

Abbott's Run

City of Wilmington Stormwater Detention Calculations

Job #: PW 205
 Engineer: JHF
 Date: 2/11/2017

Drainage Area: **ABBOTT'S RUN WET DETENTION POND**

Rational Method Control Panel

Drainage Area:	<input type="text" value="15.45"/> ac	Predevelopment C=	<input type="text" value="0.20"/>	Weighted Composite C=	<input type="text" value="0.54"/>
Impervious Area:	<input type="text" value="7.00"/> ac	Postdevelopment C=	<input type="text" value="0.95"/>		
% Impervious:	<input type="text" value="45.32"/> %	Hydraulic Length=	<input type="text" value="330"/> ft		
Pervious Area:	<input type="text" value="8.45"/> ac	Watershed Height=	<input type="text" value="2"/> ft		
% Pervious=	<input type="text" value="54.68"/> %	Time of Concentration=	<input type="text" value="4.85"/> min		

Rainfall Intensity Calculations

10 Year Rainfall Intensity= in/hr
 50 Year Rainfall Intensity= in/hr

drainage area input

total area	673002 SF
sidewalks	29200 SF
parking	162500 SF
bldgs	83000 SF
streets	24300 SF
reserve	6000 SF
total prop BL	305000 SF

Pre and Post Development Flow Comparisons

10 Year
 Predevelopment= cfs
 Postdevelopment= cfs

Note: Predevelopment flow utilized predevelopment C while post uses Weighted composite C

50 Year
 Postdevelopment= cfs

Time to Peak
 Soils Data:

Predominant Soil Type= Use HSG

Curve Number: Open Space=
 Impervious=

Weighted Composite Curve Number=

Ultimate Soil Storage Capacity= in

$S=(1000/CN)-10$

Design Storm Precipitation Levels:

10 Year in
 50 Year in 6 Hour Duration

Design Storm Runoff Calculation:

10 Year=
 50 Year= Note: Calculated by $R_v=(P-0.2S)^2/(P+0.8S)$

Calculated Time to Peak:

$T_p=(45.38 * A * RO)/Q_p$ (NHC pg.70-2,3)

$T_{p\ 10\ Yr} =$ min
 $T_{p\ 50\ Yr} =$ min

Estimated City Detention Volume

10YR STORAGE (CF) = $(Q_{post})T_p \times 1.39 \times 60 =$ cf

Final SW Calcs
 SWP 2017009
 03/13/2017
 JB



2/15/2017
[Handwritten Signature]

