

**DRAINAGE CALCULATIONS**  
**APPENDIX**

**SECTION II**  
**SUMMARY OF PROJECT CRITERIA**

*REVISED*  
*February 4, 2021*

BENTLEY ARCHITECTS + ENGINEERS, INC.			
<b>PROJECT TITLE:</b>	Clermont Public Works Facility		
<b>PROJECT NUMBER:</b>	2017.072	<b>DATE:</b>	2/4/2021
		<b>CALC'D BY:</b>	CMR
		<b>CHECKED BY:</b>	MAV

Project Criteria - Peak Flow Attenuation					
Agency	Requirement	Pre-Development (cfs)		Post-Development (cfs)	Remarks
St. Johns River Water Management District (SJWMD Permit Information Manual)	Section 3.2.1.a Mean annual / 24-Hour peak discharge rate (Pre vs. Post)	North: 0.37 South: 0.08 Waterbrooke: 1.02		0.12 0.04 0.14	See Appendix Sections III and IV for detailed ICPR model routing results.
	Section 3.2.1.b 25-Year / 24-Hour peak discharge rate (Pre vs. Post)	North: 1.62 South: 0.35 Waterbrooke: 4.61		0.31 0.08 0.71	See Appendix Sections III and IV for detailed ICPR model routing results.
City of Clermont (Land Development Code)	Section 94-221.c.2 10-Year / 2-Hour peak discharge rate (Pre vs. Post)	North: 0.80 South: 0.17 Waterbrooke: 1.86		1.08 0.37 0.18	See Appendix Sections III and IV for detailed ICPR model routing results.

Project Criteria - Discharge Volume Attenuation					
Agency	Requirement	Pre-Development (cu.ft.)		Post-Development (cu.ft.)	Remarks
St. Johns River Water Management District (SJWMD Permit Information Manual)	Section 3.2.1.c 25-Year / 96-Hour discharge volume (Pre vs. Post)	North: 102,929 South: 22,075 Waterbrooke: 300,243		18,122 3,892 104,884	See Appendix Sections III and IV for detailed ICPR model routing results.
City of Clermont (Land Development Code)	Section 94-221.c.2 50-Year / 24-Hour discharge volume (Pre vs. Post)	North: 79,889 South: 17,130 Waterbrooke: 231,508		14,991 3,382 35,086	See Appendix Sections III and IV for detailed ICPR model routing results.

Project Criteria - Treatment Volume			
Agency	Requirement	Treatment Volume (Ac.ft.)	Remarks
St. Johns River Water Management District (SJWMD Permit Information Manual)	Section 5.2.b The greater of: 1" over drainage area, or 1.25" over impervious + 0.5" over drainage area	2.769 3.361	Drainage area for these calcs includes Parcels A, B, C, and D and the Hancock Road widening area. = 33.23 Ac. X 1.00 in. = 18.98 Ac. X 1.25 in. + 33.23 Ac. X 0.50 in.
	Section 5.2.c Runoff from the 3-Year / 1-Hour storm	5.290	See Appendix Section IV for detailed ICPR model routing results.
	Section 13.7.a.1.i (Table 17.3-1) 4" over project area	11.078	= 33.23 Ac. X 4.00 in. Based on commercial developments (80% maximum impervious) with Hydrologi Soil Group A
	<b>Required Treatment Volume</b>	<b>11.078</b>	

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Project Criteria - Recovery Time			
Agency	Requirement	Recovery Time (hours)	Remarks
St. Johns River Water Management District (SJWMD Permit Information Manual)	Section 3.2.7 Recover retention volume to provide attenuation for peak discharge rates and discharge	approx. 9 days	See Appendix Sections V for detailed Ponds recovery analysis results.
	Section 5.3 Recover treatment volume within 72 hours	less than 12 hours	See Appendix Sections V for detailed Ponds recovery analysis results.

