RYMAR®

WATERWORKS INNOVATIONS

BENEFITS OF SKIMMERS FOR POST-CONSTRUCTION WATER QUALITY

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www.RymarWaterworks.com

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1992 Graduate – Clemson University
BS – Civil Engineering

1999 - Founded CCAD Engineering

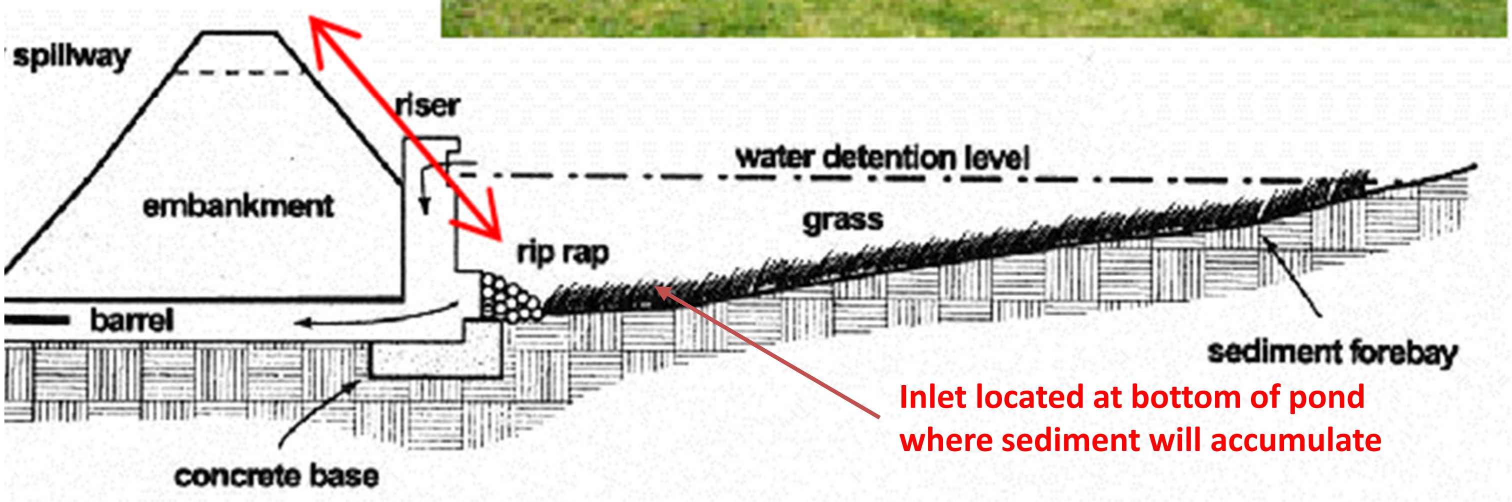
2013 - Invented the Marlee Float skimmer

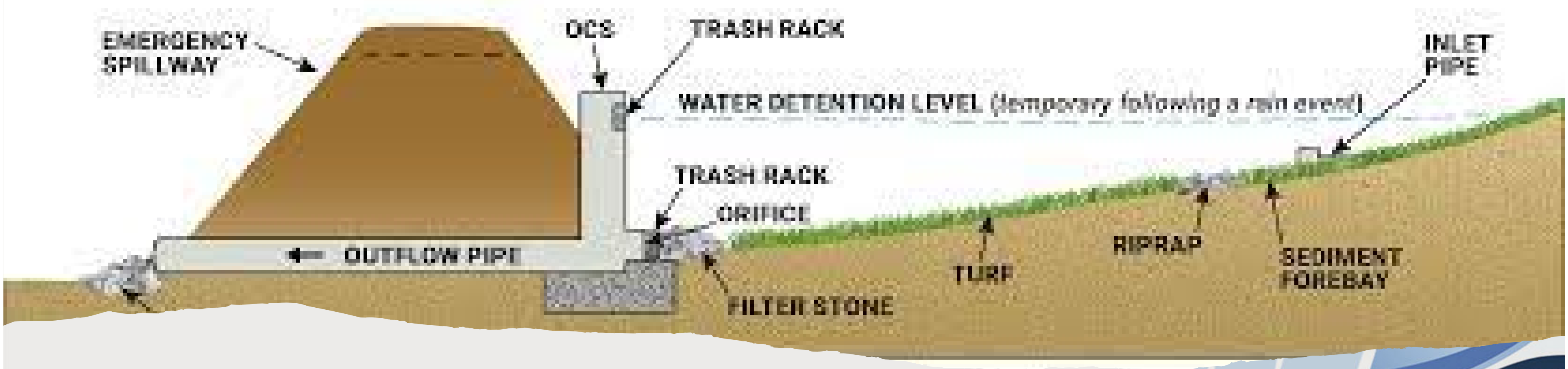
Licensed Professional Engineer in
SC, NC & GA

Presentation Agenda

- Understand the benefits of use of skimmers in permanent basins
- Introduce the post-construction filter for water quality
- Learn how to incorporate a skimmer into hydrology model
- Comparison of traditional water quality design to filtration based design

Typical Dry Detention Basin





Typical Dry Detention Basin

- Skimmer is removed
- Low Flow Orifice installed at bottom of riser to release “First Flush”
- Often includes some sort of guard or filter to reduce clogging

Flaws with using Extended Detention for Water Quality

Basins are designed to capture pollutants by holding runoff for an extended time, allowing for settlement

Basins that rely on settling time provide very little treatment for smaller storm events due to limited ponding/holding time

Volume based design results in larger pond sizes

Benefits to Filtration instead of Settling

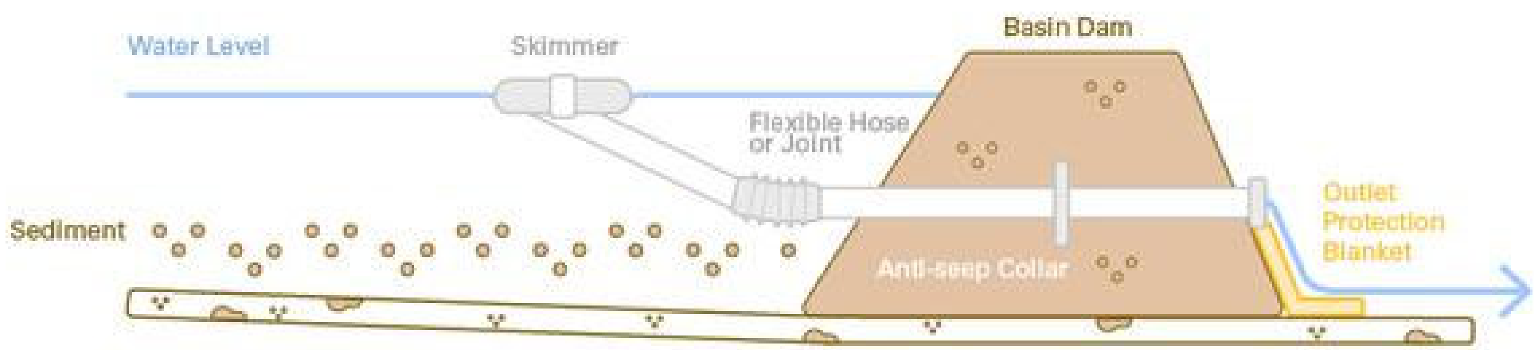
Filter does not require extended time for settling, which allows for "first flush" to be released faster, resulting in smaller ponds.

There is excellent potential to retrofit older basins that did not include water quality benefits in the design if peak flow rate can be maintained

Filters in ponds are relatively easy to access and maintain, especially when compared to systems that use underground vaults and require confined space entry.

Audience Question

Have you ever considered a skimmer for permanent use?



Basins rely upon the natural settling of sediment particles as they travel from the inlet to the outlet.

Skimmers release the cleaner water from the surface. Widely accepted for construction and proven to be very cost effective.

Makes sense to use same methods for post-construction water quality.

Benefits to Using Skimmers with Filtration

- The skimmer can be sized to control the peak rate for lower storm events
- Skimmer increases filter efficiency by withdrawing from the surface, where water is cleaner
- Skimmer is easy to access or pull to side of pond for maintenance and changing filters.

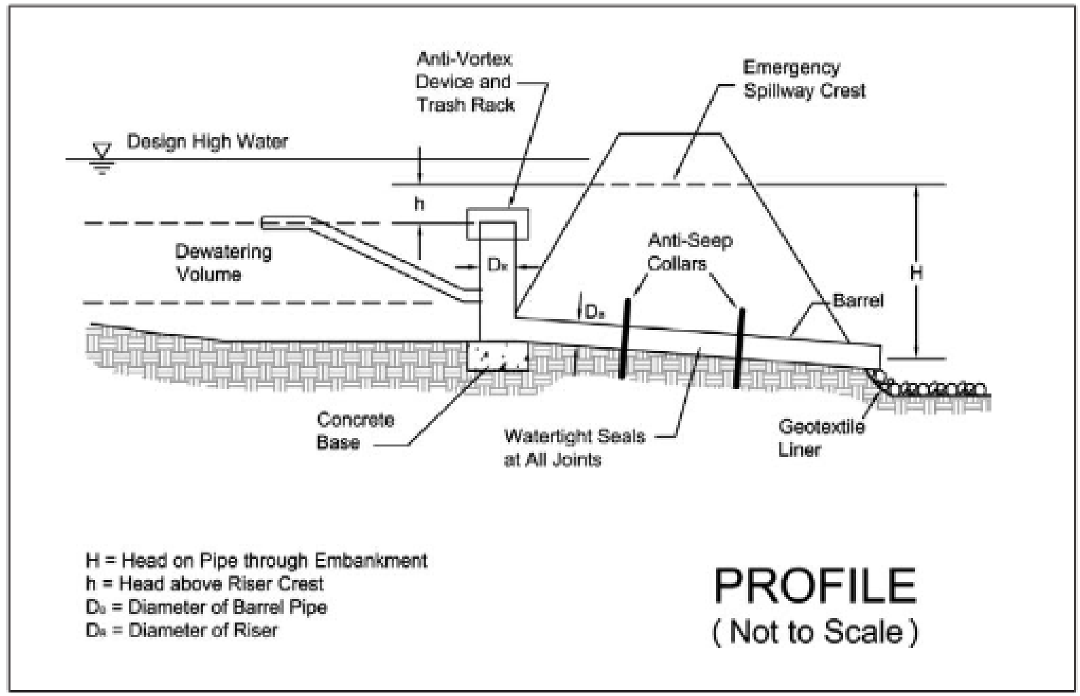


Figure 6.1.10 Principal Spillway Design

Challenges to Using Skimmers with Filtration

Filters are prone to clog over time and will require maintenance and periodic cleaning or changing

Skimmer must be durable and last more than a few years to be suitable for permanent use. May need alternate drain during frozen conditions.