Abbott's Run

DATE: February 10, 2017

Job #: PW 205

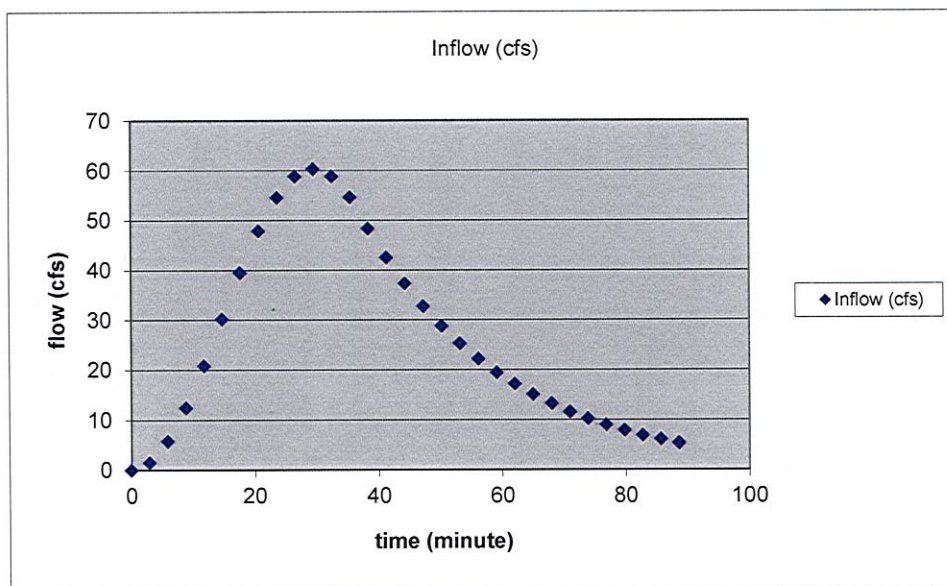
WET DETENTION POND

10 YR STORM ROUTING SHEET 1 OF 3

INFLOW HYDROGRAPH

Q_p = 60.3 cfs
T_p = 29.5 min

Time (min)	Inflow (cfs)
0	0
2.952	1.475
5.904	5.754
8.856	12.421
11.808	20.822
14.760	30.136
17.712	39.453
20.664	47.860
23.616	54.537
26.568	58.830
29.520	60.320
32.472	58.860
35.424	54.594
38.376	48.305
41.328	42.417
44.280	37.246
47.232	32.705
50.184	28.718
53.136	25.217
56.088	22.143
59.040	19.444
61.992	17.074
64.944	14.992
67.896	13.165
70.848	11.560
73.800	10.151
76.752	8.913
79.704	7.827
82.656	6.873
85.608	6.035
88.560	5.299



Piner Run

DATE: February 10, 2017

Job #: PW 1198

POND A

10 YR STORM ROUTING SHEET 2 OF 3

STAGE-STORAGE RELATION

ELEV.	Surface Ar	Inc. Volum	Acc. Vol.	Stage	S	Z
33	20,102	0	0	0.0	0	0
34	22,591	21,347	21,347	1.0	21,347	1
35	25,115	23,853	45,200	2.0	45,200	2
35.5	26,096	12,803	58,002	2.5	58,002	2.5
36	39,439	16,384	74,386	3.0	74,386	3
36.5	76,131	28,892	103,278	3.5	103,278	3.5
37	112,822	47,238	150,517	4.0	150,517	4

