CITY OF WHITE HOUSE
Board of Mayor and Aldermen Agenda
Study Session
December 9, 2024
5:30 p.m.

1. Call to Order by the Mayor
2. Roll Call
3. Adoption of the Agenda
4. Public Comment
5. New Business
    a. Discuss the Hydraulic Analysis and Cost Estimate Report for Covington Bend and Winchester Ct.
6. Adjournment

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November 22, 2024
Project No. 21-924

Mr. Isaiah Manfredi
City of White House Public Services
725 Industrial Drive
White House, TN 37188

REFERENCE: **Hydraulic Analysis at Covington Bend and Winchester Court**

In discussions about stormwater coordination for the City of White House, drainage issues on Covington Bend and Winchester Court were identified. CSR Engineering was assigned to observe and analyze the stormwater infrastructure in these areas to address the concerns. Figure 1 illustrates the specific location that was analyzed. The review involved: site visits, visual inspections, storm flow analysis, and stormwater improvement recommendations.

Overview:

The analysis within the study area identified three main sub-basins. These drainage areas encompass low to medium-density residential developments, streets, roads, as well as grassed and wooded areas. Figure 2 shows areas of sub-basins and their primary flow paths.

- **North Sub-basin (86 acres):** This sub-basin primarily collects stormwater through a channel that starts south of Meadows Road. The water then flows through a series of 36-inch HDPE pipes and catch basins, crossing Winchester Court and discharging at an outfall on its southwest side.
- **Southeast Sub-basin (14 acres):** Located north of Meadows Road near the White House High School baseball and soccer fields, this sub-basin collects water via a channel that directs flow into a single 48-inch HDPE pipe. This pipe crosses Covington Bend from the southeast, with the outfall situated on the southwest side of Winchester Court.
- **Southwest Sub-basin (7+14+86=107 acres):** This sub-basin begins where the other two sub-basins discharge into a ditch. For analysis, we have included the drainage area of the two upstream sub-basins. The ditch flows southwest into a series of 48-inch HDPE pipes and catch basins that cross Covington Bend, eventually flowing into an existing channel.

At the intersection of these sub-basins around Covington Bend and Winchester Court, storm events have caused drainage issues, resulting in flooding on roads and in nearby houses.

The characteristics of these basins, along with invert elevations and culvert lengths from the City of White House Stormwater Utilities GIS, were used to calculate the volumetric flow rates and ponding elevations for both the pipes and the Southwest ditch.

Figure 1: Existing Pipes and Catch Basins near Covington Bend and Winchester Court

Analysis:

The pipes shown in Figure 1 receive stormwater runoff from a total of approximately 107 acres as shown in the following table.

Existing Drainage Areas					
Sub Basin	Total (Ac.)	Impervious (Ac.)	Grass (Ac.)	Wooded (Ac.)	Curve Number
North 36"	86.08	14.16	47.70	24.22	65
Southeast 48"	13.89	2.54	8.49	2.86	67
Southwest 48"	106.57	19.13	60.37	27.08	66

