TECHNICAL MEMORANDUM

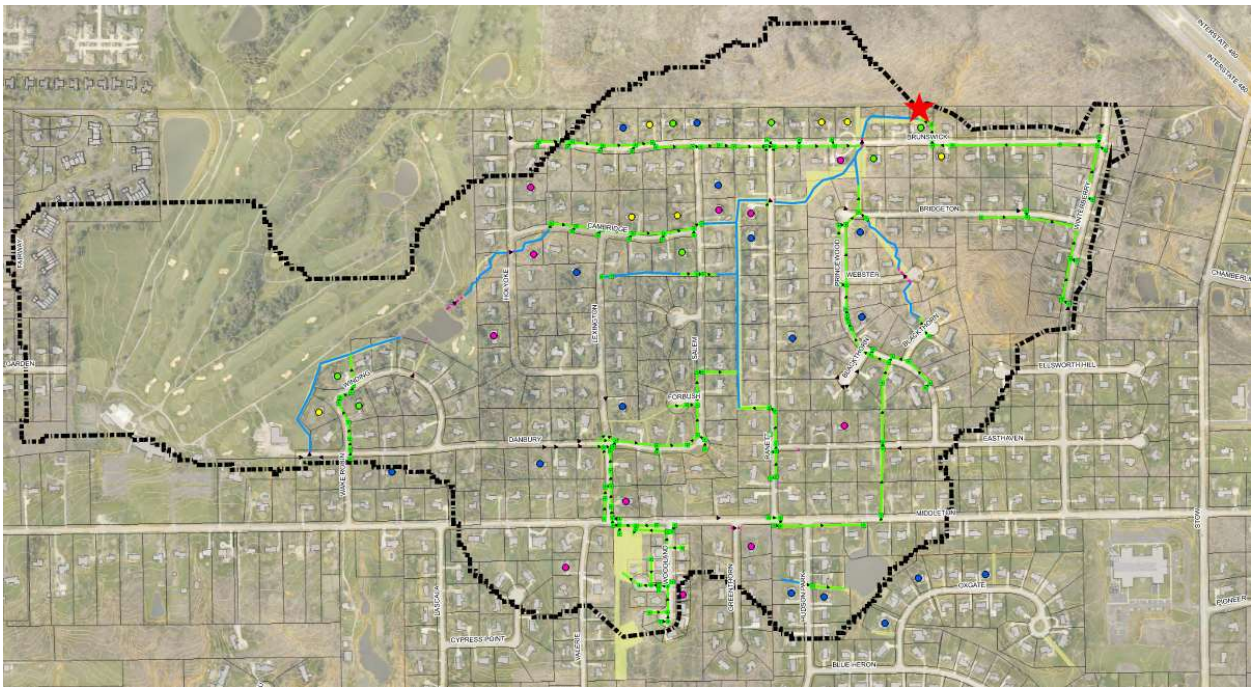
TO: Bradley Kosco, P.E., P.S., City Engineer

FROM: Biljana Sverko, PE, CFM

DATE: 1/15/2025

RE: **Brunswick Lane Drainage Area Study Documentation**

The City of Hudson's Brunswick Lane area experienced severe flooding during the storm on August 8, 2024. The scope of the drainage study includes investigation of existing storm system deficiencies in the Brunswick area and identify improvements that could help prevent future flooding. The study area is shown below and is bounded by the drainage area upstream of an outlet at an unnamed ditch at the municipal boundary with the Summit County unincorporated area and covers an area of 400 acres. 1-D Modeling was performed in PCSWMM for the 24-hour period at 10-year, 25-year and 100-year.



Existing Conditions Assumptions:

- City of Hudson provided information and reports related to storm event on August 8, 2024. According to rain gauge KOOHHUDSON46 via Weather Underground, approximately 6.5 inches

of rain fell between 6 P.M. to 9 P.M., with a total of 6.98 inches within a 24-hour period. Based on National Oceanic and Atmospheric (NOAA) Atlas 14 precipitation frequency estimates, the August 8th storm event is approximately a 500-year, 6-hour storm event.

