



150 & Ward Multi-Family
Storm Drainage Study – Addendum 1
Lee's Summit, Missouri. Jackson County

Addendum 1: March 17th, 2025

Prepared For: **Milhaus Development, LLC**
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Kimley»Horn

EXISTING VS. PROPOSED ANALYSIS

ANALYSIS AT CRITICAL POINT 1:

An existing versus proposed analysis was performed at Critical Point 1 (the outlet of the most downstream culvert under Ward Road) to determine if the proposed development would cause an increase in stormwater runoff while accounting for existing upstream stormwater detention. The stormwater model was built using PondPack and models a 100-year event with a Type II 24-hr distribution and a precipitation depth of 9.2 inches. The existing stormwater detention basins just upstream of the project site receive stormwater runoff from an off-site drainage area of 62.2 AC. with a Curve Number of CN = 82. This drainage area is contained within the overall 566 AC. drainage area that drains to Critical Point 1. Refer to Appendix A for a Drainage Area Exhibit.

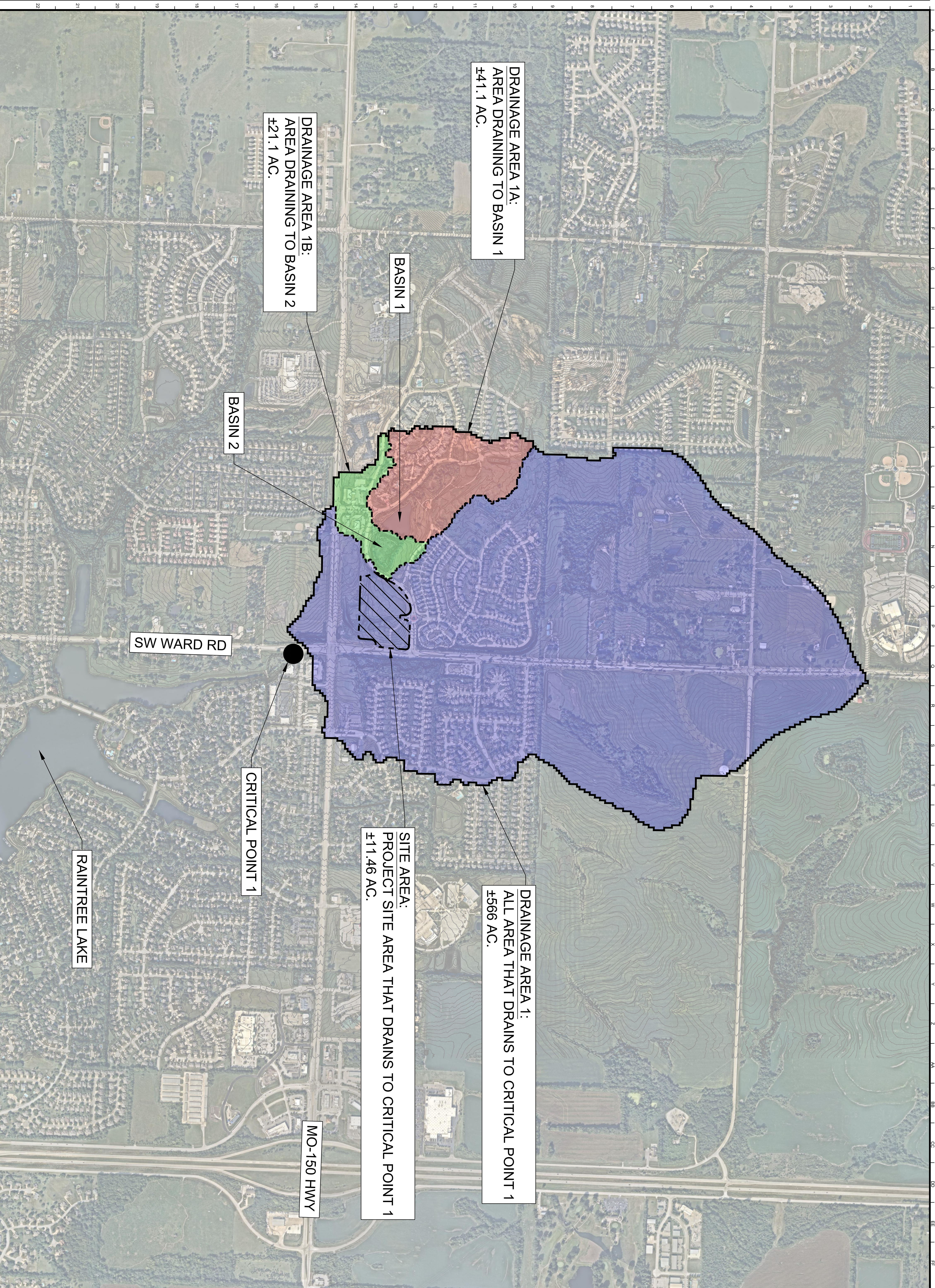
There are two existing detention basins just upstream of the project site. The first detention basin, Basin 1, is an extended-wet retention basin. Basin 1 has a 20' long weir that leads to Basin 2. The second detention basin, Basin 2, is an extended-dry detention basin. Basin 2 has a reinforced concrete box outlet control structure with three (3) 1'x6' rectangular perpendicular orifices. Stormwater then flows through a 12" N-12 HDPE pipe that drains to the project site.