Project Criteria - Phosphorous (P) Load Discharge			
Agency	Requirement	P Load Discharge (kg/yr.)	Remarks
St. Johns River Water Management District (SJWMD Permit Information Manual)	Section 13.7.a.1.ii & 13.7.a.3 Post-development P Load Discharge must not exceed Pre-Development P Load Discharge	Pre-Development P Load Discharge: 0.121	Calculations Includes Parcels A, C, and D only. From Table 13.7-3 (Parcels A, C, and D are Open Land with HSG A) = 30.34 Ac. X 0.004 /Ac.-yr
		Post-Development P Load: 22.497	From Table 13.7-3 (Parcels A and D are Commercial with HSG A; Parcel C is Open Land with HSG A) A & D: = 25.00 Ac. X 0.899 kg/Ac.-yr C: + 5.34 Ac. X 0.004 kg/Ac.-yr
		Load Removal: 22.272	From Table 13.7-22 (Retention depth greater than 4 inches with residence time just under 14 days) = 22.50 kg/yr X 99 %
		Post-Development P Load Discharge: 0.225	= 22.50 kg/yr - 22.27 kg/yr See narrative for compliance discussion.

**DRAINAGE CALCULATIONS**  
**APPENDIX**

**SECTION V**  
**RECOVERY ANALYSIS**

*REVISED*  
*November 18, 2020*

*REVISED*  
*February 4, 2021*

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**Retention Pond Recovery - Refined Method**  
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**Project Data**

Project Name: Clermont Public Works Facility  
Simulation Description:  
Project Number: 2017.072  
Engineer : Carlos M. Rexach  
Supervising Engineer: Molly deVivero  
Date: 08-19-2019

**Aquifer Data**

Base Of Aquifer Elevation, [B] (ft datum): 120.79  
Water Table Elevation, [WT] (ft datum): 120.89  
Horizontal Saturated Hydraulic Conductivity, [Kh] (ft/day): 17.00  
Fillable Porosity, [n] (%): 30.00  
Unsaturated Vertical Infiltration Rate, [Iv] (ft/day): 17.0  
Maximum Area For Unsaturated Infiltration, [Av] (ft<sup>2</sup>): 142499.0

**Geometry Data**

Equivalent Pond Length, [L] (ft): 481.4  
Equivalent Pond Width, [W] (ft): 296.0  
Ground water mound is expected to intersect the pond bottom

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**Stage vs Area Data**

<u>Stage (ft datum)</u>	<u>Area (ft<sup>2</sup>)</u>
131.00	81601.0
131.50	84117.0
132.00	86634.0
132.50	89201.0
133.00	91768.0
133.50	94386.0
134.00	97003.0
134.50	99670.0
135.00	102338.0
135.50	105056.0
136.00	107774.0
136.50	110542.0
137.00	113310.0
137.50	116128.0
138.00	118946.0
138.50	121815.0
139.00	124684.0
139.50	127603.0
140.00	130521.0
140.50	133491.0
141.00	136460.0
141.50	139479.0
142.00	142499.0

**Ditch Data**

Ditch (or interceptor trench) parallel to length axis is inactive

Ditch (or interceptor trench) parallel to width axis is inactive

**Discharge Structures**

**Discharge Structure #1 is active as weir**

Structure Parameters

Description: Structure 8" Slot

Weir elevation, (ft datum):	139.5
Weir coefficient:	3.13
Weir length, (ft):	2
Weir exponent:	1.5

Tailwater - disabled, free discharge

**Discharge Structures (cont'd.)**

**Discharge Structure #2 is active as weir**

Structure Parameters

Description:

Weir elevation, (ft datum):	140.67
Weir coefficient:	3.13
Weir length, (ft):	5.7
Weir exponent:	1.5

Tailwater - disabled, free discharge

**Discharge Structure #3 is inactive**

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**Scenario Input Data**

*Scenario 1 :: Slug Load at Stage 139.50'*

Hydrograph Type: Slug Load  
 Modflow Routing: Routed with infiltration

Treatment Volume (ft<sup>3</sup>) 883987

Initial ground water level (ft datum) 120.89 (default)

Time After Storm Event (days)	Time After Storm Event (days)	Time After Storm Event (days)
0.100	2.000	6.000
0.250	2.500	8.000
0.500	3.000	10.000
1.000	3.500	12.000
1.500	4.000	14.000

*Scenario 2 :: Treatment Volume (11.078 ac.ft.)*

Hydrograph Type: Slug Load  
 Modflow Routing: Routed with infiltration

Treatment Volume (ft<sup>3</sup>) 482545

Initial ground water level (ft datum) 120.89 (default)