There are no established standards for basis of design and permitting based upon combination of pond and filtration

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Prototype installed to test adding filter media around the skimmer to remove TSS, metals, hydrocarbons and other pollutants

Field Testing of Protoype

- The prototype is regularly monitored and has been in the pond for over 24 months

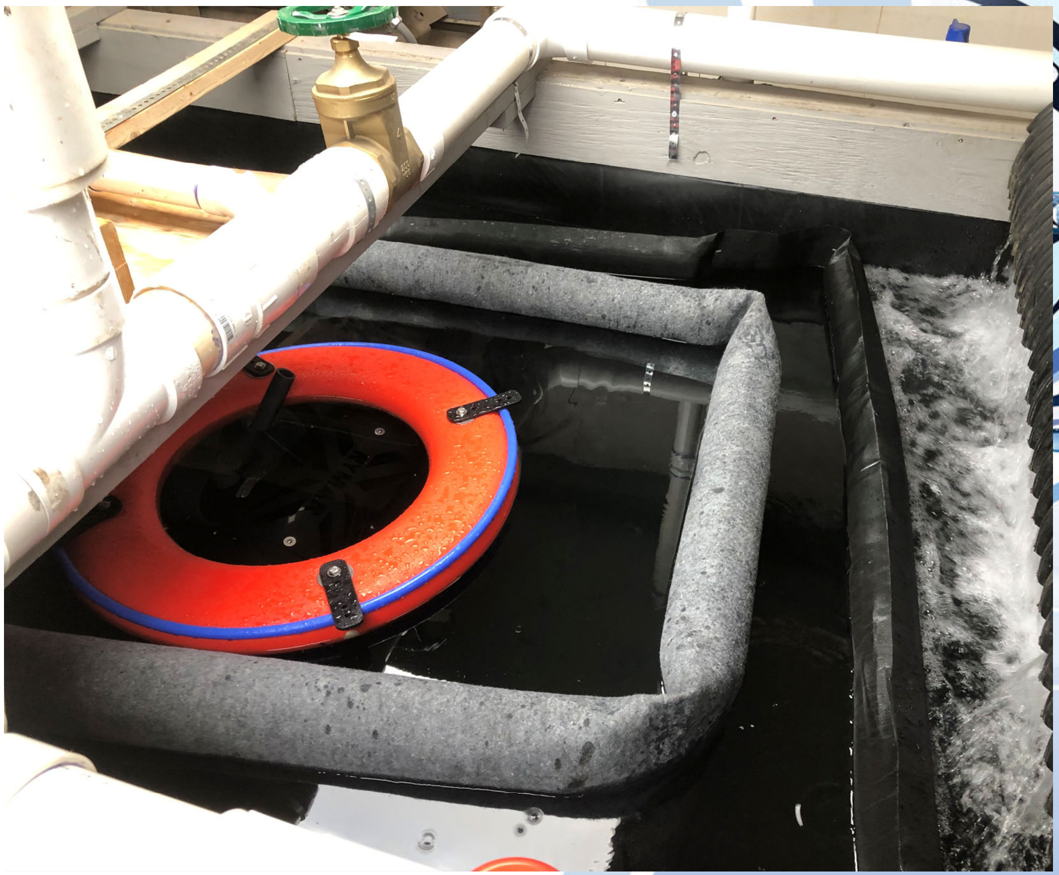
- Area flowing to pond is highly developed with few other stormwater management facilities, therefore, large volume of sediment, trash and debris enters this pond

Field Testing Results

- **Field testing of double filtration model shows discharge water has less turbidity and minimal sediment.**
- **Filter material still functioning after 24 months**

Third Party Testing

- **TRI Environmental tested two versions of the skimmer with filter in accordance with ASTM C1746.**
- **ASTM C1746 is a standard test method for sediment retention devices.**
- **Tank was setup to minimize effect of the “pond” by introducing sediment laden water within 2’ of the filter.**



Testing Results

Both versions achieved greater than

90% TSS Removal Efficiency

Commercial Version has been installed to continue monitoring and has time lapse camera installed to document performance

Benefits to Filtration vs Settlement

The peak rate of discharge can be based on filter treatment flow rate up to first quantity storm event

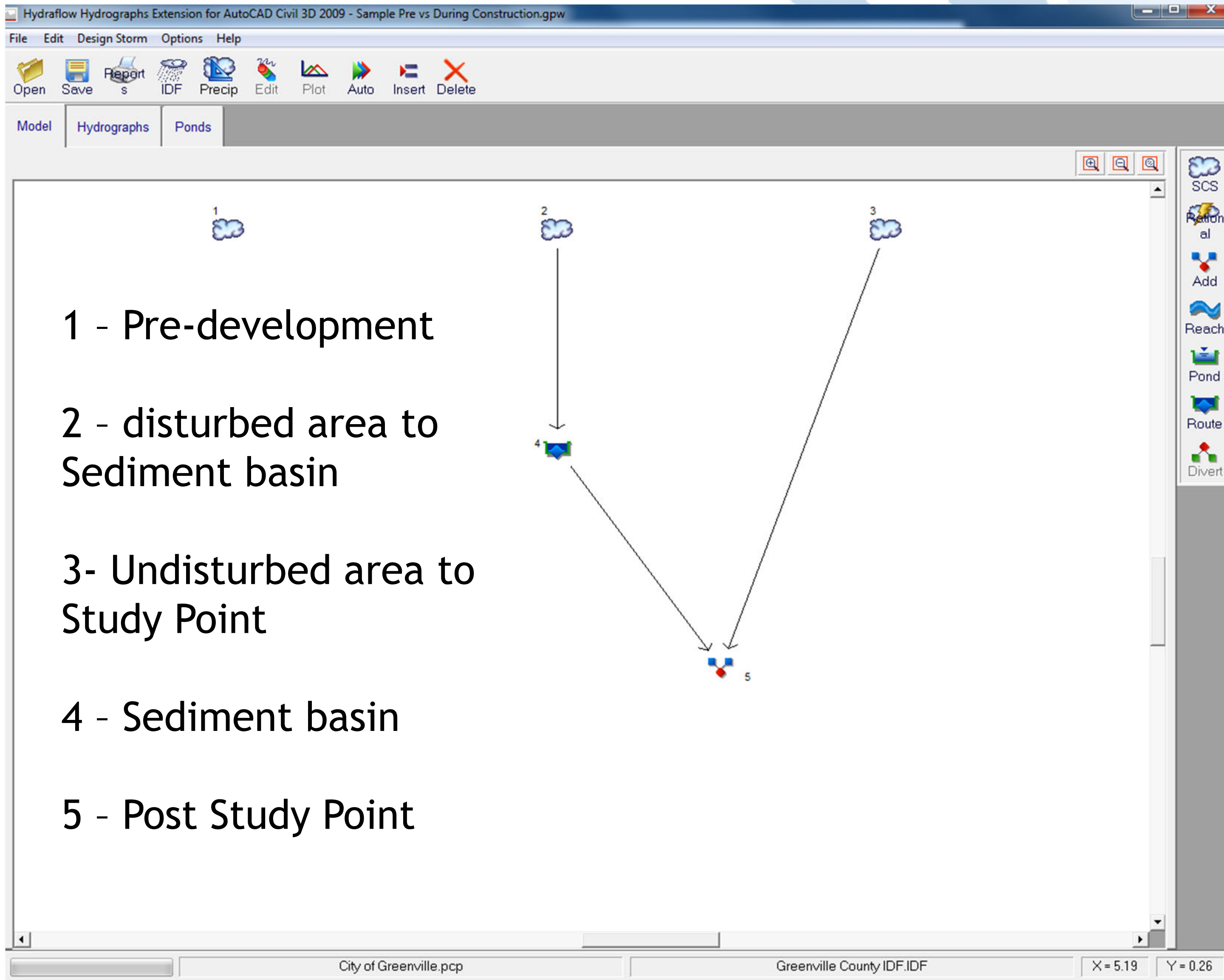
The filter treats 100% of runoff from storms up to the peak rate of the filter

The filtration media can be customized to target specific pollutants of concern.

Advanced Skimmer Modeling with Hydraflow Hydrographs

How to Model The Marlee Float in Hydraflow Hydrographs

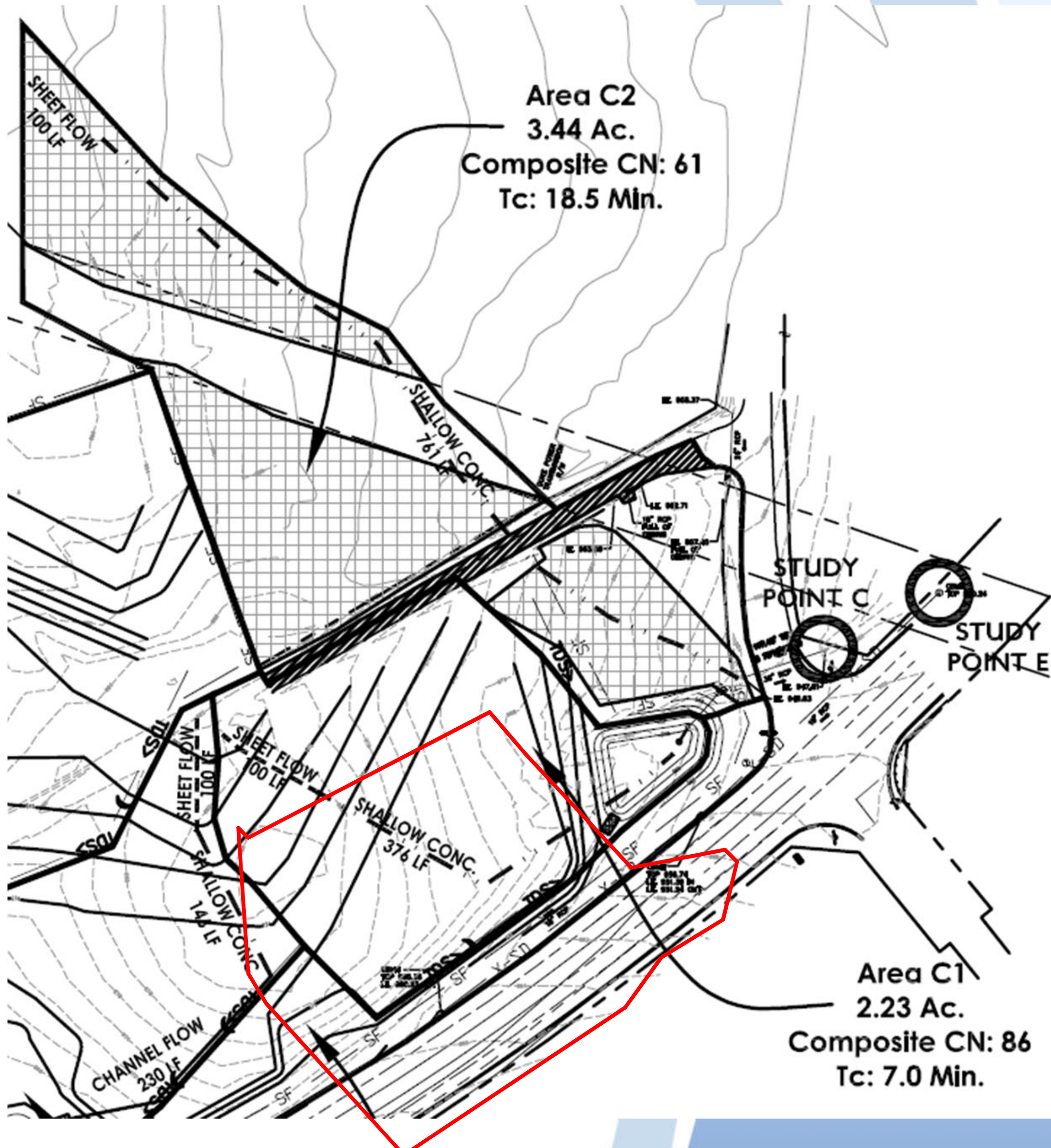
Used to reflect Peak Rate Attenuation effect of skimmer – ideal in lieu of small low flow orifices that are prone to clog.



