DRAINAGE AREA MAP

HOMEFIELD VILLAS & TOWNHOMES OF HOMEFIELD

97-9203AB 10-21-09

LAKESIDE MANOR DR.

PROPERTY N/F
BRIGHT STAR, L.L.C.
CITY OF O'FALLON
ZONED: R-1 P.U.D.

PROPERTY N/F
BRIGHT STAR ACADEMY, INC.
CITY OF O'FALLON
ZONED: C-2 P.U.D.

EXISTING DAY CARE CENTER

PROPERTY N/F
SUMMIT POINTE L.C.
CITY OF O'FALLON
ZONED: C-2 P.U.D.

LAKESIDE MANOR
PB33/PG217

LOT A
COMMON GROUND
PROPERTY N/F
LAKESIDE MANOR
OWNERS ASSOCIATION
CITY OF O'FALLON
ZONED: R-1

LOT A
PROPERTY N/F
SUBSIDIZED HOUSING
ASSOCIATES, L.P.
CITY OF O'FALLON
ZONED: R-2

HOMEFIELD BOULEVARD

HOMEFIELD TOWN LOOP (50' W PUBLIC)

MAX AVENUE (PUBLIC)

S 88°51'16" E 233.27'

L=230.81' R=330.00

S 53°45'07" E 499.99'

N 00°19'55" E 1087.32'

GRAPHIC SCALE

(IN FEET)
1 inch = 40 ft.

CLIFFORD L. HEITMANN
CIVIL ENGINEER
029817

UNDERGROUND UTILITIES HAVE BEEN PLOTTED FROM AVAILABLE INFORMATION AND THEREFORE THEIR LOCATIONS SHALL BE CONSIDERED APPROXIMATE ONLY. THE VERIFICATION OF THE LOCATION OF ALL UNDERGROUND UTILITIES, EITHER SHOWN OR NOT SHOWN ON THESE PLANS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR, AND SHALL BE LOCATED PRIOR TO ANY GRADING OR CONSTRUCTION OF THE IMPROVEMENTS.

DRAINAGE AREA MAP

HOMEFIELD VILLAS & TOWNHOMES OF HOMEFIELD

97-9203AB

10-21-09

LOT A
PROPERTY N/F
O'FALLON LEASED HOUSING
ASSOCIATES, L.P.
CITY OF O'FALLON
ZONED: R-2
PROPERTY N/F
COLIN L. &
JANET K. FOSTER
1701/863
CITY OF O'FALLON
ZONED: C-2
PROPERTY N/F
CITY OF O'FALLON
4442/1207
CITY OF O'FALLON
ZONED: P-R
PROPERTY N/F
BANK OF OLD MONROE
CITY OF O'FALLON
ZONED: C-2 P.U.D.
PROPERTY N/F TERRY OHLMS
REVOCABLE TRUST 4971/1413
CITY OF O'FALLON ZONED: C-2 P.U.D.
T.R. HUGHES BLVD.
TOM GINNEVER AVE
(VARIABLE WIDTH)
CLOVER
(50'W) LANE
MAX AVENUE (PRIVATE)
HOME VILLA LOOP (60'W PUBLIC)
GRAPHIC SCALE
(IN FEET)
1 inch = 40 ft.
ONSITE:
0.89 ac. @ 3.30
0.40 ac. @ 3.85
OFFSITE:
2.17 ac. @ 2.64
TQ=10.21 c.f.s.
1.12 ac. @3.85
Q = 4.32 c.f.s.
N 89°31'34" W
S 00°13'35" W
250.00
N 00°19'55" E
1087.32
PROPOSED TQ-10 YR
=41.21cfs (W/O RAIN GARDENS)
=40.93cfs (W/RAIN GARDENS)

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ASBUILT STORMWATER DETENTION ANALYSIS
PREPARED BY: BAX ENGINEERING

THE TOWNHOMES OF HOMEFIELD AND HOMEFIELD VILLAS
BAX PROJECT NO. 97-9203AB
October 18, 2011

INTRODUCTION

The presently undeveloped tract of land lies North of Tom Ginnever Avenue, and Southwest of Homefield Blvd. in the City of O'Fallon, Missouri. The 15.21 acre overall tract is to be developed into two residential developments, The Townhomes of Homefield and Homefield Villas.

A lake is proposed in the south west area of the site. This will provide storm water detention for both developments as per the City of O'Fallon requirements and discharge into the existing storm water system along Tom Ginnever Avenue.

The lake has been analyzed for the 2- year, 15-year, 25 year and 100 year, 20 minute design storms and all have been checked for safe passage of the 100 year, 20 minute design storm under low-flow blocked conditions.