ADJUST VALUES FOR NON PRISMATIC POND SECTION

$Ks_1 =$ 21,347

$b_1 =$ 1.091

$Ks_1 =$ 7,174

$b_1 =$ 2.129

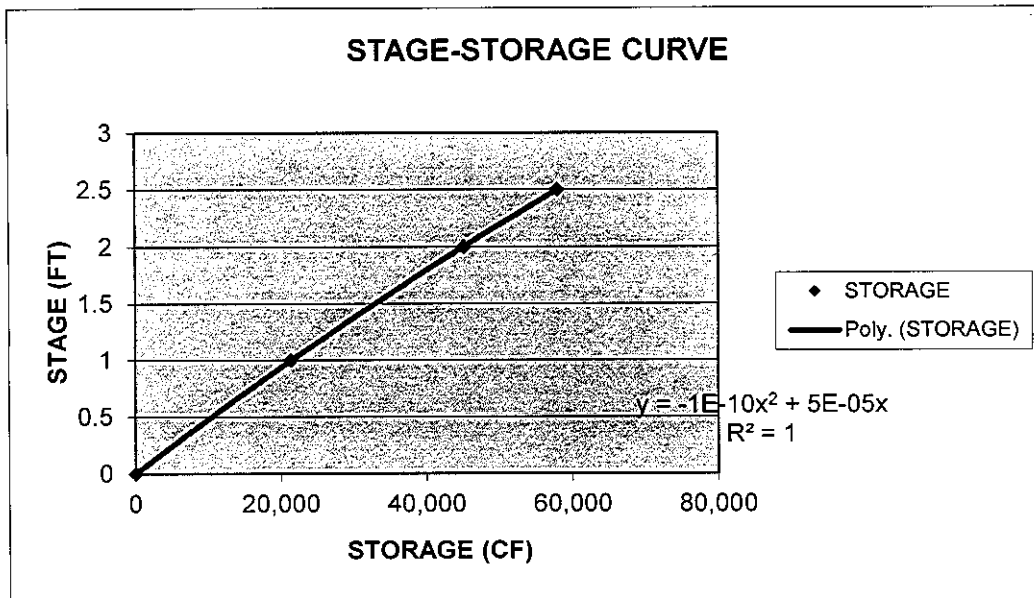
$Ks_1' =$ 21,347

$b_1' =$ -0.558

$Ks_1' =$ 1,305

$b_1' =$ 3.680

SURCHARGE CALIBRATION



Abbott's Run

DATE: February 10, 2017

PW 1198

POND A

10 YR STORM ROUTING SHEET 3 OF 3

10YR STORM ROUTING

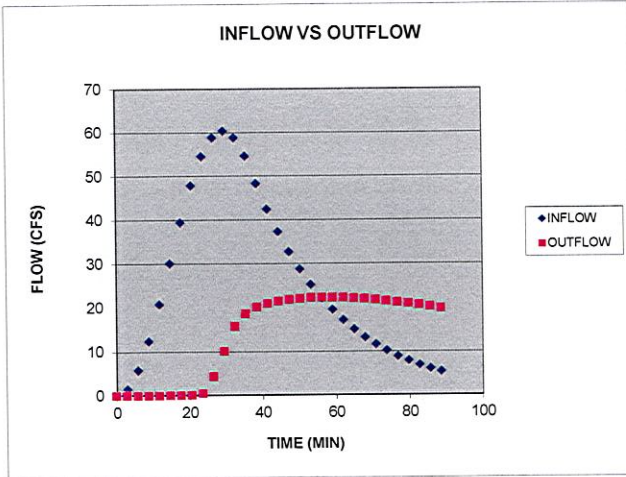
ORIFICE (IN) = 2.00
 ORIFICE AREA (SQ. FT.) = 0.022

THRESHOLD STAGES

ORIFICE 1 0.2
 CITY WIEF 1.18
 OVERFLO 3.2
 BYPASS V 20

WEIR LENGTH (FT) = 4.00
 WEIR HEIGHT (FT) = 0.92
 WEIR AREA (SF) = 3.68

TIME	INFLOW	STORAGE	STAGE	OUTFLOW	WSE
0.000	0.000	0.00	0.00	0.00	33.00
2.952	1.475	0.00	0.00	0.00	33.00
5.904	5.754	261.19	0.02	0.00	33.02
8.856	12.421	1280.41	0.08	0.00	33.08
11.808	20.822	3480.37	0.19	0.00	33.19
14.760	30.136	7168.32	0.37	0.06	33.37
17.712	39.453	12494.73	0.61	0.08	33.61
20.664	47.860	19468.00	0.92	0.10	33.92
23.616	54.537	27927.20	1.28	0.49	34.28
26.568	58.830	37499.29	1.68	4.33	34.68
29.520	60.320	47152.54	2.07	10.19	35.07
32.472	58.860	56031.89	2.42	15.83	35.42
35.424	54.594	63652.85	2.72	18.61	35.72
38.376	48.305	70026.68	2.92	20.20	35.92
41.328	42.417	75005.44	3.01	20.93	36.01
44.280	37.246	78810.26	3.08	21.47	36.08
47.232	32.705	81605.16	3.13	21.84	36.13
50.184	28.718	83529.69	3.17	22.09	36.17
53.136	25.217	84703.84	3.19	22.24	36.19
56.088	22.143	85231.42	3.20	22.31	36.20
59.040	19.444	85202.75	3.20	22.30	36.20
61.992	17.074	84696.59	3.19	22.24	36.19
64.944	14.992	83781.91	3.17	22.12	36.17
67.896	13.165	82519.17	3.15	21.96	36.15
70.848	11.560	80961.53	3.12	21.75	36.12
73.800	10.151	79155.81	3.09	21.51	36.09
76.752	8.913	77143.31	3.05	21.24	36.05
79.704	7.827	74960.58	3.01	20.93	36.01
82.656	6.873	72639.98	2.97	20.59	35.97
85.608	6.035	70210.29	2.92	20.22	35.92
88.560	5.299	67697.12	2.87	19.83	35.87
91.512	4.653	65123.35	2.82	19.41	35.82
94.464	4.086	62509.51	2.76	18.97	35.76
97.416	3.588	59874.05	2.71	18.50	35.71
100.368	3.150	57233.65	2.65	18.00	35.65
103.320	2.766	54603.48	2.59	17.48	35.59
106.272	2.429	51997.36	2.54	16.94	35.54
109.224	2.133	49428.00	2.48	16.37	35.48
112.176	1.873	46907.15	2.06	10.02	35.06
115.128	1.645	45463.99	2.00	9.06	35.00
118.080	1.444	44151.44	1.95	8.20	34.95
121.032	1.268	42954.19	1.90	7.45	34.90
123.984	1.114	41859.17	1.85	6.78	34.85
126.936	0.978	40855.19	1.81	6.19	34.81
129.888	0.859	39932.60	1.78	5.66	34.78
132.840	0.754	39083.04	1.74	5.18	34.74
135.792	0.662	38299.19	1.71	4.75	34.71
138.744	0.581	37574.68	1.68	4.37	34.68
141.696	0.510	36903.87	1.65	4.02	34.65
144.648	0.448	36281.79	1.63	3.71	34.63
147.600	0.394	35704.03	1.60	3.43	34.60
150.552	0.346	35166.68	1.58	3.17	34.58
153.504	0.303	34666.22	1.56	2.94	34.56
156.456	0.266	34199.52	1.54	2.73	34.54
159.408	0.234	33763.75	1.52	2.53	34.52