- Existing conditions were reviewed from City of Hudson GIS and available storm records.
- Osborn identified missing records, City of Hudson field verified existing conditions and provided survey information to be input into the model including ditch cross sections, storm sewer inverts, and culvert sizes, materials, and inverts.
- Assumptions on open ditch typical sections was based off of survey data provided by the City, visual observation, and available digital elevation data from USGS.
- Results from the existing conditions model were reviewed, any deficiencies between model results and City of Hudson Engineering standards were identified. Storm infrastructure design guidelines set by City of Hudson Code:
    - Storm Sewers – 10-year
    - Open Ditches – 10-year
    - Culverts – 25-year
    - Combination of Major flow path and sewer/ditch system – 100-year

Alternate Analysis:

Three alternate analyses were performed as described below:

- Alternate 1 – Storm Sewer System Improvements
    - Storm infrastructure was increased to handle design guidelines set.
    - Storm Sewers were improved along Wake Robin, Danbury-Salem, Ranett, and Brunswick Lane west of culvert at 2566 Brunswick Lane.
    - Increased flow and capacity of sewers upstream of the Ranett culvert causes the culvert to be undersized at the 25-year event and is shown to be improved in this alternate. (Options to increasing the Ranett box culvert size include providing a bypass culvert along the east right-of-way of Ranett Ave. but will require a more in-depth study).
    - Flow downstream of the Brunswick Lane drainage area increased due to increased capacity of the storm system shown in this alternate. To reduce the increased peak flows to existing conditions, a 3.5 acre-feet (approximately 350ft x 180ft x 3ft figured) detention basin is required.
    - The detention basin evaluated requires property acquisition outside of City limits downstream of the Brunswick Lane drainage area.
    - See Appendix A for result table and OPCC and Figure 1 for concept layout.

- Alternate 2 – Linear Capacity Improvements
    - This includes all improvements discussed under Alternate 1.
    - In addition to storm system improvements, the open ditches between Ranett Ave and Salem Dr and between Ranett culvert and Brunswick culvert, were maximized to increase capacity.
        - Existing inverts were maintained.
        - Open ditch geometry was modified to match proposed geometry per Winterberry Heights Subdivision Record plans. (Additional modification options may include the addition of in-line weirs to control flow and maximize storage but will require a more in-depth study).
        - Open ditches were centered within the existing storm easements.
        - Top of banks for the open ditches provide a 3.0ft setback to maintain City access.
    - See Appendix A for result table and OPCC and Figure 2 for concept layout, and Figure 2A for ditch cross-section.

- Alternate 3 – Detention Improvements
    - In addition to improvements under Alternates 1, detention was provided within the drainage area.
    - Upstream of the Brunswick culvert was identified as an ideal location to provide detention within the drainage area.
        - To construct detention the city would need to acquire one of the properties in this area.
        - There are existing storm water easements that can be utilized for maximizing footprint of detention.
        - Alternate 3 had provided 4 acre-feet of storage.
    - Detention downstream of Brunswick Lane drainage area was removed from this alternate due to addition of detention within drainage area.
    - See Appendix A for results and OPCC and Figure 3 for concept layout.
- Although Alternate 1 indicates that approximately 6,000 LF of storm sewers are undersized, the City received minimal flood complaints or other drainage problems in this area. Further evaluation will be needed to determine if any restrictions can be eliminated without upgrading all the items in Alternate 1.