GENERAL SITE AND RUNOFF CALCULATIONS

The pre-developed and post-developed P.I. factors used in the analysis are:

	20 minute storm 2 year	20 minute storm 15 year	20 minute storm 25 year	20 minute storm 100 year
Imperviousness				
Undeveloped/Greenspace – 5%	1.15	1.87	2.31	2.95
10,000 ft^2 – 40%	1.61	2.64	3.26	4.17
Multi-Family – 70%	2.00	3.30	4.07	5.21
Commercial – 100%	2.39	3.85	4.75	6.08

CITY OF O'FALLON
COMMUNITY DEVELOPMENT DEPARTMENT
ACCEPTED FOR CONSTRUCTION
BY: _____ DATE: 10/26/11
PROFESSIONAL ENGINEER'S SEAL
INDICATES RESPONSIBILITY FOR DESIGN

STATE OF MISSOURI
TODD C. FLAUAUS
NUMBER PE-2005000982
PROFESSIONAL ENGINEER
10/18/11

PREDEVELOPED RUNOFF

15 YR – 20 Minute Storm

Ac		cfs/Ac		cfs
15.21	@	1.87	=	28.44
	Total =			28.44

2 Year-20 Minute Storm:	17.49 cfs
15 Year-20 Minute Storm:	28.44 cfs
25 Year-20 Minute Storm:	35.14 cfs
100 Year-20 Minute Storm:	44.87 cfs

POSTDEVELOPED RUNOFF

15 YR – 20 Minute Storm

Ac		cfs/Ac		cfs
14.81	@	3.30	=	48.87
0.40	@	3.85	=	1.54
	Total =			50.41

2 Year-20 Minute Storm:	30.58 cfs
15 Year-20 Minute Storm:	50.41 cfs
25 Year-20 Minute Storm:	62.18 cfs
100 Year-20 Minute Storm:	79.59 cfs

REQUIRED ATTENUATION

Design Storm	Postdeveloped Runoff	-	Predeveloped Runoff	=	Required Attenuation
2 Year	30.58 cfs	-	17.49 cfs	=	13.08 cfs
15 Year	50.41 cfs	-	28.44 cfs	=	21.97 cfs
25 Year	62.18 cfs	-	35.14 cfs	=	27.04 cfs
100 Year	79.59 cfs	-	44.87 cfs	=	34.72 cfs

INFLOW TO THE DETENTION LAKE

Time of Concentration

The time of concentration flow path begins off-site to the north of the site. Runoff flows approximately 270 feet overland to ~~AI-5~~ AI 53. From there it flows approximately ~~910'~~ 1017 via pipe to FE 2 at the lake. Time of concentration flow path is labeled on the attached Drainage Area Map. Time of concentration is estimated as follows:

Tc = tc1 + tc2

tc1 L=270'

Elevation Difference = ~~6.50~~ 4.00'

tc1 (overland) = ~~**2.50** minutes~~ 3.00: see Figure 1

tc2 L=~~910'~~ 1017

Velocity of 5.0 ft./sec.

tc2 (pipe) = ~~165.71~~ 203.40 seconds = ~~**3.03** minutes~~ 3.39

Tc = ~~2.50~~ 3.00 minutes + ~~3.03~~ 3.39 minutes = ~~5.53~~ 6.39 minutes => **Use 5 minutes**

Lake Inflow

15 YR – 20 Minute Storm

	Ac 10.39		cfs/Ac		cfs
Onsite	~~10.70~~ 10.18	@	3.30	=	~~35.33 cfs~~ ~~33.61~~ cfs 34.29
Onsite	0.40 ✓	@	3.85	=	~~6.12~~ cfs 1.54
Offsite	2.32 ✓	@	2.64	=	1.54 cfs 6.12
			Total =		~~43.00 cfs~~ ~~41.27~~ cfs 41.95

2 Year-20 Minute Storm:	~~26.11 cfs~~	~~25.06~~ cfs 25.47
15 Year-20 Minute Storm:	~~43.00 cfs~~	~~41.27~~ cfs 41.95
25 Year-20 Minute Storm:	~~53.04 cfs~~	~~50.91~~ cfs 51.75
100 Year-20 Minute Storm:	~~67.89 cfs~~	65.17 cfs 66.24

