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REFERENCE: **Hydraulic Analysis at Wilkinson Lane, Hickerson Drive,
Shady Lane, and Meadow Court**

During discussions about stormwater coordination for the City of White House various drainage issues near Wilkinson Lane were presented. These issues include improper backwater and flows at the intersection of Wilkinson Lane and Hickerson Drive, roadway overtopping at the intersection of Wilkinson Lane and Meadow Court, and multiple residential drainage issues near Shady Lane and Meadow Court. CSR Engineering was tasked to further observe and analyze the stormwater infrastructure where drainage issues are occurring. Figure 1 shows the location of the area that was analyzed. The review involved: site visits, visual inspections, photo documentation, topographical survey, and storm flow analysis and recommendations.

Overview

Analysis of the collected data revealed one primary drainage feature preceded by a series of storm structures. The primary feature is a culvert running under Wilkinson Lane. This cross drain is made up of one 64"x43" CMP arch north of the Wilkinson Lane and Hickerson Drive intersection. Preceding this is a 68"x43" elliptical RCP running under Hickerson Drive. Upstream from this is a 24" CMP beginning at the intersection of Wilkinson Lane and Meadow Court, transitioning to a 36" HDPE pipe after an unknown distance. At this intersection there are drainage issues from storm events causing stormwater to run into the road.

The culvert under Hickerson Drive is also fed by a channel originating at an endwall with a 24" CMP that collects runoff from catch basins near 109 Meadow Ct. Near this ditch, there has been reports of residential flooding.

Further upstream is a pond fed by a 24" CMP and 38"x24" elliptical RCP crossing Shady Lane. There is a channel running from these two pipes that collects stormwater from Stadium Drive and Winston Drive. A drainage issue at the inlet of these pipes has been causing ponding in the residential area.

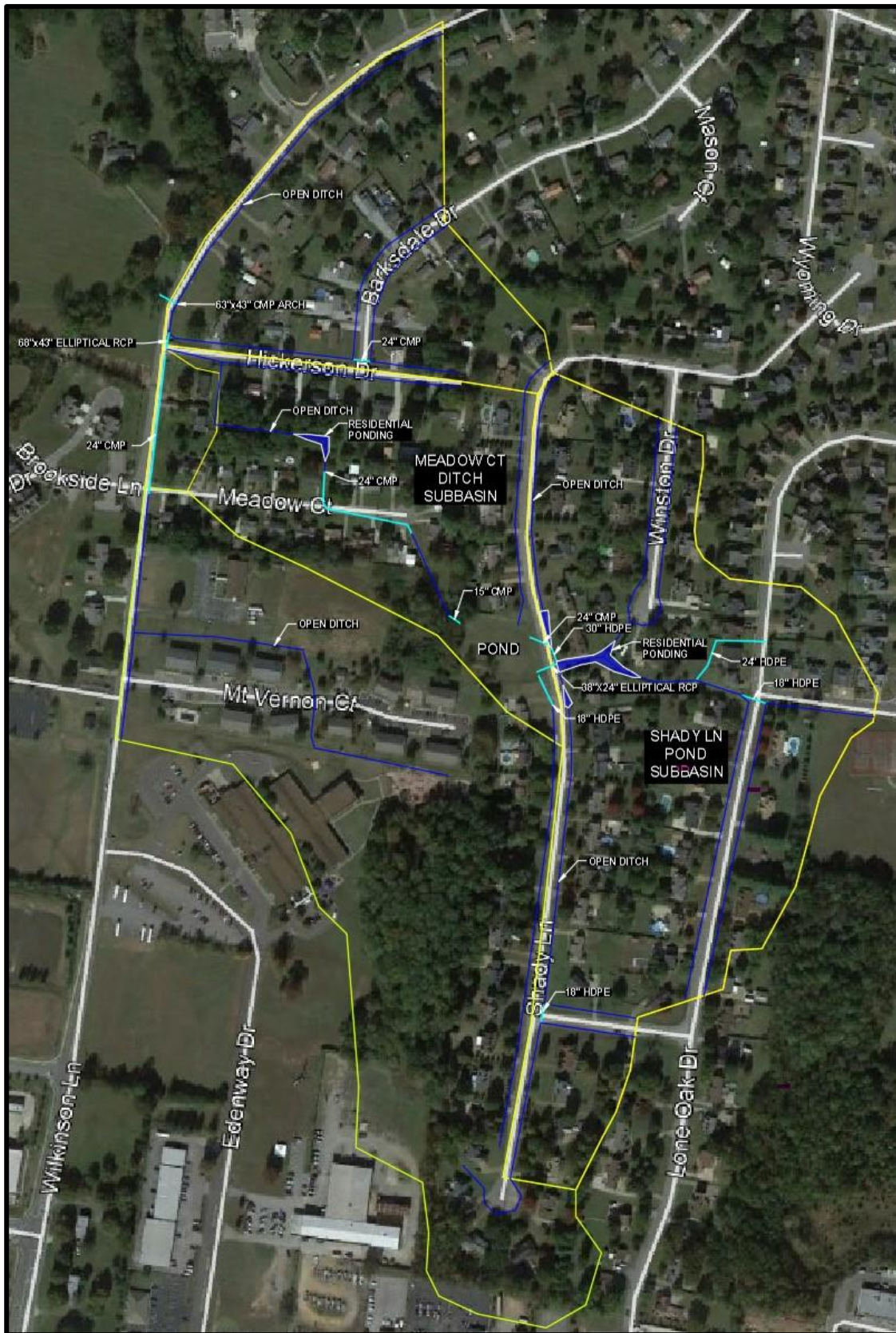


Figure 1: Wilkinson Lane Basin and Subbasins

Wilkinson Lane Drainage Analysis

The primary culvert shown in Figure 2 receives stormwater runoff from approximately 96.7 acres. The drainage basin consists of low density residential development (80%), commercial developments (10%), and streets and roads (10%). These basin characteristics coupled with survey collected inverts and culvert lengths, revealed the existing 64"x43" CMP arch and 68"x43" elliptical RCP structures can pass the maximum stormwater flow of a 100-year storm event, assuming the pipes are free and clear of sediment and debris. Through the storm event analysis we understand that stormwater runoff at the intersection of Wilkinson Lane and Meadow Court is exceeding the existing 24" CMP's capacity with all rain events that are larger than a 2-year storm event. Stormwater is being allowed to pass over the edge of the street at any elevation that exceeds 806.28.