Sample Site:

Disturbed area drains to a sediment basin prior to discharging to road r/w.

Undisturbed area bypasses basin and flows to study point "C".

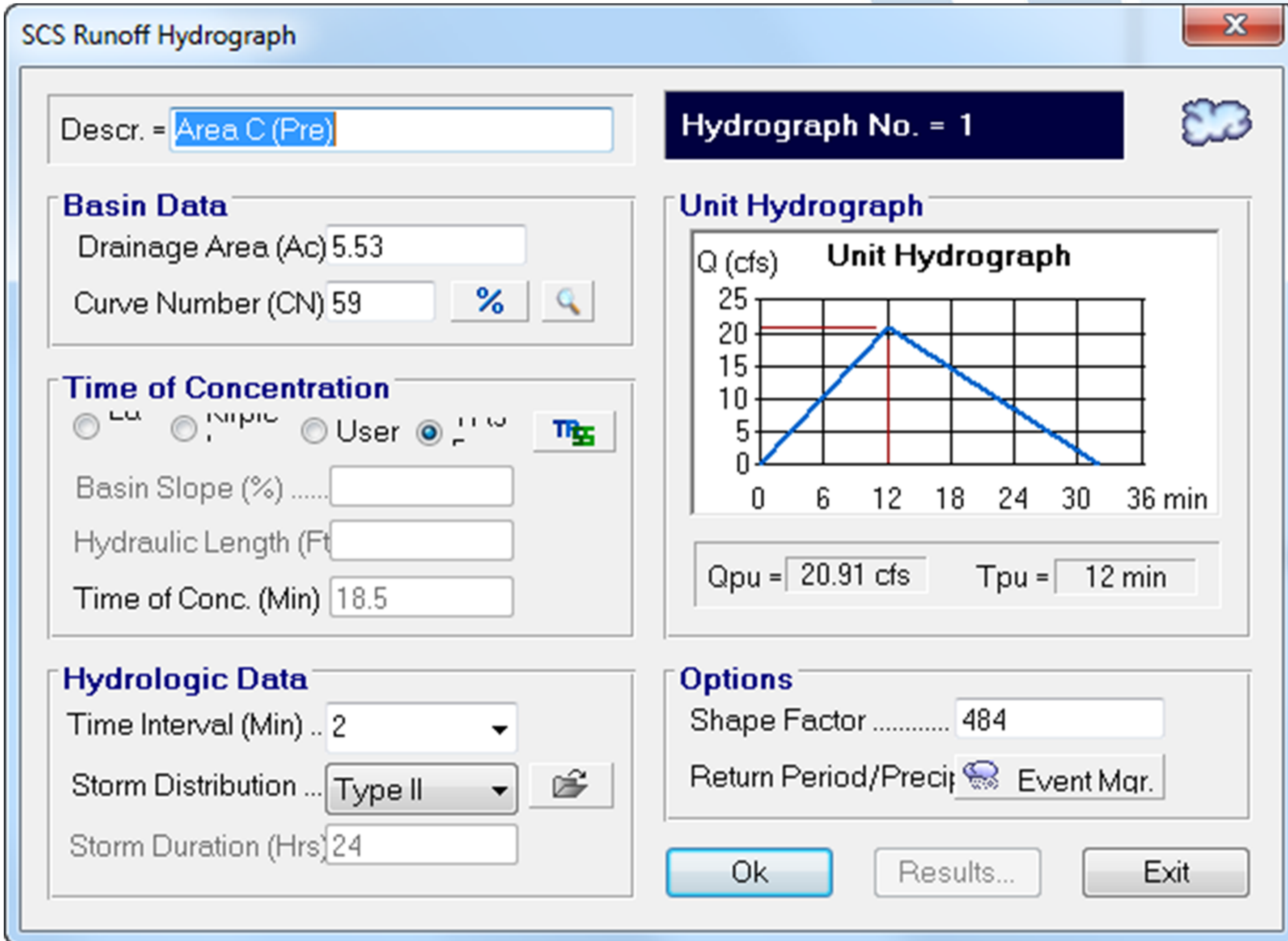


Pre-Development

Area 5.53 Ac

CN = 59

Tc = 18.5 min

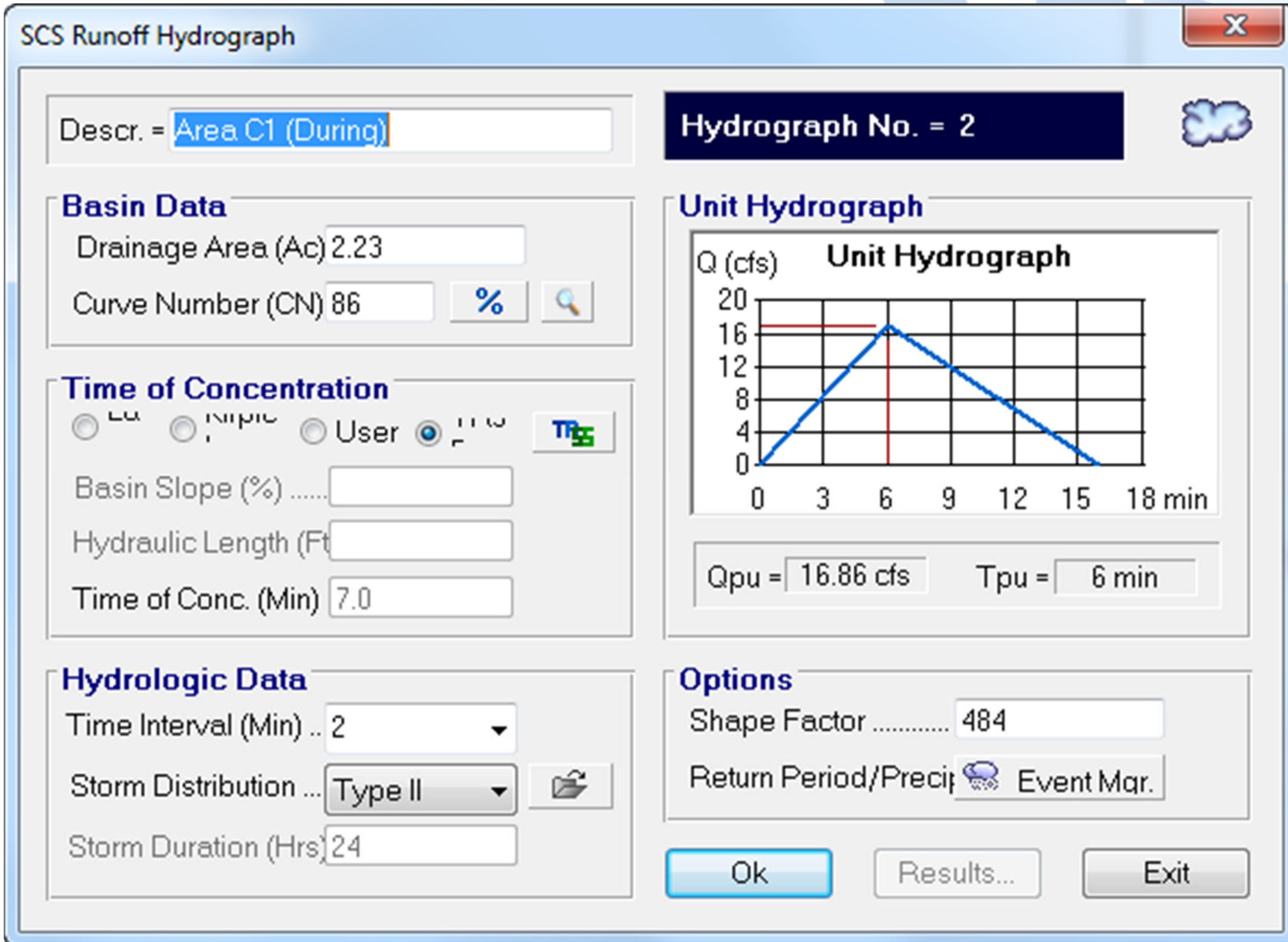


Post-Development To Sediment Basin

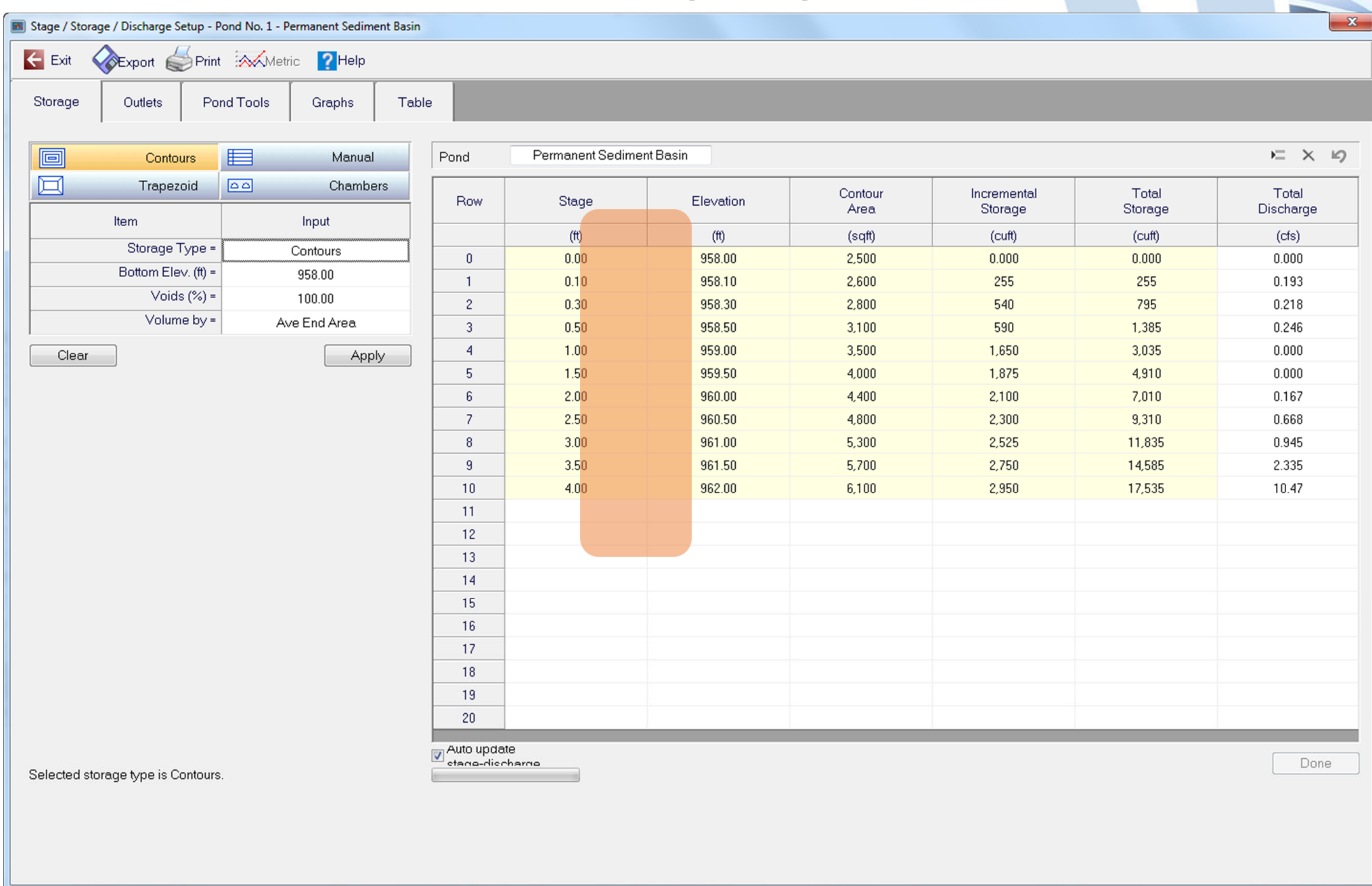
Area 2.23 Ac

CN = 86 (disturbed condition)

Tc = 7 min



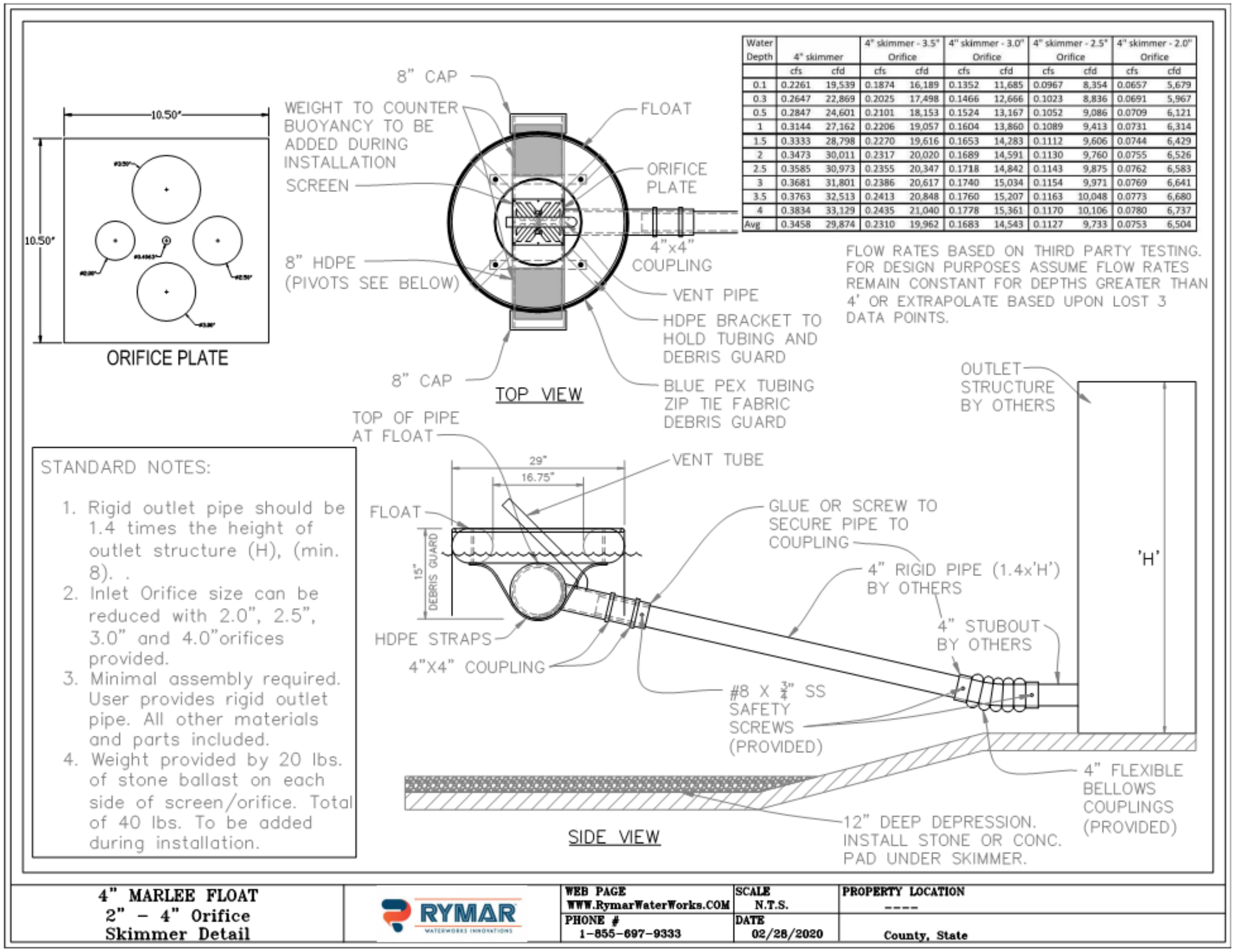
Enter Storage at each contour
Make sure to include data points at each skimmer
Flow rate data point per detail



Row	Stage (ft)	Elevation (ft)	Contour Area (sqft)	Incremental Storage (cuft)	Total Storage (cuft)	Total Discharge (cfs)