Time After Storm Event (days)	Time After Storm Event (days)	Time After Storm Event (days)
0.100	1.250	2.500
0.250	1.500	2.750
0.500	1.750	3.000
0.750	2.000	
1.000	2.250	



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**Modflow Log**

MODFLOW CONTROL PARAMETERS

Perimeter boundary condition: constant head  
Maximum iterations of outer loop: 150  
Maximum iterations of inner loop: 60  
Horizontal conductivity within pond: 1000000 (if ground water mound is expected to intersect pond bottom)  
Instantaneous storage coefficient: Volumetric balance  
Default head closure tolerance: .01  
Default residual closure tolerance: .5  
Target water budget error: 1  
On failure to converge: Rerun limiting inner loop to one iteration  
    > Maximum number of iterations of outer loop: 500  
Running Average Porosity is active  
    > Starting on pass: 2  
    > When outer iteration reaches: 50  
    > Number of data points: 4  
Running Average Pond Stage (for discharge structures with tailwater) is active  
    > Starting on pass: 2  
    > When outer iteration reaches: 50  
    > Number of data points: 4  
Grid size: 1000 ft (from pond centerline)  
Mound Output: none

Begin Scenario 1 2/4/2021 16:59:47

End Scenario 1 2/4/2021 16:59:47

Begin Scenario 2 2/4/2021 16:59:48

End Scenario 2 2/4/2021 16:59:48

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**Detailed Results** :: Scenario 1 :: Slug Load at Stage 139.50'