ALLOWABLE RELEASE RATE

Design Storm	Lake Inflow		-	Required Attenuation	=	Allowable Release Rate	
2 Year	~~26.11 cfs~~	~~25.06~~ cfs	-25.47	13.08 cfs ✓	=	~~13.02 cfs~~	~~11.97~~ cfs 12.39
15 Year	~~43.00 cfs~~	~~41.27~~ cfs	-41.95	21.97 cfs ✓	=	~~21.03 cfs~~	~~19.30~~ cfs 19.98
25 Year	~~53.04 cfs~~	~~50.91~~ cfs	-51.75	27.04 cfs ✓	=	~~26.00 cfs~~	~~23.87~~ cfs 24.71
100 Year	~~67.89 cfs~~	~~65.17~~ cfs	-66.24	34.72 cfs ✓	=	~~33.17 cfs~~	~~30.44~~ cfs 31.52

STORM ROUTING CALCULATIONS AND RESULTS

A computer program, Pond Pack 10 was used to aid in the routing of the lake. The 100-year low flow blocked analysis was also checked for the lake. As found in the routing calculations attached, the results are as follows for free outlet flow:

Design Storm	Lake Inflow 25.47		Allowable Release Rate		Calculated Release Rate		High Water	
2 Year	~~26.11 cfs~~	~~25.06~~ cfs	~~13.02 cfs~~ 12.39	~~11.97~~ cfs	~~10.35 cfs~~	8.88 cfs ✓	~~490.40~~	490.38 ✓
15 Year	~~43.00 cfs~~	~~41.27~~ cfs 41.95	~~21.03 cfs~~ 19.98	~~19.30~~ cfs	~~19.14 cfs~~	17.32 cfs ✓	~~491.11~~	491.00 ✓
25 Year	~~53.04 cfs~~	~~50.91~~ cfs 51.75	~~26.00 cfs~~ 24.71	~~23.87~~ cfs	~~21.59 cfs~~	19.52 cfs ✓	~~491.55~~	491.38 ✓
100 Year	~~67.89 cfs~~	~~65.17~~ cfs 66.24	~~33.17 cfs~~ 31.52	~~30.44~~ cfs	~~24.99 cfs~~	22.57 cfs ✓	~~492.20~~	491.95 ✓
100 Year (low flow blocked)	~~67.89 cfs~~	~~65.17~~ cfs 66.24	------- cfs		~~63.96 cfs~~	57.71 cfs ✓	~~494.09~~	494.21 ✓

SEDIMENT VOLUME CALCULATION:

The lake shall be analyzed to accommodate 2 years of sediment storage.

-The Drainage area to the lake = ~~12.73 Acres~~ ~~12.90~~ 13.11 Acres
-Rational Method runoff coefficient 'c'= 0.06
-Annual sediment storage volume (from figure 2) = 120 ft^3/Acre
-The sediment volume and storage required =

2 years of sediment storage = 12.90 Acres (120 ft^3/Acre/year)(2 years)

2 years of sediment storage = ~~3,089 ft^3~~ 3,096 ft^3

To provide for the additional sediment storage the top of the overflow sill will be set at ~~493.00~~ 493.19.

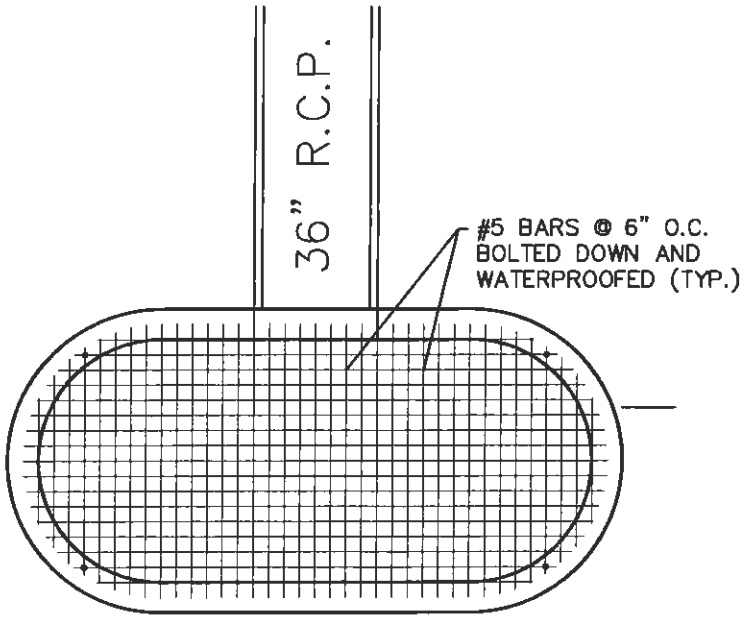
Volume between the 100-year high water of ~~492.20~~ 491.95 and the overflow sill elevation of ~~493.00~~ 493.19 is ~~22,196 ft^3~~ 31,960 ft^3.