By modeling the upstream detention basins to analyze Critical Point 1, the reduction in peak flow due to the storage by the basins is incorporated. Additionally, when modeling the existing vs. proposed condition for the project site, there is an increase in impervious area and Curve Number from the existing to the proposed condition. However, the reduction in the time of concentration offsets this, resulting in a lower overall peak discharge at Critical Point 1. Refer to **Table 1** below:

Peak Flow Analysis at Critical Point 1	
	100-Year Event
Existing Peak Discharge (CFS)	1370.50
Proposed Peak Discharge (CFS)	1362.77

In conclusion, the proposed development results in an increase in impervious area. However, the reduction in time of concentration results in an overall decrease in peak flow at Critical Point 1 (Refer to **Table 1**). Refer to PondPack Results in **Appendix B** for more information.

APPENDIX A – Drainage Area Map



APPENDIX B – PondPack Report

Project Summary	
Title	150 & Ward - Basin Modeling EXISTING
Engineer	Patrick Joyce, PE
Company	Kimley-Horn and Associates, Inc.
Date	3/18/2025

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Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft ³ /s)
AREA 1	100-YR EVENT	100	23.776	12.150	256.86
AREA 2	100-YR EVENT	100	12.422	12.150	130.72
OFFSITE AREA	100-YR EVENT	100	231.763	12.600	1,348.34
SITE AREA	100-YR EVENT	100	5.448	12.150	60.74

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft ³ /s)
O-2	100-YR EVENT	100	241.827	12.600	1,370.50

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft ³ /s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
POND 1 (IN)	100-YR EVENT	100	23.776	12.150	256.86	(N/A)	(N/A)
POND 1 (OUT)	100-YR EVENT	100	23.568	12.300	182.67	1,000.10	4.891
POND 2 (IN)	100-YR EVENT	100	35.990	12.250	293.06	(N/A)	(N/A)
POND 2 (OUT)	100-YR EVENT	100	4.616	12.850	4.79	997.00	20.914

Subsection: Elevation-Area Volume Curve

Label: POND 1

Scenario: 100-YR EVENT

Return Event: 100 years

Storm Event: 100-YR EVENT

Elevation (ft)	Planimeter (ft ²)	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
998.00	0.0	2.045	0.000	0.000	0.000
1,000.00	0.0	2.605	6.958	4.639	4.639
1,002.00	0.0	3.499	9.123	6.082	10.721

Subsection: Elevation-Area Volume Curve
 Label: POND 2
 Scenario: 100-YR EVENT

Return Event: 100 years
 Storm Event: 100-YR EVENT

Elevation (ft)	Planimeter (ft ²)	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
988.00	0.0	1.695	0.000	0.000	0.000
990.00	0.0	1.998	5.533	3.689	3.689
992.00	0.0	2.179	6.264	4.176	7.865
994.00	0.0	2.393	6.855	4.570	12.435
996.00	0.0	2.922	7.959	5.306	17.741
997.00	0.0	3.430	9.518	3.173	20.914