0	0.00	958.00	2,500	0.000	0.000	0.000
1	0.10	958.10	2,600	255	255	0.193
2	0.30	958.30	2,800	540	795	0.218
3	0.50	958.50	3,100	590	1,385	0.246
4	1.00	959.00	3,500	1,650	3,035	0.000
5	1.50	959.50	4,000	1,875	4,910	0.000
6	2.00	960.00	4,400	2,100	7,010	0.167
7	2.50	960.50	4,800	2,300	9,310	0.668
8	3.00	961.00	5,300	2,525	11,835	0.945
9	3.50	961.50	5,700	2,750	14,585	2.335
10	4.00	962.00	6,100	2,950	17,535	10.47
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

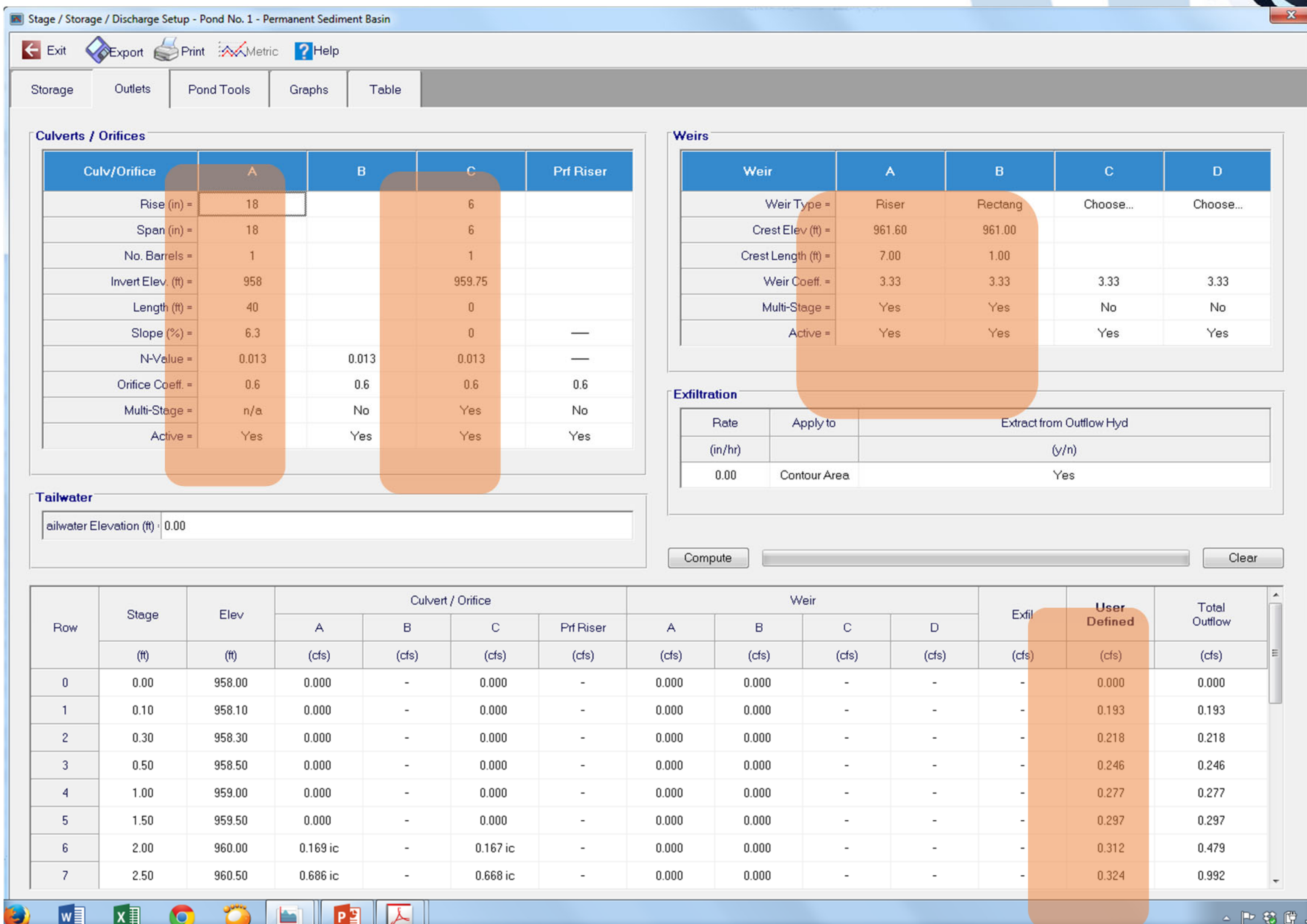
Enter Storage at each contour
Make sure to include data points at each skimmer
Flow rate data point per detail