~~22,196 ft^3 provided > 3,089 ft^3 required~~
31,960 ft^3 provided > 3,096 ft^3 required

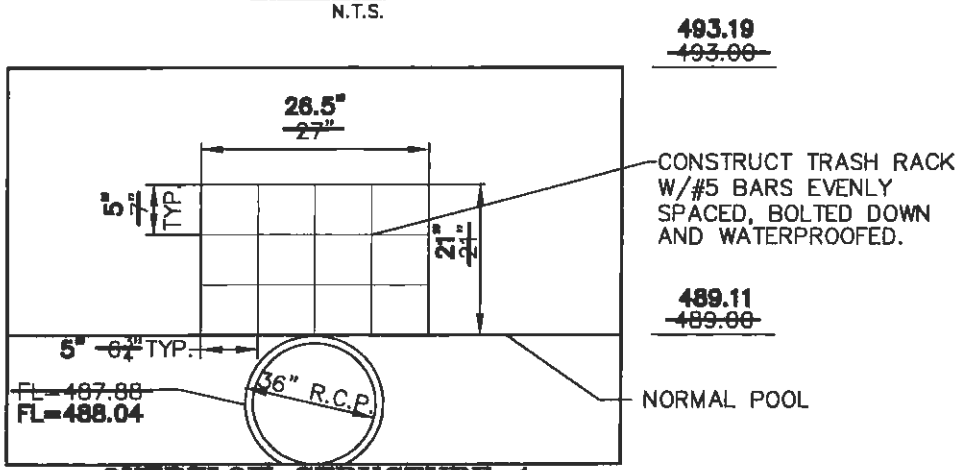
SUMMARY

2 Year, 20 Minute H.W.	~~490.40~~	490.38
15 Year, 20 Minute H.W.	~~491.11~~	491.00
25 Year, 20 Minute H.W.	~~491.55~~	491.38
100 Year, 20 Minute H.W.	~~492.20~~	491.95
100 Year, 20 Minute Low Flow Blocked	~~494.09~~	494.21
Structure	Double Area Inlet Base	
Low Flow Slot	~~1.75' H x 2.25' W~~	1.75' H x 2.21' W
Elevation	~~489.00~~	489.11
Structure Crest Elevation	~~493.00~~	493.19
Top of Dam	~~499~~	496.14
Freeboard for 100 Year with low flow blocked	~~4.91'~~	1.93'

STRUCTURE DETAILS



TOP VIEW
N.T.S.



OVERFLOW STRUCTURE 1
N.T.S.

POND 10

Routing Calculations for

2, 15, and 25 Year 20 Minute Design Storms

Table of Contents

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)
Inflow	D-100 Year	0	1.795	5.000	65.17
Inflow	A-2 Year	0	0.690	5.000	25.06
Inflow	B-15 Year	0	1.137	5.000	41.27
Inflow	C-25 Year	0	1.402	5.000	50.91

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)
Out 10	D-100 Year	0	1.777	24.000	22.57
Out 10	A-2 Year	0	0.690	23.000	8.88
Out 10	B-15 Year	0	1.126	24.000	17.32
Out 10	C-25 Year	0	1.388	24.000	19.52

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
Lake (IN)	D-100 Year	0	1.777	6.000	65.17	(N/A)	(N/A)
Lake (OUT)	D-100 Year	0	1.777	24.000	22.57	491.95	2.082
Lake (IN)	A-2 Year	0	0.690	5.000	25.06	(N/A)	(N/A)
Lake (OUT)	A-2 Year	0	0.690	23.000	8.88	490.38	1.290
Lake (IN)	B-15 Year	0	1.126	6.000	41.27	(N/A)	(N/A)
Lake (OUT)	B-15 Year	0	1.126	24.000	17.32	491.00	1.587
Lake (IN)	C-25 Year	0	1.388	6.000	50.91	(N/A)	(N/A)
Lake (OUT)	C-25 Year	0	1.388	24.000	19.52	491.38	1.779

Subsection: Planimeter Volume Curve
Label: Lake

Return Event: 15 years
Storm Event:

Pond Volume Calculations

Scale (Planimeter): 1.000 ft/in

Elevation (ft)	Planimeter (ft^2)	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
487.00	92.31	0.305	0.000	0.000	0.000
488.00	105.34	0.348	0.979	0.326	0.326
489.00	119.12	0.394	1.112	0.371	0.697
490.00	134.37	0.444	1.256	0.419	1.116
491.00	149.51	0.494	1.407	0.469	1.585
492.00	167.37	0.553	1.570	0.523	2.108
493.00	186.35	0.616	1.753	0.584	2.693
494.00	205.98	0.681	1.945	0.648	3.341
495.00	226.25	0.748	2.142	0.714	4.055
496.00	247.15	0.817	2.347	0.782	4.837