13.49448
 13.49448

CHECK VALIDITY OF ADJUSTED VALUES FOR POND
 STAGE-STORAGE RELATIONSHIP

ERROR APPEARS TO BE LESS THAN 1%--OK

POST DEVELOPMENT FLOW <PREDEVELOPMENT FLOW OF 9.06 cfs

Abbott's Run

DATE: February 10, 2017

Job #: PW 205

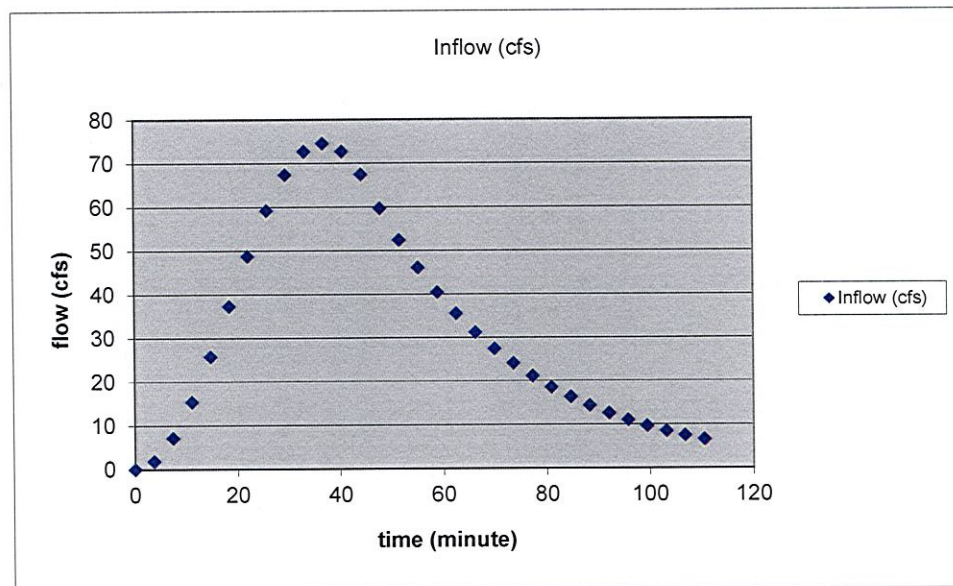
WET DETENTION POND

50 YR STORM ROUTING SHEET 1 OF 3

INFLOW HYDROGRAPH

Q_p = 74.5 cfs
T_p = 36.8 min

Time (min)	Inflow (cfs)
0	0
3.681	1.821
7.362	7.106
11.043	15.339
14.724	25.713
18.405	37.215
22.086	48.720
25.767	59.103
29.448	67.349
33.129	72.651
36.810	74.490
40.491	72.687
44.172	67.419
47.853	59.653
51.534	52.381
55.215	45.995
58.896	40.388
62.577	35.465
66.258	31.141
69.939	27.345
73.620	24.012
77.301	21.085
80.982	18.514
84.663	16.257
88.344	14.275
92.025	12.535
95.706	11.007
99.387	9.665
103.068	8.487
106.749	7.452
110.430	6.544



Piner Run

DATE: February 10, 2017

Job #: PW 1198

POND A

10 YR STORM ROUTING SHEET 2 OF 3

STAGE-STORAGE RELATION

ELEV.	Surface Ar	Inc. Volum	Acc. Vol.	Stage	S	Z
33	20,102	0	0	0.0	0	0
34	22,591	21,347	21,347	1.0	21,347	1
35	25,115	23,853	45,200	2.0	45,200	2
35.5	26,096	12,803	58,002	2.5	58,002	2.5
36	39,439	16,384	74,386	3.0	74,386	3
36.5	76,131	28,892	103,278	3.5	103,278	3.5
37	112,822	47,238	150,517	4.0	150,517	4