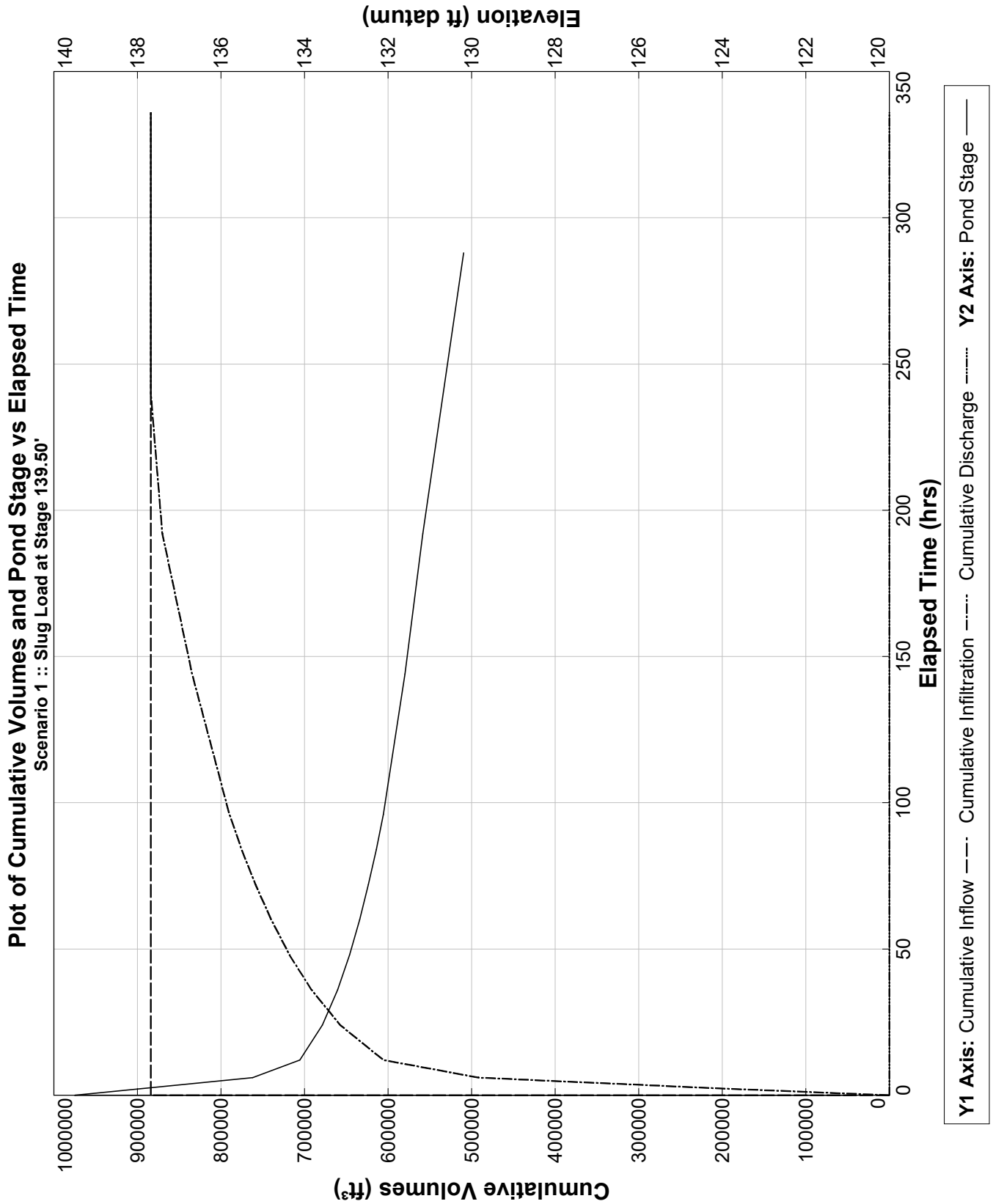
Elapsed Time (hours)	Instantaneous Inflow Rate (ft <sup>3</sup> /s)	Outside Recharge (ft/day)	Stage Elevation (ft datum)	Infiltration Rate (ft <sup>3</sup> /s)	Combined Instantaneous Discharge Rate (ft <sup>3</sup> /s)	Cumulative Inflow Volume (ft <sup>3</sup> )	Cumulative Infiltration Volume (ft <sup>3</sup> )	Combined Cumulative Discharge (ft <sup>3</sup> )	Flow Type
0.000	147331.2000	0.00000	120.89000	0.00000	0	0.000	0.0	0	N.A.
0.002	147331.2000	0.00000	139.49880	25.10643	0	883987.000	150.6	0	U/P
2.400	0.0000	0.00000	137.79720	23.23277	0	883987.000	208896.3	0	U/P
6.000	0.0000	0.00000	135.24260	15.61224	0	883987.000	491621.3	0	U/P
12.000	0.0000	0.00000	134.11040	3.91547	0	883987.000	605539.1	0	U/S
24.000	0.0000	0.00000	133.57210	0.99582	0	883987.000	657312.2	0	S
36.000	0.0000	0.00000	133.20680	0.70256	0	883987.000	691577.9	0	S
48.000	0.0000	0.00000	132.91980	0.55885	0	883987.000	718013.5	0	S
60.000	0.0000	0.00000	132.67900	0.47018	0	883987.000	739862.9	0	S
72.000	0.0000	0.00000	132.46940	0.40872	0	883987.000	758637.1	0	S
84.000	0.0000	0.00000	132.28270	0.36305	0	883987.000	775176.3	0	S
96.000	0.0000	0.00000	132.11350	0.32629	0	883987.000	790004.4	0	S
144.000	0.0000	0.00000	131.59360	0.23227	0	883987.000	834666.5	0	S
192.000	0.0000	0.00000	131.16720	0.14271	0	883987.000	870276.6	0	S
240.000	0.0000	0.00000	130.68170	0.03967	0	883987.000	883987.0	0	S
288.000	0.0000	0.00000	130.19140	0.00000	0	883987.000	883987.0	0	S
336.000	0.0000	0.00000	129.78850	----	----	883987.000	883987.0	0	N.A.