Attachments:

Appendix A	Alternate Result Summary Tables
Figure 1	Alternate 1 - Storm Sewer System Improvements
Figure 2	Alternate 2 - Linear Capacity Improvements
Figure 2A	Alternate 2 – Ditch Cross-Section
Figure 3	Alternate 3 - Detention Improvements

Appendix A

BRUNSWICK LANE DRAINAGE STUDY
SUMMARY OF H&H RESULTS

Description	Existing			Alt 1			Alt 2			Alt 3		
	10 YR	25 YR	100 YR	10 YR	25 YR	100 YR	10 YR	25 YR	100 YR	10 YR	25 YR	100 YR
Pre - Detention Flow (cfs)	210	275	376	217	291	409	211	283	380	210	291	409
Peak Increase (cfs)	N/A	N/A	N/A	7	16	33	1	8	4	7	16	33
Storage Provided (ac-ft)	N/A	N/A	N/A	3.5			3.5			4.0		
Post - Outfall Peak Flow (cfs)	210	275	376	197	267	383	192	270	367	146	216	302

Asset	Existing		Alt 1		Alt 2		Alt 3	
	Level of Service	Flow (cfs)	Level of Service	Flow (cfs)	Level of Service	Flow (cfs)	Level of Service	Flow (cfs)
Wake Robin Sewers	5 YR	3.3	25 YR	7.4	25 YR	7.4	25 YR	7.4
Danbury-Salem Sewers	5 YR	46.2	10 YR	57.8	10 YR	57.8	10 YR	55
Ranett Sewer	5 YR	4	25 YR	12	25 YR	12	25 YR	12
Brunswick West Sewers	5 YR	19	10 YR	29	10 YR	29	10 YR	29
Ranett Culvert	25 YR	119.6	25 YR	142.6	25 YR	135.5	25 YR	142.5
Brunswick Culvert	25 YR	206.2	25 YR	237.7	25 YR	228	100 YR	310
Ditch - Upstream of Ranett	100 YR	162.3	100 YR	190.5	100 YR	163.2	100 YR	191
Ditch - Ranett to Brunswick	25 YR	189.3	25 YR	205.8	25 YR	194.69	100 YR	209
Ditch - Downstream of Brunswick	100 YR	317.1	100 YR	355.3	100 YR	380.6	100 YR	245

LOS below City standards

Culvert: 25-YR storm is below top of pavement

BRUNSWICK LANE DRAINAGE STUDY
OPINION OF PROBABLE CONSTRUCTION COST (OPCC) - CONCEPT LEVEL

Asset	Alt 1		Alt 2		Alt 3		Comments	Ave Cost
Sewer Improvements	LF	Cost	LF	Cost	LF	Cost		
Wake Robin Sewers	716	$ 89,500	716	$ 89,500	716	$ 89,500	Ave cost of sewer improvements $125/LF	$ 125
Danbury-Salem Sewers	2,364	$ 295,500	2,364	$ 295,500	2,364	$ 295,500		
Ranett Sewer	755	$ 94,375	755	$ 94,375	755	$ 94,375		
Brunswick West Sewers	2,343	$ 292,875	2,343	$ 292,875	2,343	$ 292,875		
Subtotal	**6,178**	**$ 772,250**	**6,178**	**$ 772,250**	**6,178**	**$ 772,250**		

Culvert Improvements	LF	Cost	LF	Cost	LF	Cost	Comments	Ave Cost
Ranett Culvert	49	$ 49,000	49	$ 49,000	49	$ 49,000	Ave cost of culvert improvements $1000/LF	$ 1,000
Brunswick Culvert	-	$ -	-	$ -	-	$ -		
Subtotal	**49**	**$ 49,000**	**49**	**$ 49,000**	**49**	**$ 49,000**		

Ditch Improvements	LF	Cost	LF	Cost	LF	Cost	Comments	Ave Cost
Ditch - Upstream of Ranett	-	$ -	1,500	$ 37,500	-	$ -	Ave cost of ditch improvements $25/LF	$ 25
Ditch - Ranett to Brunswick	-	$ -	700	$ 17,500	-	$ -		
Ditch - Downstream of Brunswick	-	$ -	600	$ 15,000	-	$ -		
Subtotal	**-**	**$ -**	**2,800**	**$ 70,000**	**-**	**$ -**		