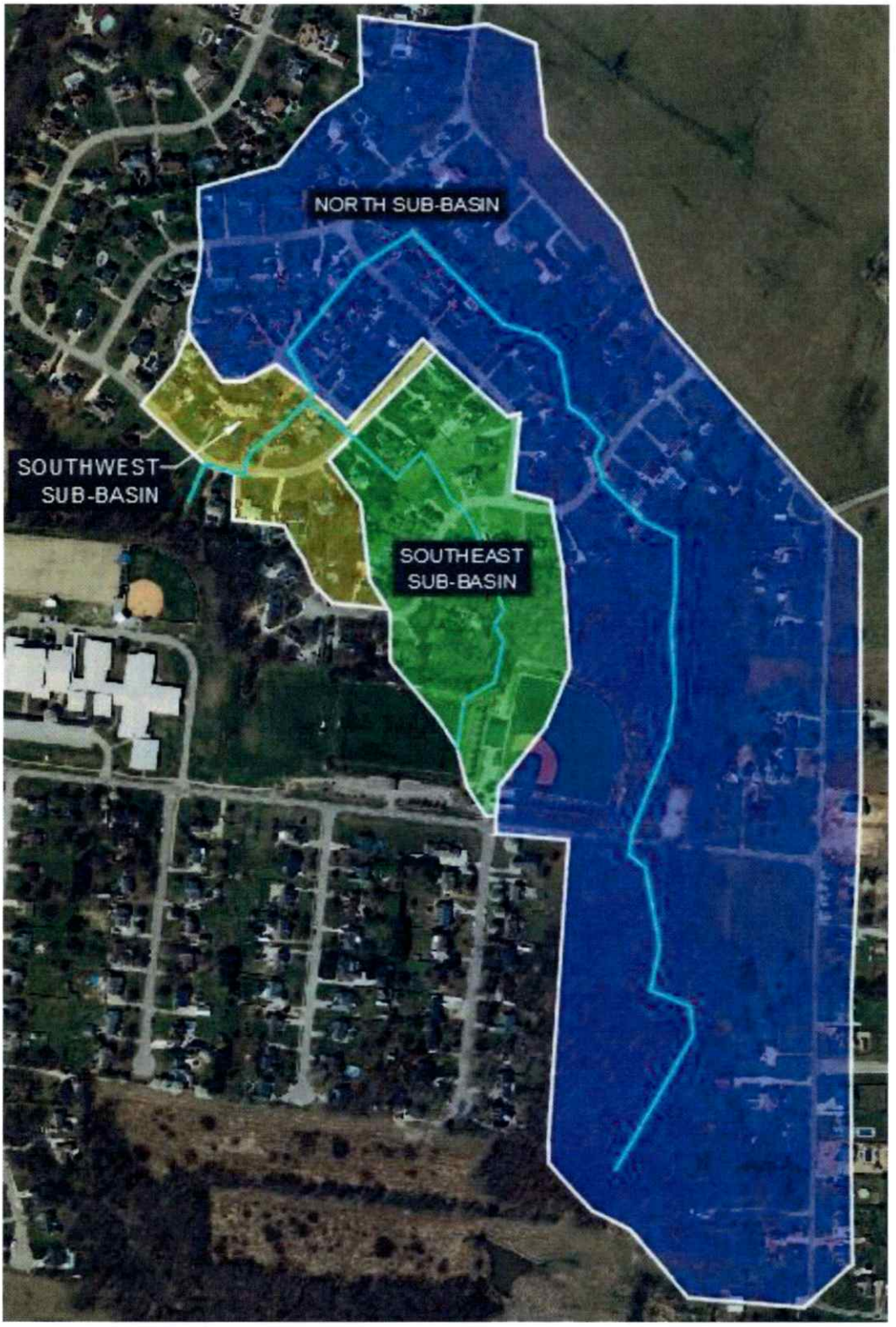

Figure 2: Overall Sub-basins

- **North 36" HDPE Inlet:** The hydraulic analysis indicates that the 36-inch HDPE culvert in the North sub-basin is undersized for handling stormwater flows exceeding a 5-year storm event. The capacity of the existing pipes is 53.63 cfs.

  The capacity was calculated assuming free flow of water from the outlet of the pipe, however this pipe discharges water into the ditch at a low point which is 1.45 feet lower than the other end of the ditch and the inlet of the receiving 48-inch pipe in the Southwest subbasin. This elevation difference hinders the free flow from the 36-inch pipe, leading to upstream flooding during 2-year storm events and above.

- **Southeast 48" HDPE Inlet:** The existing 48-inch HDPE culvert in the Southeast sub-basin is adequately sized to manage stormwater flow up to and including a 500-year storm event. This pipe has a capacity of 178.26 cfs.

- **Southwest Ditch:** The ditch in the Southwest sub-basin, designed to receive stormwater from both the North and Southeast sub-basins, is adequately sized for 10-year and smaller storm events. However, due to its outlet being 1.45 feet higher than its inlet, it fails to effectively convey the flow, further contributing to drainage issues.

- **Southwest 48" HDPE Inlet:** The existing 48-inch HDPE pipe has a capacity of 246.43 which would be sufficient to handle the existing flows up to a 100-year storm event. However, its effectiveness is significantly limited by the ditch's inability to efficiently transport water to the pipe inlet.

Recommendations:

The recommendations include using standard HDPE pipes or reinforced concrete pipes (RCP), with all suggestions for the Southwest sub-basin based on simultaneously upgrading the North sub-basin's 36-inch pipe to manage equivalent-year storm events. It is proposed to regrade the ditch in the Southwest sub-basin to achieve a minimum 1% slope along its length and to align the upstream end of the ditch with the existing North 36-inch pipe or its replacement. The downstream end will be set 0.93 feet lower than the upstream end. Precise elevations for the inverts cannot be determined until the replacement pipe size for the North sub-basin is chosen, as this may impact the outlet elevation.

