43	32.23	37.00	37.70	CI-21
10	9	124	0.56	0.56	0.95	0.53	0.53	5.0	5.0	9.6	5.11	9.44	5.13	15	2.14	31.35	34.00	32.33	34.92	37.00	37.70	CI-21
11	3	18	0.00	0.71	0.00	0.00	0.66	5.0	7.0	9.1	6.06	19.49	3.43	18	3.44	24.20	24.82	28.23	28.29	28.59	31.79	Inlet 13
12	11	5	0.16	0.71	0.88	0.14	0.66	5.0	6.9	9.1	6.07	11.50	3.45	18	1.20	26.79	26.85	28.29	28.30	31.79	33.00	CI-15
13	12	72	0.00	0.55	0.00	0.00	0.52	5.0	6.5	9.2	4.83	9.98	3.42	18	0.90	26.85	27.50	28.37	28.45	33.00	34.50	JB-14
14	13	70	0.18	0.55	0.95	0.17	0.52	5.0	6.2	9.3	4.87	5.46	4.98	15	0.71	27.50	28.00	28.47	28.90	34.50	34.25	DI-6
15	14	52	0.07	0.37	0.95	0.07	0.35	5.0	6.0	9.4	3.29	3.49	4.25	12	0.96	28.00	28.50	29.04	29.44	34.25	35.50	DI-7
16	15	52	0.18	0.18	0.95	0.17	0.17	5.0	5.0	9.6	1.64	8.04	2.93	12	5.10	28.50	31.15	29.66	31.69	35.50	36.00	DI 24
17	15	84	0.12	0.12	0.95	0.11	0.11	5.0	5.0	9.6	1.09	1.94	1.39	12	0.30	28.50	28.75	29.68	29.75	35.50	31.00	DI 25
18	8	88	0.04	0.04	0.95	0.04	0.04	5.0	5.0	9.6	0.36	0.56	1.86	6	1.00	31.25	32.13	32.51	32.88	37.00	40.00	Bridge Outfall

DECK SD'S 2

Number of lines: 18

Run Date: 5/3/17

NOTES: Intensity = 198.56 / (Inlet time + 28.80) ^ 0.86; Return period = Yrs. 100 ; c = cir e = ellip b = box