Subsection: Diverted Hydrograph
Label: Outlet-2
Scenario: 100-YR EVENT

Return Event: 100 years
Storm Event: 100-YR EVENT

Peak Discharge	4.79 ft ³ /s
Time to Peak	16.550 hours
Hydrograph Volume	4.616 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Flow (ft ³ /s)	Flow (ft ³ /s)	Flow (ft ³ /s)	Flow (ft ³ /s)	Flow (ft ³ /s)
12.250	0.00	1.65	4.24	4.35	4.43
12.500	4.50	4.57	4.62	4.67	4.71
12.750	4.74	4.78	4.79	4.79	4.79
13.000	4.79	4.79	4.79	4.79	4.79
13.250	4.79	4.79	4.79	4.79	4.79
13.500	4.79	4.79	4.79	4.79	4.79
13.750	4.79	4.79	4.79	4.79	4.79
14.000	4.79	4.79	4.79	4.79	4.79
14.250	4.79	4.79	4.79	4.79	4.79
14.500	4.79	4.79	4.79	4.79	4.79
14.750	4.79	4.79	4.79	4.79	4.79
15.000	4.79	4.79	4.79	4.79	4.79
15.250	4.79	4.79	4.79	4.79	4.79
15.500	4.79	4.79	4.79	4.79	4.79
15.750	4.79	4.79	4.79	4.79	4.79
16.000	4.79	4.79	4.79	4.79	4.79
16.250	4.79	4.79	4.79	4.79	4.79
16.500	4.79	4.79	4.79	4.79	4.79
16.750	4.79	4.79	4.79	4.79	4.79
17.000	4.79	4.79	4.79	4.79	4.79
17.250	4.79	4.79	4.79	4.79	4.79
17.500	4.79	4.79	4.79	4.79	4.79
17.750	4.79	4.79	4.79	4.79	4.79
18.000	4.79	4.79	4.79	4.79	4.79
18.250	4.79	4.79	4.79	4.79	4.79
18.500	4.79	4.79	4.79	4.79	4.79
18.750	4.79	4.79	4.79	4.79	4.79
19.000	4.79	4.79	4.79	4.79	4.79
19.250	4.79	4.79	4.79	4.79	4.79
19.500	4.79	4.79	4.79	4.79	4.79
19.750	4.79	4.79	4.79	4.79	4.79
20.000	4.79	4.79	4.79	4.79	4.79
20.250	4.79	4.79	4.79	4.79	4.79
20.500	4.79	4.79	4.79	4.79	4.79
20.750	4.79	4.79	4.79	4.79	4.79
21.000	4.79	4.79	4.79	4.79	4.79
21.250	4.79	4.79	4.79	4.79	4.79
21.500	4.79	4.79	4.79	4.79	4.79
21.750	4.79	4.79	4.79	4.79	4.79

Subsection: Diverted Hydrograph
 Label: Outlet-2
 Scenario: 100-YR EVENT

Return Event: 100 years
 Storm Event: 100-YR EVENT

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft ³ /s)	Flow (ft ³ /s)	Flow (ft ³ /s)	Flow (ft ³ /s)	Flow (ft ³ /s)
22.000	4.79	4.79	4.79	4.79	4.79
22.250	4.79	4.79	4.79	4.79	4.79
22.500	4.79	4.79	4.79	4.79	4.79
22.750	4.79	4.79	4.79	4.79	4.79
23.000	4.79	4.79	4.79	4.79	4.79
23.250	4.79	4.79	4.79	4.79	4.79
23.500	4.79	4.79	4.79	4.79	4.79
23.750	4.79	4.79	4.79	4.79	4.79
24.000	4.79	(N/A)	(N/A)	(N/A)	(N/A)

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POND 2 (Elevation-Area Volume Curve, 100 years (100-YR EVENT))...4

Project Summary	
Title	150 & Ward - Basin Modeling PROPOSED
Engineer	Patrick Joyce, PE
Company	Kimley-Horn and Associates, Inc.
Date	3/18/2025

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Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft ³ /s)
AREA 1	100-YR EVENT	100	23.776	12.150	256.86
AREA 2	100-YR EVENT	100	12.422	12.150	130.72
OFFSITE AREA	100-YR EVENT	100	231.857	12.600	1,348.89
SITE AREA	100-YR EVENT	100	7.124	11.950	118.00

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft ³ /s)
O-2	100-YR EVENT	100	243.391	12.600	1,362.77

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft ³ /s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
POND 1 (IN)	100-YR EVENT	100	23.776	12.150	256.86	(N/A)	(N/A)
POND 1 (OUT)	100-YR EVENT	100	23.568	12.300	182.67	1,000.10	4.891
POND 2 (IN)	100-YR EVENT	100	35.990	12.250	293.06	(N/A)	(N/A)
POND 2 (OUT)	100-YR EVENT	100	4.410	12.550	4.57	996.00	17.741

Subsection: Elevation-Area Volume Curve

Label: POND 1

Scenario: 100-YR EVENT

Return Event: 100 years

Storm Event: 100-YR EVENT

Elevation (ft)	Planimeter (ft ²)	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
998.00	0.0	2.045	0.000	0.000	0.000
1,000.00	0.0	2.605	6.958	4.639	4.639
1,002.00	0.0	3.499	9.123	6.082	10.721