Treatment volume recovered within 10 hours

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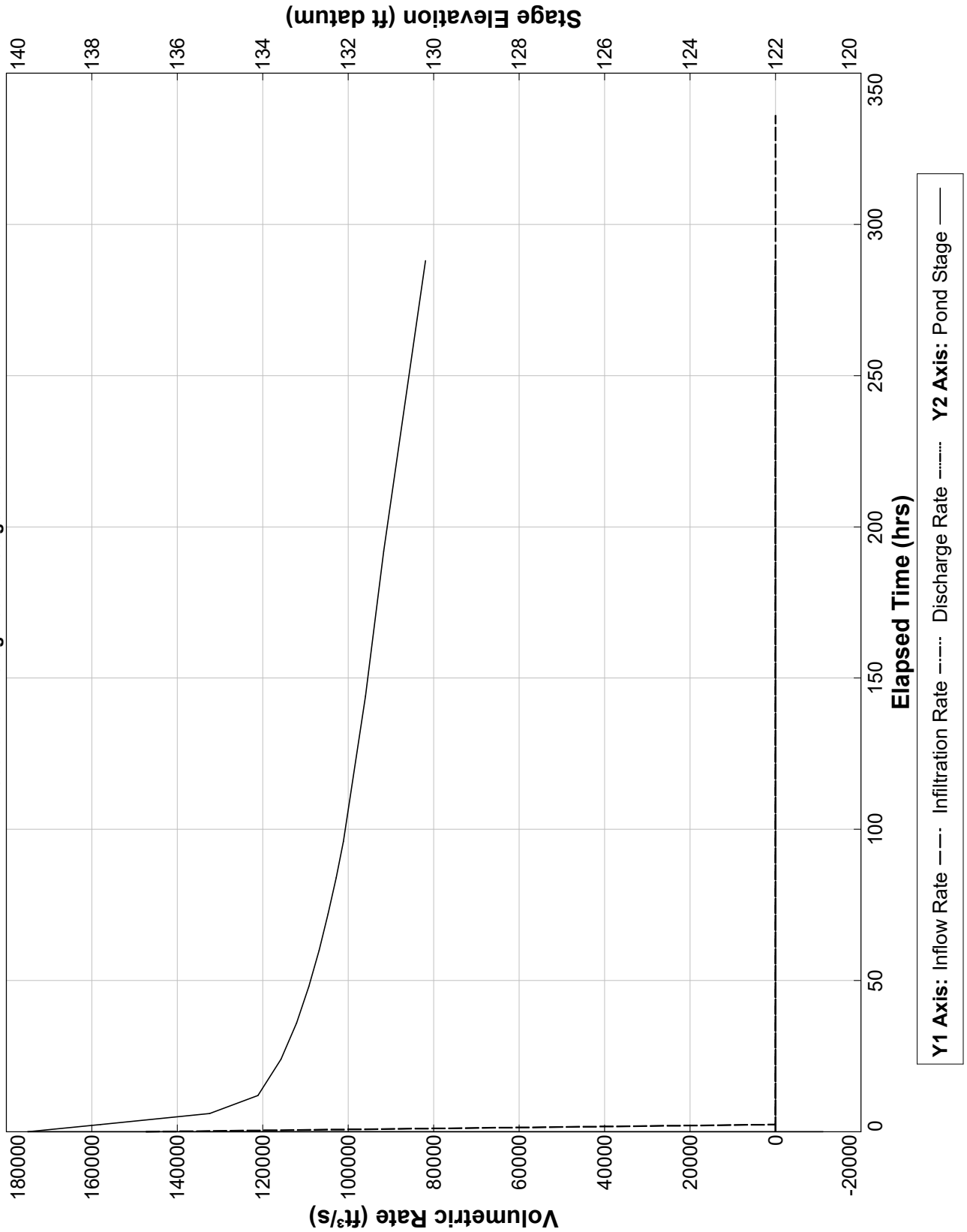
**Summary of Results** :: Scenario 1 :: Slug Load at Stage 139.50'

	Time (hours)	Stage (ft datum)	Rate (ft <sup>3</sup> /s)	Volume (ft <sup>3</sup> )
<b>Stage</b>				
Minimum	0.000	120.89		
Maximum	0.002	139.50		
<b>Inflow</b>				
Rate - Maximum - Positive	0.002		147331.2000	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	0.002			883987.0
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	336.000			883987.0
<b>Infiltration</b>				
Rate - Maximum - Positive	0.002		25.1064	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	240.000			883987.0
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	336.000			883987.0
<b>Combined Discharge</b>				
Rate - Maximum - Positive	None		None	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	None			None
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	336.000			0.0
<b>Discharge Structure 1 - simple weir</b>				
Rate - Maximum - Positive	None		None	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	None			None
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	336.000			0.0
<b>Discharge Structure 2 - simple weir</b>				
Rate - Maximum - Positive	None		None	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	None			None
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	336.000			0.0
<b>Discharge Structure 3 - inactive</b>				
Rate - Maximum - Positive	disabled		disabled	
Rate - Maximum - Negative	disabled		disabled	
Cumulative Volume - Maximum Positive	disabled			disabled
Cumulative Volume - Maximum Negative	disabled			disabled
Cumulative Volume - End of Simulation	disabled			disabled
<b>Pollution Abatement:</b>				
36 Hour Stage and Infiltration Volume	36.000	133.21		691577.9
72 Hour Stage and Infiltration Volume	72.000	132.47		758637.1



**Plot of Flow Rates and Pond Stage vs Elapsed Time**

Scenario 1 :: Slug Load at Stage 139.50'



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**Detailed Results** :: Scenario 2 :: Treatment Volume (11.078 ac.ft.)