Water Depth	4" skimmer	
	cfs	cfd
0.1	0.2261	19,539
0.3	0.2647	22,869
0.5	0.2847	24,601
1	0.3144	27,162
1.5	0.3333	28,798
2	0.3473	30,011
2.5	0.3585	30,973
3	0.3681	31,801
3.5	0.3763	32,513
4	0.3834	33,129
Avg	0.3458	29,874



Water Depth	4" skimmer		4" skimmer - 3.5" Orifice		4" skimmer - 3.0" Orifice		4" skimmer - 2.5" Orifice		4" skimmer - 2.0" Orifice	
	cfs	cfd	cfs	cfd	cfs	cfd	cfs	cfd	cfs	cfd
0.1	0.2261	19,539	0.1874	16,189	0.1352	11,685	0.0967	8,354	0.0657	5,679
0.3	0.2647	22,869	0.2025	17,498	0.1466	12,666	0.1023	8,836	0.0691	5,967
0.5	0.2847	24,601	0.2101	18,153	0.1524	13,167	0.1052	9,086	0.0709	6,121
1	0.3144	27,162	0.2206	19,057	0.1604	13,860	0.1089	9,413	0.0731	6,314
1.5	0.3333	28,798	0.2270	19,616	0.1653	14,283	0.1112	9,606	0.0744	6,429
2	0.3473	30,011	0.2317	20,020	0.1689	14,591	0.1130	9,760	0.0755	6,526
2.5	0.3585	30,973	0.2355	20,347	0.1718	14,842	0.1143	9,875	0.0762	6,583
3	0.3681	31,801	0.2386	20,617	0.1740	15,034	0.1154	9,971	0.0769	6,641
3.5	0.3763	32,513	0.2413	20,848	0.1760	15,207	0.1163	10,048	0.0773	6,680
4	0.3834	33,129	0.2435	21,040	0.1778	15,361	0.1170	10,106	0.0780	6,737
Avg	0.3458	29,874	0.2310	19,962	0.1683	14,543	0.1127	9,733	0.0753	6,504

Hydraflow does allow “User Defined” discharge. Set Culvert A as Multi-stage and Weir A as Riser. Then enter user defined discharge based on skimmer size and flow rates per details. Also enter any other orifices or weirs.



Culv/Orifice	A	B	C	Prf Riser
Rise (in) =	18		6	
Span (in) =	18		6	
No. Barrels =	1		1	
Invert Elev. (ft) =	958		959.75	
Length (ft) =	40		0	
Slope (%) =	6.3		0	—
N-Value =	0.013	0.013	0.013	—
Orifice Coeff. =	0.6	0.6	0.6	0.6
Multi-Stage =	n/a	No	Yes	No
Active =	Yes	Yes	Yes	Yes

Weir	A	B	C	D
Weir Type =	Riser	Rectang	Choose...	Choose...
Crest Elev (ft) =	961.60	961.00		
Crest Length (ft) =	7.00	1.00		
Weir Coeff. =	3.33	3.33	3.33	3.33
Multi-Stage =	Yes	Yes	No	No
Active =	Yes	Yes	Yes	Yes

Rate	Apply to	Extract from Outflow Hyd
(in/hr)		(y/n)
0.00	Contour Area	Yes

Row	Stage	Elev	Culvert / Orifice A	Culvert / Orifice B	Culvert / Orifice C	Culvert / Orifice Prf Riser	Weir A	Weir B	Weir C	Weir D	Exfil	User Defined	Total Outflow
	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
0	0.00	958.00	0.000	-	0.000	-	0.000	0.000	-	-	-	0.000	0.000
1	0.10	958.10	0.000	-	0.000	-	0.000	0.000	-	-	-	0.193	0.193
2	0.30	958.30	0.000	-	0.000	-	0.000	0.000	-	-	-	0.218	0.218
3	0.50	958.50	0.000	-	0.000	-	0.000	0.000	-	-	-	0.246	0.246
4	1.00	959.00	0.000	-	0.000	-	0.000	0.000	-	-	-	0.277	0.277
5	1.50	959.50	0.000	-	0.000	-	0.000	0.000	-	-	-	0.297	0.297
6	2.00	960.00	0.169 ic	-	0.167 ic	-	0.000	0.000	-	-	-	0.312	0.479
7	2.50	960.50	0.686 ic	-	0.668 ic	-	0.000	0.000	-	-	-	0.324	0.992

Hydraflow will interpolate between entry points
If Basin is over 4’ deep, use the flow rate at 4’ for depths greater than 4’ or extrapolate based on last 3 data points.

Row	Stage	Elev	Culvert / Orifice				Weir				Exfil	**User Defined**	Total Outflow
			A	B	C	Prf Riser	A	B	C	D			
	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
4	1.00	959.00	0.000	-	0.000	-	0.000	0.000	-	-	-	0.277	0.277
5	1.50	959.50	0.000	-	0.000	-	0.000	0.000	-	-	-	0.297	0.297
6	2.00	960.00	0.169 ic	-	0.167 ic	-	0.000	0.000	-	-	-	0.312	0.479
7	2.50	960.50	0.686 ic	-	0.668 ic	-	0.000	0.000	-	-	-	0.324	0.992
8	3.00	961.00	0.970 ic	-	0.945 ic	-	0.000	0.000	-	-	-	0.334	1.280
9	3.50	961.50	2.371 ic	-	1.158 ic	-	0.000	1.177	-	-	-	0.343	2.678
10	4.00	962.00	10.47 ic	-	1.245 ic	-	5.898	3.330	-	-	-	0.351	10.82
11													

For deeper ponds, use the Sediment Basin Design Tool to determine flow rates

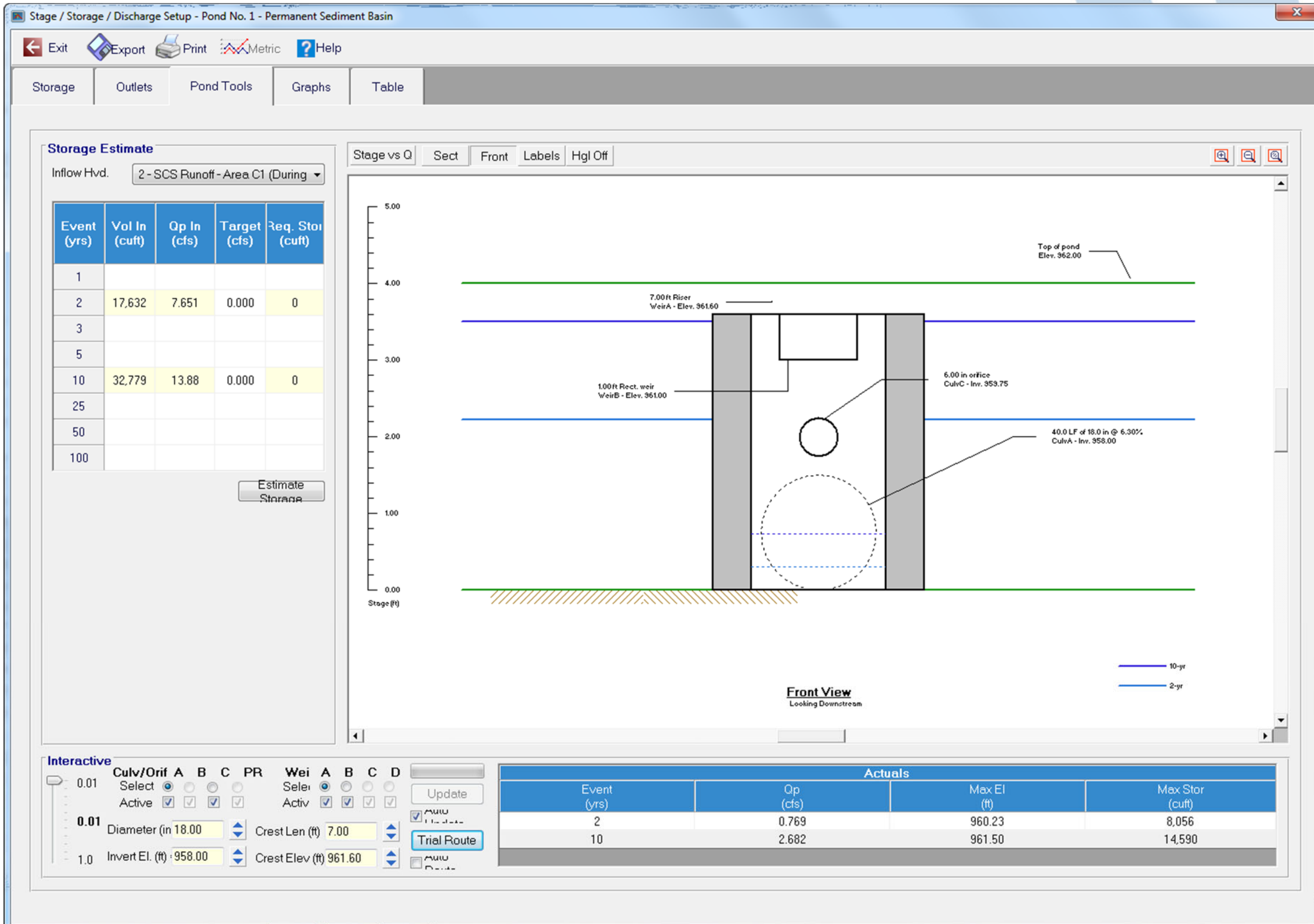
Tool will provide flow rate at 20 increments