For the southwest sub-basin, it is also recommended that the existing 48-inch pipe (or its replacement) be adjusted so that the inlet elevation aligns with the outlet of the ditch. If the 48-inch pipe is retained, approximately 144 linear feet will need to be adjusted. However, if a larger pipe is selected as a replacement, about 471 linear feet will need to be replaced. Additionally, the existing three catch basins and one area drain in the Southwest sub-basin may require replacement to accommodate the larger pipe size. Detailed engineering plans will be required for determining the precise geometry and construction details.

The following tables provide the recommended corrective options for the drainage issues. Pipe sizes for the North sub-basin shown in the tables assume maintaining the current slope of the existing pipes. Recommendations for the pipe sizes in the Southwest sub-basin assume regrading the ditch and lowering the existing inlet elevation.

North Sub-Basin (36" HDPE Existing)						
Recommended Solutions to prevent flooding per storm event						
Storm Event (yr)	Sub-Basin Flow (cfs)	Ex. Pipe Capacity (cfs)	Ex. Slope	Recommendation	Prop. Slope	Prop. Pipe Capacity (cfs)
50	124.63	53.63	0.65%	Replace with 54" HDPE	0.65%	158.11
100	152.12	53.63	0.65%	Replace with 54" HDPE	0.65%	158.11
500	225.66	53.63	0.65%	Replace with 60" HDPE	0.65%	226.85

Southeast Sub-Basin (48" HDPE Existing)				
Recommended Solutions to prevent flooding per storm event				
Storm Event (yr)	Sub-Basin Flow (cfs)	Ex. Pipe Capacity (cfs)	Ex. Slope	Recommendation
50	29.72	178.26	1.54%	No Change
100	36.03	178.26	1.54%	No Change
500	52.78	178.26	1.54%	No Change

Southwest Sub-Basin (Ditch)						
Recommended Solutions to prevent flooding per storm event						
Storm Event (yr)	Sub-Basin Flow (cfs)	Ex. Ditch Capacity (cfs)	Ex. Slope	Recommendation	Prop. Slope	Prop. Ditch Capacity
50	150.26	63.33	-0.16%	Regrade Ditch	1.00%	610.69
100	182.97	63.33	-0.16%	Regrade Ditch	1.00%	610.69
500	269.85	63.33	-0.16%	Regrade Ditch	1.00%	610.69

Southwest Sub-Basin (48" HDPE Existing)						
Recommended Solutions to prevent flooding per storm event						
Storm Event (yr)	Sub-Basin Flow (cfs)	Ex. Pipe Capacity (cfs)	Ex. Slope	Recommendation	Prop. Slope	Prop. Pipe Capacity
50	150.26	246.43	2.94%	Replace with 60" HDPE	0.73%	222.58
100	182.97	246.43	2.94%	Replace with 66" RCP	0.73%	286.99
500	269.85	246.43	2.94%	Replace with 72" RCP	0.73%	361.94

The drainage calculations and recommendations provided in the tables above assume that the ditch will be regraded. Regrading will enable free outflow from the contributing sub-basins and help reduce ponding. However, resetting the 48-inch Southwest pipe to allow for this free flow from the regraded ditch will decrease the pipe's slope, resulting in a reduced flow capacity compared to its current state. To maintain adequate flow capacity for larger storm events, upsizing the pipes will be necessary.

Once the ditch is regraded, the Southwest pipe must be reset to align with the ditch's new invert elevation. This will require lowering the pipe's inlet by approximately 0.93 feet, which in turn reduces the pipe's slope and flow capacity. To offset this reduction and account for the minimal elevation difference with the upstream North pipe, the Southwest pipe will need to be significantly upsized to prevent ponding in the ditch and avoid backflow into the North pipe. Failure to upgrade the Southwest pipe would likely result in ponding within the ditch and at the upstream end of the North pipe.

We appreciate the opportunity to perform this analysis and look forward to collaborating with you further. Please don't hesitate to reach out if you have any questions.

Sincerely,
CSR Engineering, Inc.