ADJUST VALUES FOR NON PRISMATIC POND SECTION

$Ks_1 =$ 21,347

$Ks_1' =$ 21,347

$b_1 =$ 1.091

$b_1' =$ -0.558

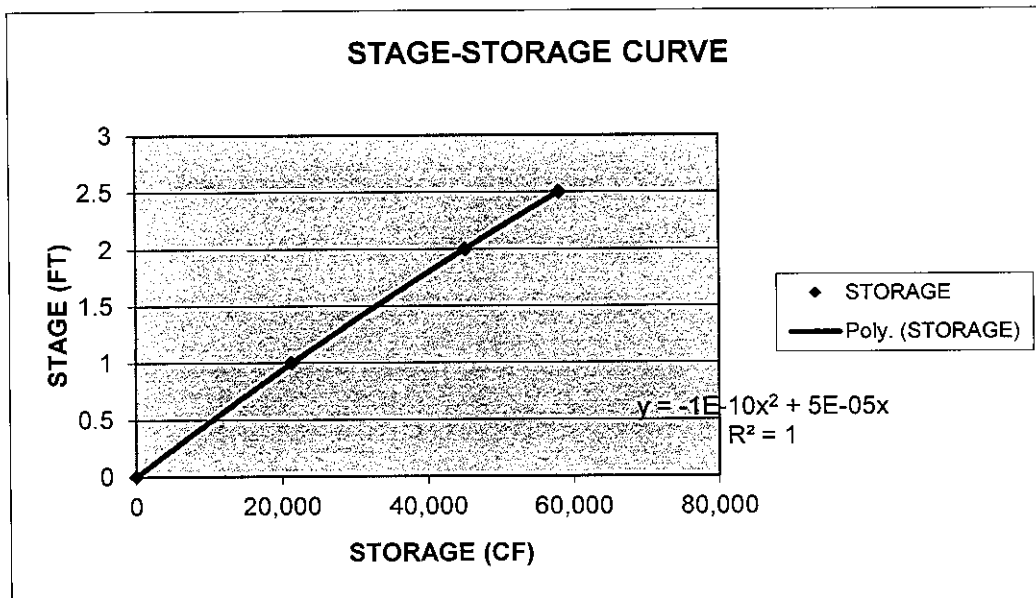
$Ks_1 =$ 7,174

$Ks_1' =$ 1,305

SURCHARGE CALIBRATION

$b_1 =$ 2.129

$b_1' =$ 3.680



Abbott's Run

DATE: February 10, 2017

PW 1198

POND A

10 YR STORM ROUTING SHEET 3 OF 3

10YR STORM ROUTING

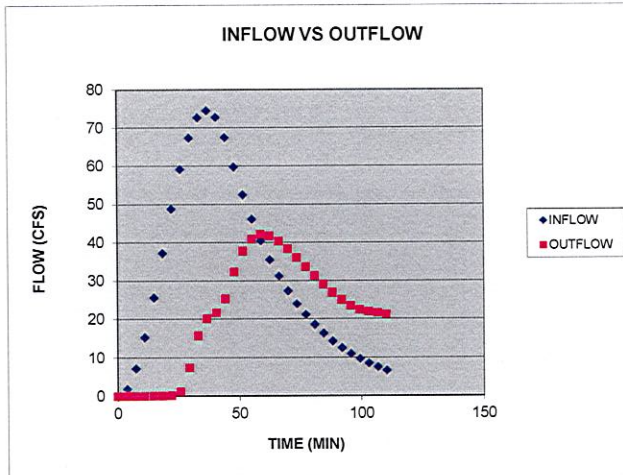
ORIFICE (IN) = 2.00
 ORIFICE AREA (SQ. FT.) = 0.022