Figure 2: Existing 64"x43" CMP Arch Culvert Crossing Wilkinson



Figure 3: Existing 24" CMP at Wilkinson and Meadow

Recommendations

It is our opinion that the existing 64"x43" CMP arch and 68"x43" elliptical RCP structures are properly sized to handle 100-year storm events, however the 24" CMP is undersized for the amount of stormwater flow that is being concentrated at this culvert. The following tables provide the recommended corrective options for the drainage issues.

Wilkinson Lane Cross Drain-Existing 64"x43" CMP Arch				
Storm Event (yr)	Inflow (cfs)	Outflow (cfs)	Water Elevation	Recommended Structure Needed
2	47.94	47.94	790.63	No Change, Clean Existing Pipe
5	69.17	69.17	790.95	
10	87.57	87.55	791.22	
25	113.00	112.98	791.60	
50	133.39	133.36	791.96	
100	154.83	154.78	792.55	

Hickerson Drive Cross Drain-Existing 68"x43" Elliptical RCP				
Storm Event (yr)	Inflow (cfs)	Outflow (cfs)	Water Elevation	Recommended Structure Needed
2	48.61	48.60	792.62	No Change
5	69.88	69.87	792.83	
10	88.15	88.14	792.98	
25	113.30	113.29	793.19	
50	133.39	133.38	793.34	
100	154.41	154.40	793.49	

Meadow Court Cross Drain-Existing 24" CMP Transitioning to 36" HDPE at Unknown Location				
Storm Event (yr)	Inflow (cfs)	Outflow (cfs)	Water Elevation	Recommended Structure Needed
2	22.01	21.26	806.09	No Change
5	31.94	20.11	806.28	Replace with 30" Pipe
10	40.52	19.96	806.39	
25	52.32	20.46	806.53	Replace with 36" Pipe
50	61.75	20.14	806.62	
100	71.62	20.67	806.71	Replace with 42" Pipe

Note: To handle the 100-year storm event, both the existing 24" CMP and 36" HDPE would need to be replaced with a 42" pipe.

Meadow Court Channel Drainage Analysis

The channel shown in Figure 4 receives stormwater runoff from approximately 43.3 acres. These basin characteristics coupled with survey collected inverts and culvert lengths, revealed the existing 24" CMP may cause ponding for a 2-year storm event. Further analysis would be needed to properly size the pipes in the catch basin network on Meadow Court. The purpose of this storm event analysis is to properly size the ditch assuming it is receiving the full flow of water from a 100-year storm event. Additionally, this analysis does not include potential obstructions in the path of the ditch such as fences or trees. We have the ability to complete further analysis if it is requested, but it is outside the scope of this report.



Figure 4: Existing 24" CMP and Ditch near Meadow

Recommendations

It is our opinion the channel is not properly sized to handle 100-year storm events. We recommend excavating a flat-bottomed V-shape ditch with a depth of 2'-3", bottom width of 3', 2:1 side slopes, and average grade of approximately 1.6%. This ditch depth is the minimum required to handle 100-year storm events with no freeboard.

Shady Lane Drainage Analysis

The culverts shown in Figures 5 and 6 receive stormwater runoff from approximately 27.1 acres. Through the storm event analysis we understand that stormwater runoff at Shady Lane is exceeding the existing 24" CMP and 38"x24" elliptical RCP's capacity with all rain events that are larger than a 5-year storm event. Stormwater is unable to pass through these pipes causing ponding in multiple yards.



Figure 5: Existing 38"x24" Elliptical RCP Culvert Crossing Shady



Figure 6: Existing 24" CMP Crossing Shady

Recommendations

It is our opinion that the existing 24" CMP and 38"x24" elliptical RCP structures are not properly sized to handle the amount of stormwater flow that is being concentrated at this area. The following table provides the recommended corrective options for the drainage issues. Recommendations below involve keeping the existing 38"x24" elliptical RCP and replacing the existing 24" CMP. Replacement structures should have an inlet of 819.54 or lower and a slope of 1.08% or greater.

Shady Lane Cross Drain-Existing 24" CMP and 38"x24" elliptical RCP				
Storm Event (yr)	Inflow (cfs)	Outflow (cfs)	Water Elevation	Recommended Structure Needed
2	22.1	22.1	821.21	No Change
5	31.27	31.27	821.61	
10	39.09	36.98	821.95	Replace with 30"x19" Elliptical Pipe
25	49.69	38.95	822.76	Replace with 38"x24" Elliptical Pipe
50	58.07	40.03	823.49	Replace with (2) 38"x24" Elliptical Pipes
100	66.76	40.92	824.36	

Engineering plans may be helpful concerning the geometry and construction details.

We appreciate the opportunity to perform this analysis and look forward to working with you in the future. Please feel free to contact us with any questions.

Sincerely,
 CSR Engineering, Inc.



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