Elapsed Time (hours)	Instantaneous Inflow Rate (ft <sup>3</sup> /s)	Outside Recharge (ft/day)	Stage Elevation (ft datum)	Infiltration Rate (ft <sup>3</sup> /s)	Combined Instantaneous Discharge Rate (ft <sup>3</sup> /s)	Cumulative Inflow Volume (ft <sup>3</sup> )	Cumulative Infiltration Volume (ft <sup>3</sup> )	Combined Cumulative Discharge (ft <sup>3</sup> )	Flow Type
0.000	80424.1600	0.00000	120.89000	0.00000	0	0.000	0.0	0	N.A.
0.002	80424.1600	0.00000	136.09250	21.30691	0	482545.000	127.8	0	U/P
2.400	0.0000	0.00000	134.39050	19.54680	0	482545.000	176556.3	0	U/P
6.000	0.0000	0.00000	131.83540	11.38428	0	482545.000	412620.9	0	U/P
12.000	0.0000	0.00000	----	----	----	482545.000	482545.0	0	dry
18.000	0.0000	0.00000	----	----	----	482545.000	482545.0	0	dry
24.000	0.0000	0.00000	----	----	----	482545.000	482545.0	0	dry
30.000	0.0000	0.00000	----	----	----	482545.000	482545.0	0	dry
36.000	0.0000	0.00000	----	----	----	482545.000	482545.0	0	dry
42.000	0.0000	0.00000	----	----	----	482545.000	482545.0	0	dry
48.000	0.0000	0.00000	----	----	----	482545.000	482545.0	0	dry
54.000	0.0000	0.00000	----	----	----	482545.000	482545.0	0	dry
60.000	0.0000	0.00000	----	----	----	482545.000	482545.0	0	dry
66.000	0.0000	0.00000	----	----	----	482545.000	482545.0	0	dry
72.000	0.0000	0.00000	----	----	----	482545.000	482545.0	0	dry

Treatment volume recovered within 10 hours

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**Summary of Results** :: Scenario 2 :: Treatment Volume (11.078 ac.ft.)

	Time (hours)	Stage (ft datum)	Rate (ft <sup>3</sup> /s)	Volume (ft <sup>3</sup> )
<b>Stage</b>				
Minimum	0.000	120.89		
Maximum	0.002	136.09		
<b>Inflow</b>				
Rate - Maximum - Positive	0.002		80424.1600	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	0.002			482545.0
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	72.000			482545.0
<b>Infiltration</b>				
Rate - Maximum - Positive	0.002		21.3069	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	6.000			412620.9
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	72.000			482545.0
<b>Combined Discharge</b>				
Rate - Maximum - Positive	None		None	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	None			None
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	72.000			0.0
<b>Discharge Structure 1 - simple weir</b>				
Rate - Maximum - Positive	None		None	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	None			None
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	72.000			0.0
<b>Discharge Structure 2 - simple weir</b>				
Rate - Maximum - Positive	None		None	
Rate - Maximum - Negative	None		None	
Cumulative Volume - Maximum Positive	None			None
Cumulative Volume - Maximum Negative	None			None
Cumulative Volume - End of Simulation	72.000			0.0
<b>Discharge Structure 3 - inactive</b>				
Rate - Maximum - Positive	disabled		disabled	
Rate - Maximum - Negative	disabled		disabled	
Cumulative Volume - Maximum Positive	disabled			disabled
Cumulative Volume - Maximum Negative	disabled			disabled
Cumulative Volume - End of Simulation	disabled			disabled
<b>Pollution Abatement:</b>				
36 Hour Stage and Infiltration Volume	36.000	Dry		482545.0
72 Hour Stage and Infiltration Volume	72.000	Dry		482545.0