THRESHOLD STAGES

ORIFICE 1 0.2
 CITY WIEF 1.18
 OVERFLO 3.2
 BYPASS V 20

WEIR LENGTH (FT) = 4.00
 WEIR HEIGHT (FT) = 0.92
 WEIR AREA (SF) = 3.68

TIME	INFLOW	STORAGE	STAGE	OUTFLOW	WSE
0.000	0.000	0.00	0.00	0.00	33.00
3.681	1.821	0.00	0.00	0.00	33.00
7.362	7.106	402.20	0.03	0.00	33.03
11.043	15.339	1971.67	0.11	0.00	33.11
14.724	25.713	5359.34	0.28	0.06	33.28
18.405	37.215	11026.03	0.55	0.08	33.55
22.086	48.720	19228.27	0.91	0.10	33.91
25.767	59.103	29966.56	1.36	1.08	34.36
29.448	67.349	42782.68	1.89	7.34	34.89
33.129	72.651	56035.27	2.42	15.83	35.42
36.810	74.490	68583.69	2.92	20.19	35.92
40.491	72.687	80576.89	3.11	21.70	36.11
44.172	67.419	91837.10	3.31	25.36	36.31
47.853	59.653	101126.38	3.47	32.35	36.47
51.534	52.381	107157.13	3.56	37.78	36.56
55.215	45.995	110381.93	3.61	40.89	36.61
58.896	40.388	111509.28	3.63	42.01	36.63
62.577	35.465	111151.62	3.62	41.65	36.62
66.258	31.141	109785.15	3.60	40.31	36.60
69.939	27.345	107761.13	3.57	38.35	36.57
73.620	24.012	105330.04	3.53	36.08	36.53
77.301	21.085	102665.41	3.49	33.68	36.49
80.982	18.514	99883.68	3.45	31.30	36.45
84.663	16.257	97059.51	3.40	29.04	36.40
88.344	14.275	94236.80	3.35	26.96	36.35
92.025	12.535	91436.16	3.31	25.11	36.31
95.706	11.007	88658.82	3.26	23.56	36.26
99.387	9.665	85885.94	3.21	22.44	36.21
103.068	8.487	83063.76	3.16	22.03	36.16
106.749	7.452	80072.79	3.11	21.64	36.11
110.430	6.544	76940.10	3.05	21.21	36.05
114.111	5.746	73701.31	2.99	20.75	35.99
117.792	5.046	70388.37	2.92	20.25	35.92
121.473	4.431	67030.08	2.86	19.72	35.86
125.154	3.891	63652.56	2.79	19.16	35.79
128.835	3.416	60279.58	2.72	18.57	35.72
132.516	3.000	56932.94	2.65	17.94	35.65
136.197	2.634	53632.78	2.57	17.28	35.57
139.878	2.313	50397.87	2.50	16.58	35.50
143.559	2.031	47245.81	2.07	10.25	35.07
147.240	1.783	45430.14	2.00	9.03	35.00
150.921	1.566	43829.03	1.93	8.00	34.93
154.602	1.375	42408.32	1.88	7.11	34.88
158.283	1.207	41140.67	1.82	6.35	34.82
161.964	1.060	40003.99	1.78	5.70	34.78
165.645	0.931	38980.20	1.74	5.12	34.74
169.326	0.818	38054.42	1.70	4.62	34.70
173.007	0.718	37214.23	1.66	4.18	34.66
176.688	0.630	36449.24	1.63	3.79	34.63
180.369	0.554	35750.64	1.60	3.45	34.60
184.050	0.486	35110.93	1.58	3.14	34.58
187.731	0.427	34523.69	1.55	2.87	34.55
191.412	0.375	33983.37	1.53	2.63	34.53
195.093	0.329	33485.17	1.51	2.41	34.51
198.774	0.289	33024.88	1.49	2.22	34.49



13.49448
 13.49448

CHECK VALIDITY OF ADJUSTED VALUES FOR POND
 STAGE-STORAGE RELATIONSHIP

ERROR APPEARS TO BE LESS THAN 1%--OK

POST DEVELOPMENT FLOW <PREDEVELOPMENT FLOW OF 9.06 cfs

February 15, 2017

Abbott's Run Apartments

City of Wilmington

Storm Water 10 & 50 Year Routings Narrative

Wilmington AR Housing, LLC, the present owner of Abbotts Run Apartments, desires to expand the Clubhouse amenity. This owner does not have the authority to modify the State Stormwater Management Permit No. SW8 990720. The original permittee corporation is dissolved. The State Storm Water Management Permit is being renewed, modified, and assigned to the present owner. The permit is being modified to permit additional Built Upon Area, BUA, given the as built condition slightly exceeds that originally permitted. The modification provides for additional BUA in reserve to allow for a future expansion. The proposed expansion can be achieved with an additional 6,000 square feet, sf, of BUA. This will increase the permitted BUA to 305,000 sf. The proposed increase in BUA will require a six inch increase in the pond's depth so as to reduce the required surface area to satisfy State storm water standards. Excavation of the pond's likely accumulated sediment shall proceed to the required increased depth.

Additionally, the City of Wilmington zoning approval process is requiring the detention pond be analyzed to route the 10 and 50 year storm events. This pond was originally designed and permitted in 2000. The routings done then have been modified to include the as built condition as well as the 6000 sf reservation for the clubhouse expansion. The following routings incorporate some storage into the lowest portions of the western most parking lot. This storage is limited to less than eight inches at the collection inlets for the 10 year storm. The attached plan now represents the contours in the affected areas. It is important to note that the original routings also incorporated some storage in these lowest areas. Standards at the time of permitting allowed for storage in parking areas. It is additionally important to note that this system has performed without nuisance for seventeen years.

JHF\jf

File F:\master\pw-205\wpd\Abbotts Run Stormwater Management Permit Renewal.doc