ENGINEERS ♻ PLANNERS ♻ LANDSCAPE ARCHITECTS ♻ SURVEYORS ♻ SUSTAINABLE DESIGN

Mallory Square

ANALYSIS OF EXISTING DOWNSTREAM STORM DRAIN

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Analysis of Off-Site Drainage To Study Point:

Mallory Square is 12.81 acre site consists of two large existing properties and multiple outlots bordered by Research Boulevard to the north, Key West Avenue to the south and Omega Drive to the west. The existing lot to the west along Omega Drive is mostly undeveloped with a large stormwater management pond and 44 car surface parking lot. The existing lot on the east contains a 2 story building and surface parking lot over most of the lot.

The proposed site design includes removal of all existing surface features and construction of a residential building on each property. The proposed redevelopment will decrease the imperviousness of the site by through the use of in-ground planters Micro-Bioretention, Planter Box Micro-Bioretention as well as Porous Pavement.

This report provides a drainage study for the public storm drain system in Omega drive (county right-of-way) as well as an evaluation of the existing receiving storm drain downstream of the site. The study point for the downstream study is shown on the Offsite Drainage Study map included in this report.

In summary, the following computations were conducted to determine:

The existing 10-year runoff, the post-redevelopment 10-year runoff and storm drain capacity to Study Point #1, located on Omega Drive.

Study Point #1

Proposed Condition:

Max Drainage Area: 14.30Ac, Impervious Area: 11.10 Ac, Grass Area: 3.20 Ac

C-factor Calculation

Composite C = (0.9)(11.10) + (0.25)(3.20)/(14.30)
= 0.75

Tc Calculation

For drainage areas greater than 2 acres, the Tc is calculated as follows:

- Determine the flow path and length (L) from the hydraulically most distant point representative of the drainage area. ***See drainage area map for flow path. Length determined to be 1,710 feet.***

- Determine the travel time (Tt) for the first 100 feet of flow length from the table in the 1991 Memorandum, utilizing the "C' factor for the drainage area. ***For the first 55 ft(sheet flow), the C factor for the drainage area is 0.75. From the table, with C=0.75, Tt is7 minutes.***

- Utilize a velocity of 7 fps for an average drainage area slope of 7% or less, or 10 fps for an average slope greater than 7%, to determine the travel time for the remaining flow path. ***For the drainage area, maximum slope is approximately 3%. Therefore, average slope is less than 7%, so average velocity (V) used will be 7 fps.***

- The sum of the two travel times is the time of concentration for the drainage area. The time of concentration (in minutes) can be calculated as follows:

Tc = Tt (from table) + ((L-55) / (Vx60))

Tc = 7 min + ((1710-55)/(7*60)) min

Tc = 10.94 min

Summary of Inputs (see above comps for info): A = 14.30 Ac

Tc = 10.94 min

I = 5.68 (From Montgomery county Intensity data)

C = 0.75

Post-Development Q_{10} at Study Point (10 year): 60.90 cfs (Q = CIA)

Pre-Development

Max Drainage Area: 13.23 Ac, Impervious Area: 5.4 Ac, Grass Area: 7.83 Ac

C-factor Calculation

Composite C = (0.9)(5.40) + (0.25)(7.83)/(13.23)
= 0.52

Tc Calculation

For drainage areas greater than 2 acres, the Tc is calculated as follows:

- Determine the flow path and length (L) from the hydraulically most distant point representative of the drainage area. ***See drainage area map for flow path. Length determined to be 906 feet.***

- Determine the travel time (Tt) for the first 100 feet of flow length from the table in the 1991 Memorandum, utilizing the "C' factor for the drainage area. ***For the first 100 ft, the C factor for the drainage area is 0.51. From the table, with C=0.51, Tt is 10 minutes.***

- Utilize a velocity of 7 fps for an average drainage area slope of 7% or less, or 10 fps for an average slope greater than 7%, to determine the travel time for the remaining flow path. ***For the drainage area, maximum slope is less than 7%, so average velocity (V) used will be 7 fps.***

- The sum of the two travel times is the time of concentration for the drainage area. The time of concentration (in minutes) can be calculated as follows:

Tc = Tt (from table) + ((L-100) / (Vx60))

Tc = 10 min + ((906-100)/(7*60)) min

Tc = 11.92 min

Using the formula Q10= Cw *I*A:

Summary of Inputs (see above comps for info): A = 13.23 Ac

Tc = 11.92 min

I = 5.49

Cw = 0.51

Pre-Development Q10 at Study Point (10 year): 37.04 cfs (Q = CIA)

Storm Drain Capacity

The existing downstream pipe from the Mallory Square site is a 36" RCP pipe at a slope of 1.1% located on the Omega Drive. An existing 36" RCP pipe at this slope has a capacity of 69.95 cfs (based on computation shown in this Appendix).

As a result of the proposed redevelopment, the overall discharge to the study point is **increased** by 21.14 cfs. This constitutes an 36.34% increase in the total offsite discharge (58.18 cfs) to the downstream system in the redevelopment condition.

Summary of Flows (see comps for more info):

Pre-Development Q_{10} at Study Point (10 year):	37.04 cfs
Post-Development Q_{10} at Study Point (10 year):	60.90 cfs
Capacity (Q_{10} at Study Point (10 year):	69.95 cfs

In the redevelopment condition, the total runoff in the pipe is 60.90 cfs. Because the total runoff is less than the capacity of the pipe, the existing storm drain adequately conveys the 10-Year Storm Event and will not adversely affect the existing downstream receiving storm drain system.

Conclusion

It is our conclusion the proposed redevelopment of our project site would not result in adverse effects downstream of the site on Omega Drive. The proposed redevelopment of Mallory Square will be safely conveyed via the existing public storm drain systems.

APPENDIX

STORM DRAIN STUDY COMPUTATIONS

Mallory Square : STUDY POINT #1

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01100	ft/ft
Normal Depth	3.00	ft
Diameter	3.00	ft
Discharge	69.95	ft³/s

Results

Discharge	69.95	ft³/s
Normal Depth	3.00	ft
Flow Area	7.07	ft²
Wetted Perimeter	9.42	ft
Hydraulic Radius	0.75	ft
Top Width	0.00	ft
Critical Depth	2.66	ft
Percent Full	100.0	%
Critical Slope	0.00983	ft/ft
Velocity	9.90	ft/s
Velocity Head	1.52	ft
Specific Energy	4.52	ft
Froude Number	0.00	
Maximum Discharge	75.25	ft³/s
Discharge Full	69.95	ft³/s
Slope Full	0.01100	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%

Mallory Square : STUDY POINT #1

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.00	ft
Critical Depth	2.66	ft
Channel Slope	0.01100	ft/ft
Critical Slope	0.00983	ft/ft

OVERALL DRAINAGE AREA MAP TO STUDY POINT