Subsection: Elevation-Area Volume Curve

Label: POND 2

Scenario: 100-YR EVENT

Return Event: 100 years

Storm Event: 100-YR EVENT

Elevation (ft)	Planimeter (ft ²)	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
988.00	0.0	1.695	0.000	0.000	0.000
990.00	0.0	1.998	5.533	3.689	3.689
992.00	0.0	2.179	6.264	4.176	7.865
994.00	0.0	2.393	6.855	4.570	12.435
996.00	0.0	2.922	7.959	5.306	17.741

Subsection: Diverted Hydrograph
Label: Outlet-2
Scenario: 100-YR EVENT

Return Event: 100 years
Storm Event: 100-YR EVENT

Peak Discharge	4.57 ft ³ /s
Time to Peak	16.350 hours
Hydrograph Volume	4.410 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Flow (ft ³ /s)	Flow (ft ³ /s)	Flow (ft ³ /s)	Flow (ft ³ /s)	Flow (ft ³ /s)
12.250	0.00	1.65	4.24	4.35	4.43
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12.750	4.57	4.57	4.57	4.57	4.57
13.000	4.57	4.57	4.57	4.57	4.57
13.250	4.57	4.57	4.57	4.57	4.57
13.500	4.57	4.57	4.57	4.57	4.57
13.750	4.57	4.57	4.57	4.57	4.57
14.000	4.57	4.57	4.57	4.57	4.57
14.250	4.57	4.57	4.57	4.57	4.57
14.500	4.57	4.57	4.57	4.57	4.57
14.750	4.57	4.57	4.57	4.57	4.57
15.000	4.57	4.57	4.57	4.57	4.57
15.250	4.57	4.57	4.57	4.57	4.57
15.500	4.57	4.57	4.57	4.57	4.57
15.750	4.57	4.57	4.57	4.57	4.57
16.000	4.57	4.57	4.57	4.57	4.57
16.250	4.57	4.57	4.57	4.57	4.57
16.500	4.57	4.57	4.57	4.57	4.57
16.750	4.57	4.57	4.57	4.57	4.57
17.000	4.57	4.57	4.57	4.57	4.57
17.250	4.57	4.57	4.57	4.57	4.57
17.500	4.57	4.57	4.57	4.57	4.57
17.750	4.57	4.57	4.57	4.57	4.57
18.000	4.57	4.57	4.57	4.57	4.57
18.250	4.57	4.57	4.57	4.57	4.57
18.500	4.57	4.57	4.57	4.57	4.57
18.750	4.57	4.57	4.57	4.57	4.57
19.000	4.57	4.57	4.57	4.57	4.57
19.250	4.57	4.57	4.57	4.57	4.57
19.500	4.57	4.57	4.57	4.57	4.57
19.750	4.57	4.57	4.57	4.57	4.57
20.000	4.57	4.57	4.57	4.57	4.57
20.250	4.57	4.57	4.57	4.57	4.57
20.500	4.57	4.57	4.57	4.57	4.57
20.750	4.57	4.57	4.57	4.57	4.57
21.000	4.57	4.57	4.57	4.57	4.57
21.250	4.57	4.57	4.57	4.57	4.57
21.500	4.57	4.57	4.57	4.57	4.57
21.750	4.57	4.57	4.57	4.57	4.57

Subsection: Diverted Hydrograph
 Label: Outlet-2
 Scenario: 100-YR EVENT

Return Event: 100 years
 Storm Event: 100-YR EVENT

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft ³ /s)	Flow (ft ³ /s)	Flow (ft ³ /s)	Flow (ft ³ /s)	Flow (ft ³ /s)
22.000	4.57	4.57	4.57	4.57	4.57
22.250	4.57	4.57	4.57	4.57	4.57
22.500	4.57	4.57	4.57	4.57	4.57
22.750	4.57	4.57	4.57	4.57	4.57
23.000	4.57	4.57	4.57	4.57	4.57
23.250	4.57	4.57	4.57	4.57	4.57
23.500	4.57	4.57	4.57	4.57	4.57
23.750	4.57	4.57	4.57	4.57	4.57
24.000	4.57	(N/A)	(N/A)	(N/A)	(N/A)

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Outlet-2 (Diverted Hydrograph, 100 years (100-YR EVENT))...5, 6

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POND 1 (Elevation-Area Volume Curve, 100 years (100-YR EVENT))...3

POND 2 (Elevation-Area Volume Curve, 100 years (100-YR EVENT))...4

APPENDIX C – Time of Concentrations

Time of Concentrations for Drainage Areas to Critical Point 1				
	Area 1	Area 1A	Area 1B	Site Area
Existing TC (mins)	69	27.5	26	25
Proposed TC (mins)	69	27.5	26	7.5