Pond Volume Equations
* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2 - El1) * (Area1 + Area2 + sqr(Area1 * Area2))

where:	EL1, EL2	Lower and upper elevations of the increment
	Area1, Area2	Areas computed for EL1, EL2, respectively
	Volume	Incremental volume between EL1 and EL2

Requested Pond Water Surface Elevations	
Minimum (Headwater)	487.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	496.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	1	Forward	cv	489.11	490.86
Inlet Box	5	Forward	cv	493.19	~~498.00~~ 496.37
Orifice-Area	2	Forward	cv	490.86	~~498.00~~ 496.37
Culvert-Circular	cv	Forward	TW	488.04	496.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: 1 Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	489.11 ft
Weir Length	2.21 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: 2 Structure Type: Orifice-Area	
Number of Openings	1
Elevation	489.11 ft
Orifice Area	3.86 ft²
Top Elevation	490.86 ft
Datum Elevation	489.99 ft
Orifice Coefficient	0.600

Structure ID: 5 Structure Type: Inlet Box	
Number of Openings	1
Elevation	493.19 ft
Orifice Area	21.06 ft²
Orifice Coefficient	0.600
Weir Length	18.76 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Structure ID: cv Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	36.0 in
Length	54.01 ft
Length (Computed Barrel)	54.01 ft
Slope (Computed)	0.011 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.500
Kb	0.007
Kr	0.200
Convergence Tolerance	0.00 ft

Outlet Control Data

Inlet Control Data	
Equation Form	Form 1
K	0.0098
M	2.0000
C	0.0398
Y	0.6700
T1 ratio (HW/D)	1.155
T2 ratio (HW/D)	1.301
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	491.50 ft	T1 Flow	42.85 ft^3/s
T2 Elevation	491.94 ft	T2 Flow	48.97 ft^3/s

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall
Convergence Tolerances	
Maximum Iterations	40
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft^3/s
Flow Tolerance (Maximum)	10.000 ft^3/s

Subsection: Composite Rating Curve
Label: Outlet 1

Return Event: 15 years
Storm Event:

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
487.00	0.00	(N/A)	0.00
487.10	0.00	(N/A)	0.00
487.20	0.00	(N/A)	0.00
487.30	0.00	(N/A)	0.00
487.40	0.00	(N/A)	0.00
487.50	0.00	(N/A)	0.00
487.60	0.00	(N/A)	0.00
487.70	0.00	(N/A)	0.00
487.80	0.00	(N/A)	0.00
487.90	0.00	(N/A)	0.00
488.00	0.00	(N/A)	0.00
488.04	0.00	(N/A)	0.00
488.10	0.00	(N/A)	0.00
488.20	0.00	(N/A)	0.00
488.30	0.00	(N/A)	0.00
488.40	0.00	(N/A)	0.00
488.50	0.00	(N/A)	0.00
488.60	0.00	(N/A)	0.00
488.70	0.00	(N/A)	0.00
488.80	0.00	(N/A)	0.00
488.90	0.00	(N/A)	0.00
489.00	0.00	(N/A)	0.00
489.10	0.00	(N/A)	0.00
489.11	0.00	(N/A)	0.00
489.20	0.18	(N/A)	0.00
489.30	0.55	(N/A)	0.00
489.40	1.04	(N/A)	0.00
489.50	1.61	(N/A)	0.00
489.60	2.27	(N/A)	0.00
489.70	3.00	(N/A)	0.00
489.80	3.80	(N/A)	0.00
489.90	4.65	(N/A)	0.00
490.00	5.53	(N/A)	0.00
490.10	6.38	(N/A)	0.00
490.20	7.24	(N/A)	0.00
490.30	8.13	(N/A)	0.00
490.40	9.03	(N/A)	0.00
490.50	9.96	(N/A)	0.00
490.60	10.92	(N/A)	0.00
490.70	11.88	(N/A)	0.00
490.80	12.88	(N/A)	0.00
490.90	16.70	(N/A)	0.00
491.00	17.30	(N/A)	0.00
491.10	17.89	(N/A)	0.00

Subsection: Composite Rating Curve
Label: Outlet 1

Return Event: 15 years
Storm Event:

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)
491.20	18.47	(N/A)	0.00
491.30	19.04	(N/A)	0.00
491.40	19.61	(N/A)	0.00
491.50	20.17	(N/A)	0.00
491.60	20.73	(N/A)	0.00
491.70	21.27	(N/A)	0.00
491.80	21.79	(N/A)	0.00
491.90	22.31	(N/A)	0.00
492.00	22.82	(N/A)	0.00
492.10	23.35	(N/A)	0.00
492.20	23.86	(N/A)	0.00
492.30	24.35	(N/A)	0.00
492.40	24.83	(N/A)	0.00
492.50	25.30	(N/A)	0.00
492.60	25.80	(N/A)	0.00
492.70	26.25	(N/A)	0.00
492.80	26.74	(N/A)	0.00
492.90	27.22	(N/A)	0.00
493.00	27.64	(N/A)	0.00
493.10	28.10	(N/A)	0.00
493.19	28.51	(N/A)	0.00
493.20	28.61	(N/A)	0.00
493.30	30.54	(N/A)	0.00
493.40	33.45	(N/A)	0.00
493.50	37.08	(N/A)	0.00
493.60	41.25	(N/A)	0.00
493.70	45.89	(N/A)	0.00
493.80	50.92	(N/A)	0.00
493.90	55.67	(N/A)	0.00
494.00	60.27	(N/A)	0.00
494.10	64.71	(N/A)	0.00
494.20	68.78	(N/A)	0.00
494.30	72.16	(N/A)	0.00
494.40	74.04	(N/A)	0.00
494.50	74.89	(N/A)	0.00
494.60	75.72	(N/A)	0.00
494.70	76.53	(N/A)	0.00
494.80	77.35	(N/A)	0.00
494.90	78.17	(N/A)	0.00
495.00	78.96	(N/A)	0.00
495.10	79.75	(N/A)	0.00
495.20	80.54	(N/A)	0.00
495.30	81.31	(N/A)	0.00
495.40	82.08	(N/A)	0.00

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)
495.50	82.84	(N/A)	0.00
495.60	83.59	(N/A)	0.00
495.70	84.34	(N/A)	0.00
495.80	85.08	(N/A)	0.00
495.90	85.82	(N/A)	0.00
496.00	86.55	(N/A)	0.00

Contributing Structures
(no Q: 1,5,2,cv)
(no Q: 1,5,2,cv)
(no Q: 1,5,2,cv)
(no Q: 1,5,2,cv)
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Composite Outflow Summary

Contributing Structures
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Subsection: Composite Rating Curve
Label: Outlet 1

Return Event: 15 years
Storm Event:

Composite Outflow Summary

Contributing Structures
5,cv (no Q: 1,2)
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Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	489.11 ft
Volume (Initial)	0.741 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	1.000 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	25.06 ft³/s	Time to Peak (Flow, In)	5.000 min
Flow (Peak Outlet)	8.88 ft³/s	Time to Peak (Flow, Outlet)	23.000 min

Elevation (Water Surface, Peak)	490.38 ft
Volume (Peak)	1.290 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.741 ac-ft
Volume (Total Inflow)	0.690 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.690 ac-ft
Volume (Retained)	0.741 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

Subsection: Level Pool Pond Routing Summary
Label: Lake (IN)

Return Event: 15 years
Storm Event:

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	489.11 ft
Volume (Initial)	0.741 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	3.000 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	41.27 ft³/s	Time to Peak (Flow, In)	6.000 min
Flow (Peak Outlet)	17.32 ft³/s	Time to Peak (Flow, Outlet)	24.000 min

Elevation (Water Surface, Peak)	491.00 ft
Volume (Peak)	1.587 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.741 ac-ft
Volume (Total Inflow)	1.126 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	1.126 ac-ft
Volume (Retained)	0.741 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	489.11 ft
Volume (Initial)	0.741 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	3.000 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	50.91 ft³/s	Time to Peak (Flow, In)	6.000 min
Flow (Peak Outlet)	19.52 ft³/s	Time to Peak (Flow, Outlet)	24.000 min

Elevation (Water Surface, Peak)	491.38 ft
Volume (Peak)	1.779 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.741 ac-ft
Volume (Total Inflow)	1.388 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	1.388 ac-ft
Volume (Retained)	0.741 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

Subsection: Level Pool Pond Routing Summary
Label: Lake (IN)

Return Event: 100 years
Storm Event:

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	489.11 ft
Volume (Initial)	0.741 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	3.000 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	65.17 ft³/s	Time to Peak (Flow, In)	6.000 min
Flow (Peak Outlet)	22.57 ft³/s	Time to Peak (Flow, Outlet)	24.000 min

Elevation (Water Surface, Peak)	491.95 ft
Volume (Peak)	2.082 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.741 ac-ft
Volume (Total Inflow)	1.777 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	1.777 ac-ft
Volume (Retained)	0.741 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