Nettie Boyle, P.E.
TN License #128904

COVINGTON DRAINAGE IMPROVEMENTS												
	50 YEAR STORM				100 YEAR STORM				500 YEAR STORM			
	QUANTITY	UNIT	UNIT COST	COST	QUANTITY	UNIT	UNIT COST	COST	QUANTITY	UNIT	UNIT COST	COST
DEMOLITION/REMOVAL				$ 40,500				$ 40,500				$ 40,500
PIPE REMOVAL												
STRUCTURE REMOVAL												
REMOVAL OF ROADWAY												
CONSTRUCTION STAKES, LINES, AND GRADE												
CLEARING AND GRUBBING												
GRADING				$ 15,240				$ 17,520				$ 20,250
EARTHWORK (EXCAVATION)	508	CY	$ 30	$ 15,240	584	CY	$ 30	$ 17,520	675	CY	$ 30	$ 20,250
STORMWATER STRUCTURES				$ 483,580				$ 551,010				$ 673,320
54" HDPE PIPE	198	LF	$ 380	$ 75,240	198	LF	$ 380	$ 75,240				
60" HDPE PIPE	471	LF	$ 540	$ 254,340					198	LF	$ 540	$ 106,920
66" RCP PIPE					471	LF	$ 670	$ 315,570				
72" RCP PIPE									471	LF	$ 800	$ 376,800
54" ENDWALL	2	EACH	$ 15,000	$ 30,000	2	EACH	$ 15,000	$ 30,000				
60" ENDWALL	2	EACH	$ 19,000	$ 38,000					2	EACH	$ 19,000	$ 38,000
66" ENDWALL					2	EACH	$ 22,100	$ 44,200				
72" ENDWALL									2	EACH	$ 26,800	$ 53,600
5'-2"x5'-2" SQUARE CONCRETE NO. 42 CATCH BASIN, SINGLE	3	EACH	$ 10,000	$ 30,000	3	EACH	$ 10,000	$ 30,000				
7'x7' SQUARE CONCRETE NO. 42 CATCH BASIN, SINGLE	2	EACH	$ 14,000	$ 28,000	2	EACH	$ 14,000	$ 28,000	5	EACH	$ 14,000	$ 70,000
7'x7' SQUARE CONCRETE NO. 42 CATCH BASIN, DOUBLE	1	EACH	$ 14,000	$ 14,000	1	EACH	$ 14,000	$ 14,000	1	EACH	$ 14,000	$ 14,000
7'x7' SQUARE CONCRETE NO. 42 AREA DRAIN	1	EACH	$ 14,000	$ 14,000	1	EACH	$ 14,000	$ 14,000	1	EACH	$ 14,000	$ 14,000
PAVING				$ 58,475				$ 60,475				$ 64,975
ASPHALT REPAIR	233	SY	$ 250	$ 58,250	241	SY	$ 250	$ 60,250	259	SY	$ 250	$ 64,750
BASE STONE	5	TONS	$ 45	$ 225	5	TONS	$ 45	$ 225	5	TONS	$ 45	$ 225
MISCELLANEOUS				$ 47,300				$ 47,300				$ 47,300
TRAFFIC CONTROL	1	LS	$ 15,000	$ 15,000	1	LS	$ 15,000	$ 15,000	1	LS	$ 15,000	$ 15,000
FINAL STABILIZATION	1	LS	$ 5,000	$ 5,000	1	LS	$ 5,000	$ 5,000	1	LS	$ 5,000	$ 5,000
EPSC	1	LS	$ 10,000	$ 10,000	1	LS	$ 10,000	$ 10,000	1	LS	$ 10,000	$ 10,000
CURB REPAIR	150	LF	$ 50	$ 7,500	150	LF	$ 50	$ 7,500	150	LF	$ 50	$ 7,500
DRIVEWAY REPAIR	2	EACH	$ 1,000	$ 2,000	2	EACH	$ 1,000	$ 2,000	2	EACH	$ 1,000	$ 2,000
MAILBOX REPLACEMENT (BRICK)	2	EACH	$ 2,000	$ 4,000	2	EACH	$ 2,000	$ 4,000	2	EACH	$ 2,000	$ 4,000
FENCE REPAIR (WOOD, PRIVACY)	10	LF	$ 200	$ 2,000	10	LF	$ 200	$ 2,000	10	LF	$ 200	$ 2,000
TREE REPLACEMENT	3	EACH	$ 600	$ 1,800	3	EACH	$ 600	$ 1,800	3	EACH	$ 600	$ 1,800
TOTAL				$ 645,095				$ 716,805				$ 846,345