Will need to create the increments in your pond stage storage

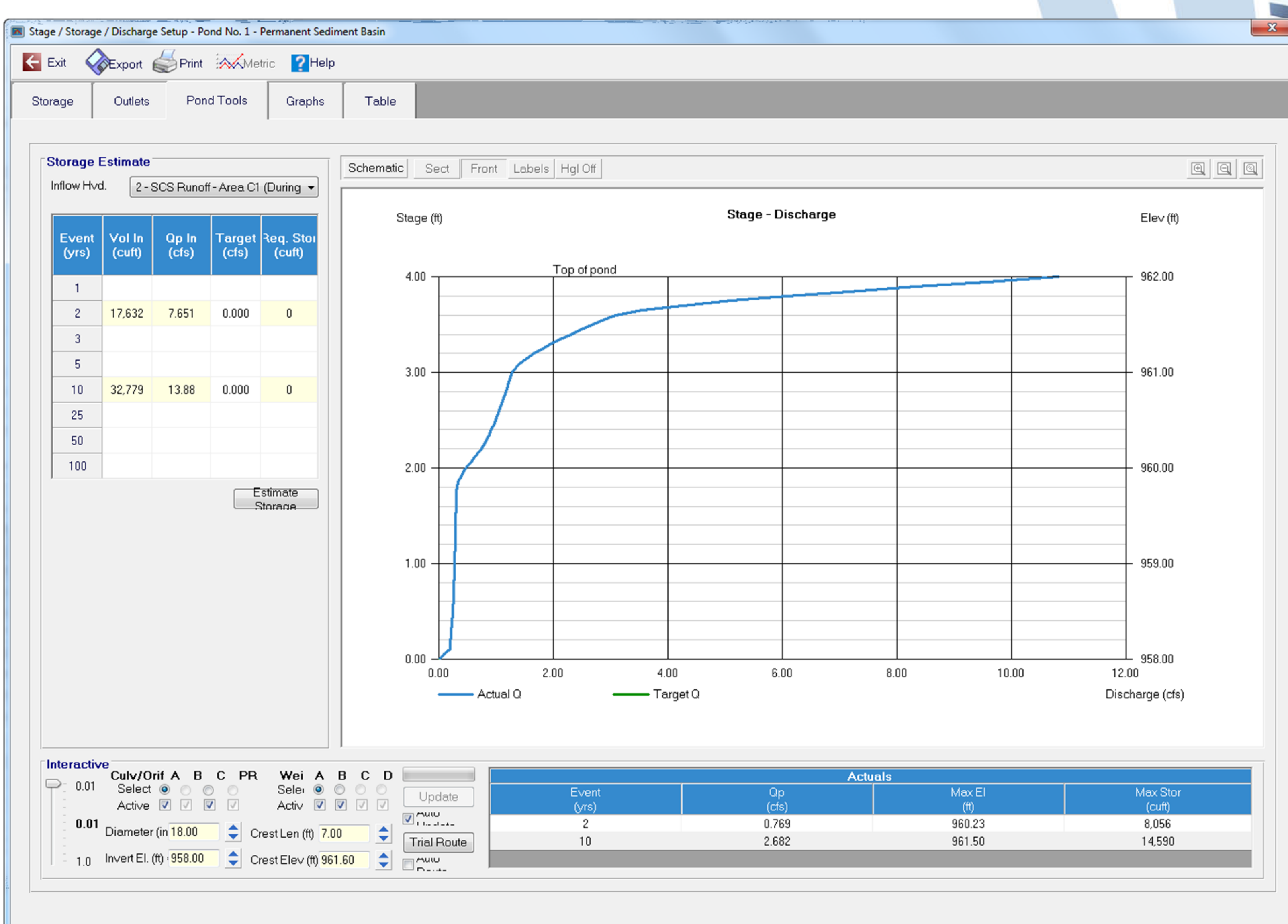
Inputs		Calculations		
Max. Time to Drain, hrs =	120	Calculated Pond Volume, ft^3 =	32,533	
Min. Time to Drain, hrs =	48			
Pond Depth, ft =	8	Calculated Pond Volume, gal =	243349.33	MF 2" - 0.5" Orifice
Pond Top Length, ft =	100	o. of Depth Increments for Calcs, in. =	20	
Pond Top Width, ft =	50	Depth Increments for Calcs, in. =	4.8	Flow Rate:
Pond Bottom Length, ft =	80	Note: Equations are from product testing:		$1.6425*depth^{0.0636}$
Pond Bottom Width, ft =	40			

Water Level Depth, in.	Avg. Water Level Depth, in.	Incr. Depth, in	L	W	Incr. Dis-charge, ft3	Cumm. Dis-charge, ft3	Cumm. Dis-charge, gal	% of Total Volume Dis-charged	Skimmer Flow Rate, gal/min	Skimmer Flow Rate cfs	Cumm. Drain Time, hrs.
96			100	50							
91.2	93.6	4.8	99	50	1980	1980	14811	6.1%	2	0.004	132
86.4	88.8	4.8	98	49	1940	3921	29326	12.1%	2	0.004	262
81.6	84	4.8	97	49	1901	5822	43547	17.9%	2	0.004	389
76.8	79.2	4.8	96	48	1862	7684	57478	23.6%	2	0.004	514
72	74.4	4.8	95	48	1824	9508	71122	29.2%	2	0.004	638
67.2	69.6	4.8	94	47	1786	11294	84482	34.7%	2	0.004	759
62.4	64.8	4.8	93	47	1748	13043	97561	40.1%	2	0.004	878
57.6	60	4.8	92	46	1711	14754	110361	45.4%	2	0.004	995
52.8	55.2	4.8	91	46	1674	16429	122886	50.5%	2	0.004	1111
48	50.4	4.8	90	45	1638	18067	135139	55.5%	2	0.004	1224
43.2	45.6	4.8	89	45	1602	19669	147122	60.5%	2	0.004	1336
38.4	40.8	4.8	88	44	1566	21235	158839	65.3%	2	0.004	1446
33.6	36	4.8	87	44	1531	22766	170293	70.0%	2	0.004	1554
28.8	31.2	4.8	86	43	1496	24263	181487	74.6%	2	0.004	1661
24	26.4	4.8	85	43	1462	25725	192423	79.1%	2	0.004	1767
19.2	21.6	4.8	84	42	1428	27153	203105	83.5%	2	0.004	1871
14.4	16.8	4.8	83	42	1394	28548	213536	87.7%	2	0.004	1975
9.6	12	4.8	82	41	1361	29909	223718	91.9%	2	0.004	2078
4.8	7.2	4.8	81	41	1328	31237	233655	96.0%	2	0.004	2182
0	2.4	4.8	80	40	1296	32533	243349	100.0%	1	0.003	2291
Lowest depth that can still drain through skimmer.			Skimmer / Orifice Combinations with Sufficient Flow:							no	