Summary for Hydrograph Addition at 'Lake'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	Inflow

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (min)	Flow (Peak) (ft^3/s)
Flow (From)	Inflow	0.690	5.000	25.06
Flow (In)	Lake	0.690	5.000	25.06

Summary for Hydrograph Addition at 'Lake'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	Inflow

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (min)	Flow (Peak) (ft^3/s)
Flow (From)	Inflow	1.137	5.000	41.27
Flow (In)	Lake	1.126	6.000	41.27

Summary for Hydrograph Addition at 'Lake'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	Inflow

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (min)	Flow (Peak) (ft^3/s)
Flow (From)	Inflow	1.402	5.000	50.91
Flow (In)	Lake	1.388	6.000	50.91

Summary for Hydrograph Addition at 'Lake'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	Inflow

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (min)	Flow (Peak) (ft^3/s)
Flow (From)	Inflow	1.795	5.000	65.17
Flow (In)	Lake	1.777	6.000	65.17

POND 10
Routing Calculations for
100 Year 20 Minute Design Storms
Low Flow Slots Blocked

Table of Contents

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)
Inflow	D-100 Year	0	1.795	5.000	65.17

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)
Out 10	D-100 Year	0	1.777	21.000	57.71

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
Lake (IN)	D-100 Year	0	1.777	6.000	65.17	(N/A)	(N/A)
Lake (OUT)	D-100 Year	0	1.777	21.000	57.71	494.21	3.483

Subsection: Planimeter Volume Curve
Label: Lake

Return Event: 100 years
Storm Event:

Pond Volume Calculations

Scale (Planimeter): 1.000 ft/in

Elevation (ft)	Planimeter (ft^2)	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
487.00	92.31	0.305	0.000	0.000	0.000
488.00	105.34	0.348	0.979	0.326	0.326
489.00	119.12	0.394	1.112	0.371	0.697
490.00	134.37	0.444	1.256	0.419	1.116
491.00	149.51	0.494	1.407	0.469	1.585
492.00	167.37	0.553	1.570	0.523	2.108
493.00	186.35	0.616	1.753	0.584	2.693
494.00	205.98	0.681	1.945	0.648	3.341
495.00	226.25	0.748	2.142	0.714	4.055
496.00	247.15	0.817	2.347	0.782	4.837

Pond Volume Equations
* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2 - El1) * (Area1 + Area2 + sqr(Area1 * Area2))

where:	EL1, EL2	Lower and upper elevations of the increment
	Area1, Area2	Areas computed for EL1, EL2, respectively
	Volume	Incremental volume between EL1 and EL2

Requested Pond Water Surface Elevations	
Minimum (Headwater)	487.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	496.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Inlet Box	5	Forward	cv	493.19	498.00
Culvert-Circular	cv	Forward	TW	488.04	496.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: 5 Structure Type: Inlet Box	
Number of Openings	1
Elevation	493.19 ft
Orifice Area	21.06 ft²
Orifice Coefficient	0.600
Weir Length	18.76 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Structure ID: cv Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	36.0 in
Length	54.01 ft
Length (Computed Barrel)	54.01 ft
Slope (Computed)	0.011 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.500
Kb	0.007
Kr	0.200
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0098
M	2.0000
C	0.0398
Y	0.6700
T1 ratio (HW/D)	1.155
T2 ratio (HW/D)	1.301
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	491.50 ft	T1 Flow	42.85 ft^3/s
T2 Elevation	491.94 ft	T2 Flow	48.97 ft^3/s

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall
Convergence Tolerances	
Maximum Iterations	40
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft^3/s
Flow Tolerance (Maximum)	10.000 ft^3/s

Subsection: Composite Rating Curve
Label: LFB

Return Event: 100 years
Storm Event:

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
487.00	0.00	(N/A)	0.00
487.10	0.00	(N/A)	0.00
487.20	0.00	(N/A)	0.00
487.30	0.00	(N/A)	0.00
487.40	0.00	(N/A)	0.00
487.50	0.00	(N/A)	0.00
487.60	0.00	(N/A)	0.00
487.70	0.00	(N/A)	0.00
487.80	0.00	(N/A)	0.00
487.90	0.00	(N/A)	0.00
488.00	0.00	(N/A)	0.00
488.04	0.00	(N/A)	0.00
488.10	0.00	(N/A)	0.00
488.20	0.00	(N/A)	0.00
488.30	0.00	(N/A)	0.00
488.40	0.00	(N/A)	0.00
488.50	0.00	(N/A)	0.00
488.60	0.00	(N/A)	0.00
488.70	0.00	(N/A)	0.00
488.80	0.00	(N/A)	0.00
488.90	0.00	(N/A)	0.00
489.00	0.00	(N/A)	0.00
489.10	0.00	(N/A)	0.00
489.20	0.00	(N/A)	0.00
489.30	0.00	(N/A)	0.00
489.40	0.00	(N/A)	0.00
489.50	0.00	(N/A)	0.00
489.60	0.00	(N/A)	0.00
489.70	0.00	(N/A)	0.00
489.80	0.00	(N/A)	0.00
489.90	0.00	(N/A)	0.00
490.00	0.00	(N/A)	0.00
490.10	0.00	(N/A)	0.00
490.20	0.00	(N/A)	0.00
490.30	0.00	(N/A)	0.00
490.40	0.00	(N/A)	0.00
490.50	0.00	(N/A)	0.00
490.60	0.00	(N/A)	0.00
490.70	0.00	(N/A)	0.00
490.80	0.00	(N/A)	0.00
490.90	0.00	(N/A)	0.00
491.00	0.00	(N/A)	0.00
491.10	0.00	(N/A)	0.00
491.20	0.00	(N/A)	0.00

Subsection: Composite Rating Curve
Label: LFB

Return Event: 100 years
Storm Event:

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
491.30	0.00	(N/A)	0.00
491.40	0.00	(N/A)	0.00
491.50	0.00	(N/A)	0.00
491.60	0.00	(N/A)	0.00
491.70	0.00	(N/A)	0.00
491.80	0.00	(N/A)	0.00
491.90	0.00	(N/A)	0.00
492.00	0.00	(N/A)	0.00
492.10	0.00	(N/A)	0.00
492.20	0.00	(N/A)	0.00
492.30	0.00	(N/A)	0.00
492.40	0.00	(N/A)	0.00
492.50	0.00	(N/A)	0.00
492.60	0.00	(N/A)	0.00
492.70	0.00	(N/A)	0.00
492.80	0.00	(N/A)	0.00
492.90	0.00	(N/A)	0.00
493.00	0.00	(N/A)	0.00
493.10	0.00	(N/A)	0.00
493.19	0.00	(N/A)	0.00
493.20	0.06	(N/A)	0.00
493.30	2.05	(N/A)	0.00
493.40	5.42	(N/A)	0.00
493.50	9.71	(N/A)	0.00
493.60	14.77	(N/A)	0.00
493.70	20.49	(N/A)	0.00
493.80	26.80	(N/A)	0.00
493.90	33.68	(N/A)	0.00
494.00	41.04	(N/A)	0.00
494.10	48.86	(N/A)	0.00
494.20	57.13	(N/A)	0.00
494.30	65.82	(N/A)	0.00
494.40	74.03	(N/A)	0.00
494.50	74.88	(N/A)	0.00
494.60	75.72	(N/A)	0.00
494.70	76.53	(N/A)	0.00
494.80	77.35	(N/A)	0.00
494.90	78.17	(N/A)	0.00
495.00	78.96	(N/A)	0.00
495.10	79.75	(N/A)	0.00
495.20	80.54	(N/A)	0.00
495.30	81.31	(N/A)	0.00
495.40	82.08	(N/A)	0.00
495.50	82.84	(N/A)	0.00

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)
495.60	83.59	(N/A)	0.00
495.70	84.34	(N/A)	0.00
495.80	85.08	(N/A)	0.00
495.90	85.82	(N/A)	0.00
496.00	86.55	(N/A)	0.00

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Composite Outflow Summary

Contributing Structures
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Subsection: Composite Rating Curve
Label: LFB

Return Event: 100 years
Storm Event:

Composite Outflow Summary

Contributing Structures
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Subsection: Level Pool Pond Routing Summary
Label: Lake (IN)

Return Event: 100 years
Storm Event:

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	493.19 ft
Volume (Initial)	2.811 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	3.000 min

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	65.17 ft³/s	Time to Peak (Flow, In)	6.000 min
Flow (Peak Outlet)	57.71 ft³/s	Time to Peak (Flow, Outlet)	21.000 min

Elevation (Water Surface, Peak)	494.21 ft
Volume (Peak)	3.483 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	2.811 ac-ft
Volume (Total Inflow)	1.777 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	1.777 ac-ft
Volume (Retained)	2.811 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

Summary for Hydrograph Addition at 'Lake'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	Inflow

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (min)	Flow (Peak) (ft^3/s)
Flow (From)	Inflow	1.795	5.000	65.17
Flow (In)	Lake	1.777	6.000	65.17