The schematic will not show a low flow orifice



Stage-Discharge graph will show the User Defined flow



If you select “User Defined” graph you will see near constant flow rate

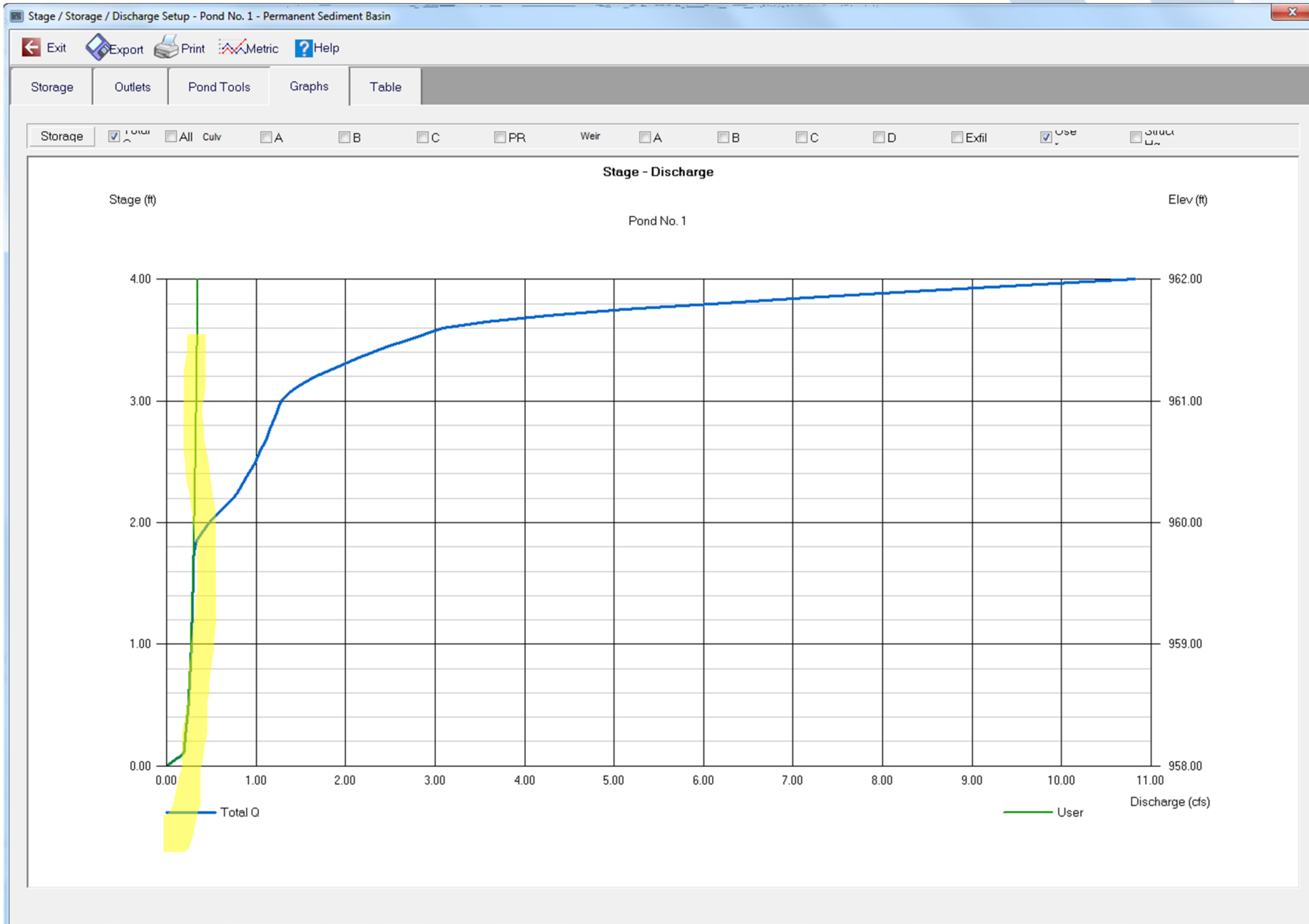


Table will show flow from each outlet, as well as combined flow at each depth

Storage | Outlets | Pond Tools | Graphs | Table

Stage	Elev	Storage	Culvert / Orifice				Weir				Exfil	User Defined	Total Outflow
			A	B	C	Prf Riser	A	B	C	D			
(ft)	(ft)	(cuft)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
0.00	958.00	0.000	0.000	-	0.000	-	0.000	0.000	-	-	-	0.000	0.000
0.10	958.10	255	0.000	-	0.000	-	0.000	0.000	-	-	-	0.193	0.193
0.30	958.30	795	0.000	-	0.000	-	0.000	0.000	-	-	-	0.218	0.218
0.50	958.50	1,385	0.000	-	0.000	-	0.000	0.000	-	-	-	0.246	0.246
1.00	959.00	3,035	0.000	-	0.000	-	0.000	0.000	-	-	-	0.277	0.277
1.50	959.50	4,910	0.000	-	0.000	-	0.000	0.000	-	-	-	0.297	0.297
2.00	960.00	7,010	0.169 ic	-	0.167 ic	-	0.000	0.000	-	-	-	0.312	0.479
2.50	960.50	9,310	0.686 ic	-	0.668 ic	-	0.000	0.000	-	-	-	0.324	0.992
3.00	961.00	11,835	0.970 ic	-	0.945 ic	-	0.000	0.000	-	-	-	0.334	1.280
3.50	961.50	14,585	2.371 ic	-	1.158 ic	-	0.000	1.177	-	-	-	0.343	2.678
4.00	962.00	17,535	10.47 ic	-	1.245 ic	-	5.898	3.330	-	-	-	0.351	10.82

Water Quality Modeling
Volume vs Filtration

Modeling for Post-Construction Water Quality

Volume Based – “First Flush” released over 24-48 hours

Vs

Filtration Based – Flow Rate of Filter

Sample Site Information

Size: 5 acres

Pre-development condition: Wooded (CN 55)

Post-development condition: Commercial (CN 92)

Step 1

Pre-Development Flow Rates

Based upon 5 acre wooded site with Tc of 48 minutes, pre-development flow rates would be:

	2 - yr (cfs)	10-yr (cfs)	25-yr (cfs)	100-yr (cfs)
Pre-	0.72	3.00	5.42	10.72

Step 2

Water Quality Volume and Post-Development Flow Rates

Based upon 5 acre commercial site with Tc of 10 minutes, calculate water quality storm event and post-development flow rates.

WQ storm event is storm that generates 1" of runoff volume for the developed site (18,150 CF). **Should be 1.2" in Georgia**

Using trial and error we determined a 1.73 in 24-hr storm would approximate the WQ volume.

	WQ (cfs)	2 - yr (cfs)	10-yr (cfs)	25-yr (cfs)	100-yr (cfs)
Post	7.23	19.72	30.42	38.53	53.35

Step 3 – Traditional Design

Size First Flush orifice

Flow rate of 0.21 cfs is needed which equates to a 2.6” orifice

5 Acre Site
First Flush Calculations

Pond Type:	Dry		
Contributing Area	217,800	ft^2	5.0 Acres
WQ Volume Req'd: (1/2" over Total for wet pond, 1" over Total for dry pond)	18,150	ft^3	

<u>Orifice Sizing:</u>

WQ Volume to be held:	24	hr
~	86,400	sec
Average Flow Rate req'd:	0.21	ft^3/s (where $Q_{req}=V_{req}/A$)

Using Orifice Equation:

$$Q = CA(2gh)^{\frac{1}{2}}$$

g = 32.2
C = 0.6

elevation for required WQ Volume (feet) =	13.00	feet
elvation at orifice invert (feet) =	10.00	feet
height difference (feet) =	3.000	feet
average head-h (feet) =	1.5	feet
required orifice area =	0.03562239	sq feet

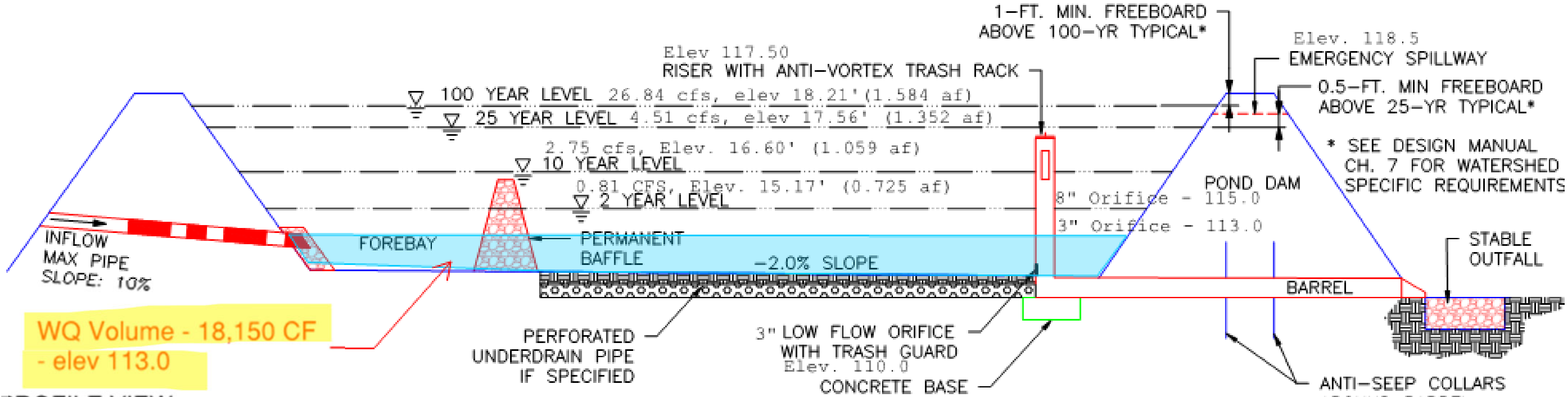
$$A = Q/(C(2gh)^{\frac{1}{2}})$$

required orifice diameter = 0.21 ft

SELECTED ORIFICE SIZE: 2.6 in

Step 4 - Determine Pond Volume and Outlet Structure to meet Pre- vs Post Flow Requirements

Traditional Riser and Emergency Spillway



PROFILE VIEW

Storm	Peak Flow (cfs)	Peak Elev.	Vol. Req (af)	Vol. Req (CF)
WQ	0.25	12.51	0.245	10,672
2-yr	0.81	15.17	0.725	31,581
10-yr	2.75	16.60	1.059	46,130
25-yr	4.51	17.56	1.352	58,893

Pre- vs Post- Analysis – Traditional Pond Summary

	WQ	2 - yr	10-yr	25-yr	100-yr
Pre-	0.00	0.72	3.0	5.42	10.72
Post-	7.23	19.72	30.42	38.53	53.35
Pond	0.25	0.81	2.75	4.51	26.84
Elev. In Pond	12.51	15.17	16.60	17.56	18.21
Storage Required	0.245	0.725	1.059	1.352	1.584

Step 3 - **Skimmer with Filter Design**

Select the Skimmer/Filter Combination to treat the WQ Volume and, when feasible, control the 2-year storm peak flow rate.

Pre-Development 2-year storm peak flow rate is 0.72 cfs

Can use 6” skimmer w/ 6” orifice to simulate this flow

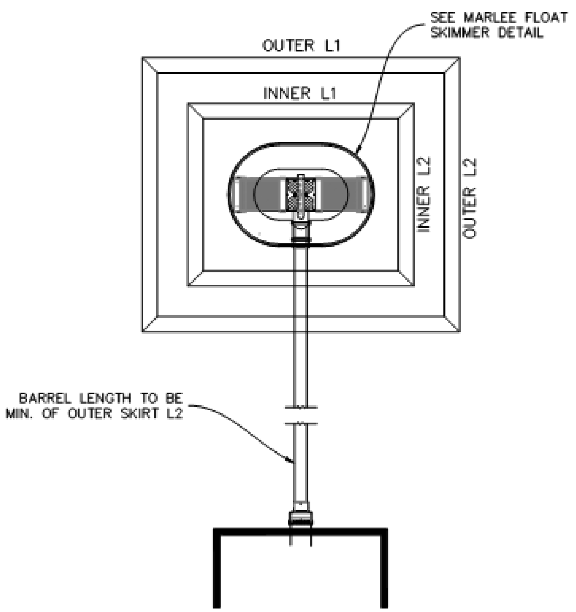
Flow Rate Chart

New Marlee Float Skimmer

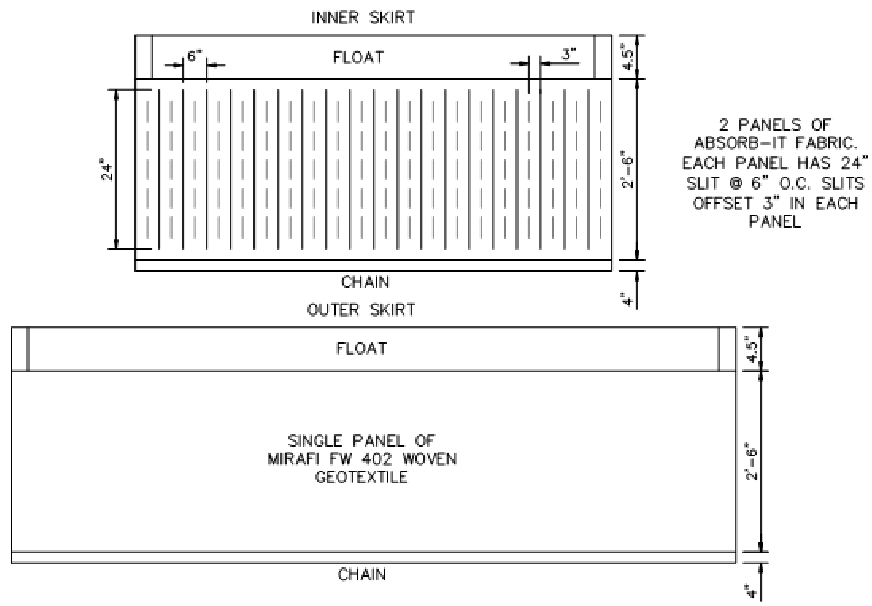
	Skimmer Size	24 Hour Peak Flow Rate* (cfd)	(cfs)	(m^3/s)
2 in. MSRP $595	0.5"	250	0.003	0.000085
	0.75"	1,290	0.015	0.000425
	1"	1,617	0.019	0.000538
	1.5"	2,887	0.033	0.000934
	2"	5,159	0.060	0.001699
3 in. MSRP $995	1.5"	3,523	0.041	0.001161
	2.0"	6,218	0.072	0.002039
	2.5"	10,664	0.123	0.003494
	3"	13,725	0.159	0.004500
4 in. MSRP $1,545	2.0"	6,737	0.078	0.002209
	2.5"	10,106	0.117	0.003313
	3"	15,361	0.178	0.005035
	3.5"	21,040	0.244	0.006895
	4"	33,129	0.383	0.010857
6 in. MSRP $3,395	3.5	21,233	0.246	0.006966
	4"	28,086	0.325	0.009203
	4.5"	38,760	0.449	0.012714
	5"	45,160	0.523	0.014810
	6"	67,221	0.778	0.022031
8 in. MSRP $4,995	5"	48,837	0.565	0.015999
	6"	69,877	0.809	0.022903
	6.5"	80,677	0.934	0.026442
	7"	117,329	1.358	0.038454
	8"	132,786	1.537	0.043523
8 in w/ 8" pipe* MSRP $6,495**	8"	158,350	1.833	0.051905

Step 3 - Skimmer Selection - Skirt/Filter

Filter is sized to treat maximum flow of skimmer



PEAK FLOW RATE (CFS)	SKIMMER SIZE	INNER SKIRT			OUTER SKIRT		
		L1	L2	TOTAL LENGTH	L1	L2	TOTAL LENGTH
0.060	2"	5'	5'	20'	8'	8'	32'
0.159	3"	5'	5'	20'	8'	8'	32'
0.383	4"	5'	5'	20'	8'	8'	32'
0.778	6"	16'	8'	48'	20'	10'	60'
1.537	8"	32'	12'	88'	36'	16'	104'
1.833	MAX 8"	32'	12'	88'	46'	16'	124'



NOT TO SCALE

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POST-CONSTRUCTION WATER QUALITY FILTER SKIRT FOR MARLEE FLOAT SKIMMER

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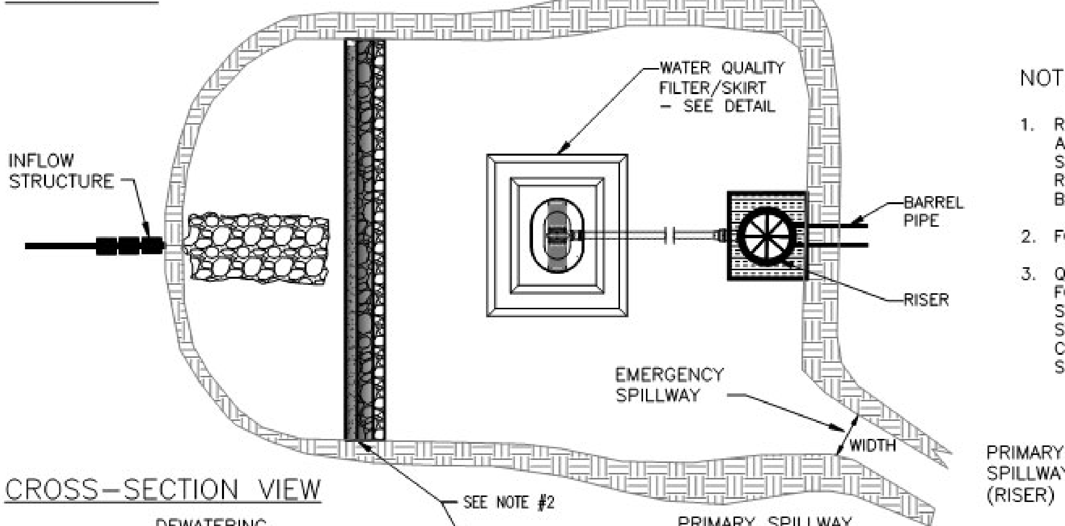
Step 3 - Skimmer Selection - Pond Detail

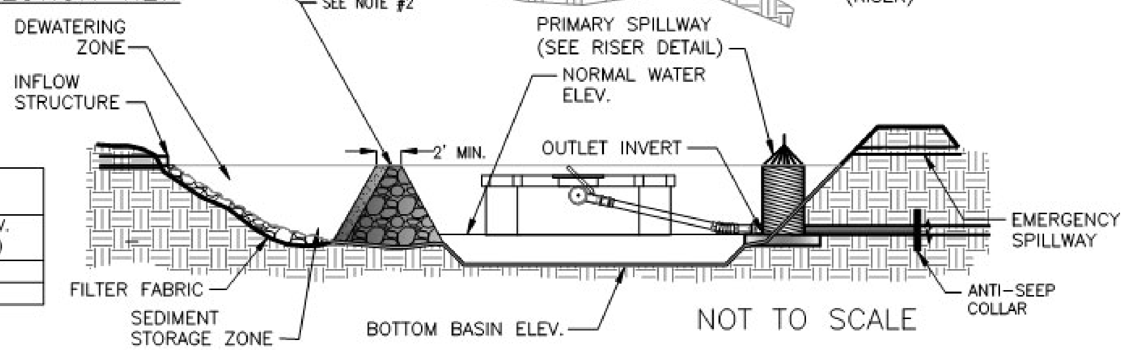
PLAN VIEW



NOTES:

1. REFER TO MS4 FOR ADDITIONAL DESIGN SPECIFICATIONS REGARDING SEDIMENT BASINS.
2. FOREBAY
3. Q EQUAL TO FLOW RATE FOR WATER QUALITY STORM EVENT OR STORM FLOW CONTROLLED BY SKIMMER.

CROSS–SECTION VIEW



NOT TO SCALE

BASIN NO.	PERMANENT POOL (WET) VOLUME		WATER QUALITY VOLUME	
	REQ. (CF)	PROV. (CF)	REQ. (CF)	PROV. (CF)

DATA BLOCK

BASIN NO.	DRAINAGE AREA (ACRES)	DISTURBED AREA (ACRES)	Q_3 (CFS)	BOTTOM OF BASIN (ELEV.)	SKIMMER OUTLET INVERT (ELEV.)	SKIMMER SIZE	SKIMMER ORIFICE DIAMETER	SKIMMER TYPE	SKIMMER FLOW RATE MIN.	MAX.	MAX SKIMMER FLOW RATE
								MARLEE			
								MARLEE			

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WET WATER QUALITY SKIMMER BASIN

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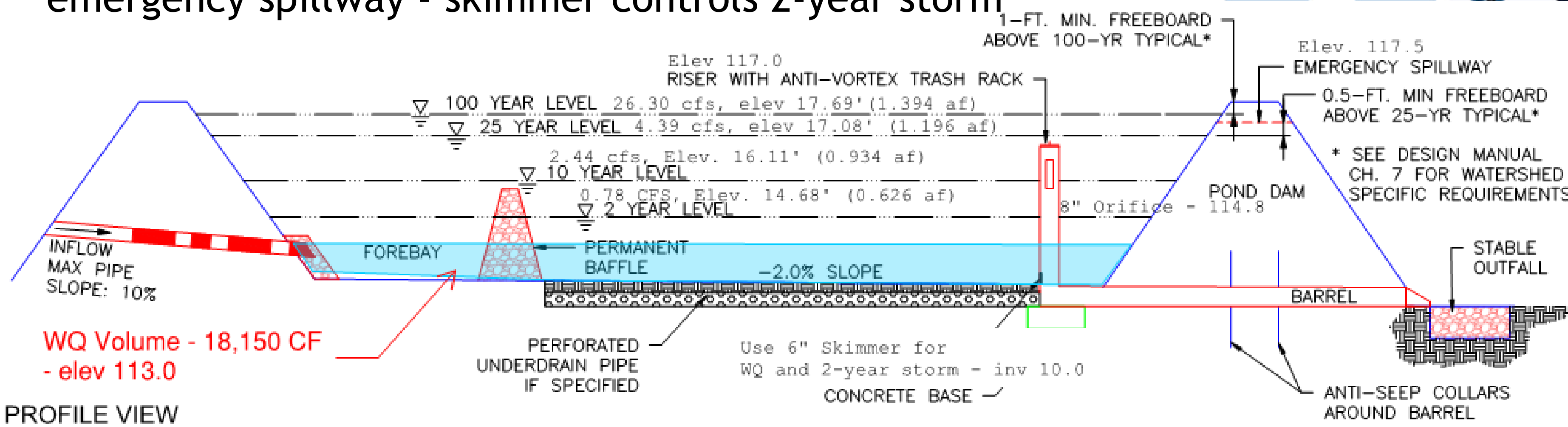
Step 4 - Determine Pond Volume and Outlet Structure to meet Pre- vs Post Flow Requirements using Skimmer

Design pond with traditional riser with skimmer in place of low flow orifice, additional orifices to control other storm events and emergency spillway - skimmer controls 2-year storm



Storm	Peak Flow (cfs)	Peak Elev.	Vol. Req (af)	Vol. Req (CF)
WQ	0.70	12.01	0.174	7,579
2-yr	0.78	14.68	0.626	27,268
10-yr	2.44	16.11	0.934	40,685
25-yr	4.39	17.08	1.196	52,098

Pre- vs Post- Analysis – Pond w/ Skimmer Summary

	WQ	2 - yr	10-yr	25-yr	100-yr
Pre-	0.00	0.72	3.0	5.42	10.72
Post-	7.23	19.72	30.42	38.53	53.35
Pond	0.70	0.78	2.44	4.39	26.30
Elev. In Pond	12.01	14.68	16.11	17.08	17.69
Storage Required	0.174	0.626	0.934	1.196	1.394

vs Traditional Pond Design

Storage Required	0.245	0.725	1.059	1.352	1.584

Traditional Pond vs Pond w/ Skimmer Comparison

	WQ	2 - yr	10-yr	25-yr	100-yr
Traditional Flow	0.25	0.81	2.75	4.51	26.84
Skimmer Pond Flow	0.70	0.78	2.44	4.39	26.30
Traditional Pond Storage	0.245	0.725	1.059	1.352	1.584`
Skimmer Pond Storage	0.174	0.626	0.934	1.196	1.394
Difference in Storage Required	-29%	-14%	-12%	-12%	-12%

Summary

Skimmers can enhance water quality and reduce maintenance in permanent basins

Filtration based methods can be a good option in ponds

Testing has confirmed TSS Removal Efficiency of over 90% for the Rymar Water Quality Filter.

Questions?

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