Detention Improvements	CY	Cost	CY	Cost	CY	Cost	Comments	Ave Cost
Detention - Downstream of City Limits	5,700	$ 171,000	5,700	$ 171,000	-	$ -	Ave cost of detention $30/CY	$ 30
Detention - Upstream of Brunswick	-	$ -	-	$ -	6,500	$ 195,000		
Property Acquisition	-	$ -	-	$ -	-	$ -	Not included	
Subtotal	**5,700**	**$ 171,000**	**5,700**	**$ 171,000**	**6,500**	**$ 195,000**		

Total Cost	**Alternative 1 =**	**$ 993,000**	**Alternative 2 =**	**$ 1,063,000**	**Alternative 3 =**	**$ 1,017,000**	Cost of property acquisition not included

Figures

IMPROVE SEWER FOR 10 YR LOS

PR. DETENTION TO ACCOUNT FOR INCREASED FLOW

IMPROVE RANETT CULVERT FOR UPSTREAM SEWER IMPROVEMENTS

POTENTIAL OPTION BYPASS RANETT CULVERT AVOID UPSIZING RANETT CULVERT

IMPROVE SEWER FOR 10 YR LOS

IMPROVE SEWER FOR 10 YR LOS

IMPROVE SEWER FOR 10 YR LOS

INTERSTATE 480

INTERSTATE 480

BRUNSWICK

BRIDGETON

WINTERBERRY

CHAMBERLIN

FAIRWAY

CAMBRIDGE

HOLYOKE

PRINCEWOOD

WEBSTER

LEX

SALEM

GARDEN

WINDING

FORBUS

ELLSWORTH HILL

DANBURY

EASTHAVEN

WAKE ROBIN

RANETT

MIDDLETON

STOW

WOODLAND

GREENTHORN

HUDSON PARK

OXGATE

LASCALA

CYPRESS POINT

VALERIE

BLUE HERON

ALTERNATE 1 - STORM SYSTEM UPGRADES

UPGRADES TO EXISTING STORM SYSTEM TO HANDLE DESIGN GUIDELINES SET IN CITY ORDINANCES

STORM SEWERS - 10 YR

CULVERTS - 25 YR

ROAD OVER TOP - 100 YR

Key:

- General Flood Call
- Stormwater in Basement
- Sanitary Sewer in Basement
- Sanitary Sewer & Stormwater in Basement

OSBORN ENGINEERING

OHIO HUDSON

ALTERNATE 1 - STORM SYSTEM IMPROVEMENTS
BRUNSWICK LANE DRAINAGE AREA STUDY
J20242357.000

N

0 400 800 Feet

COORDINATE SYSTEM: NAD 1983 2011 STATEPLANE OHIO NORTH FIPS 3401 FT US

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FIGURE 1

PR. DETENTION TO ACCOUNT FOR INCREASED FLOW

IN-LINE WEIR & ORIFICE FOR MINOR DETENTION

POTENTIAL OPTION BYPASS RANETT CULVERT AVOID UPSIZING RANETT CULVERT

ALTERNATE 2 - LINEAR CAPACITY IMPROVEMENTS

UPGRADES TO INCREASE CAPACITY IN THE DITCH WITHIN EX. STORM EASEMENTS AS SHOWN AND ALL IMPROVEMENTS WITHIN EX. STORM EASEMENTS OR RIGHT-OF-WAY INCLUDED IN ALT. 1

STORM SEWERS - 10 YR
CULVERTS - 25 YR
ROAD OVER TOP - 100 YR
DITCH IMPROVEMENTS

Key:

- General Flood Call
- Stormwater in Basement
- Sanitary Sewer in Basement
- Sanitary Sewer & Stormwater in Basement

OSBORN ENGINEERING

OHIO HUDSON

ALTERNATE 2 - LINEAR CAPACITY IMPROVEMENTS
BRUNSWICK LANE DRAINAGE AREA STUDY
J20242357.000

N

0 400 800 Feet

COORDINATE SYSTEM: NAD 1983 2011 STATEPLANE OHIO NORTH FIPS 3401 FT US

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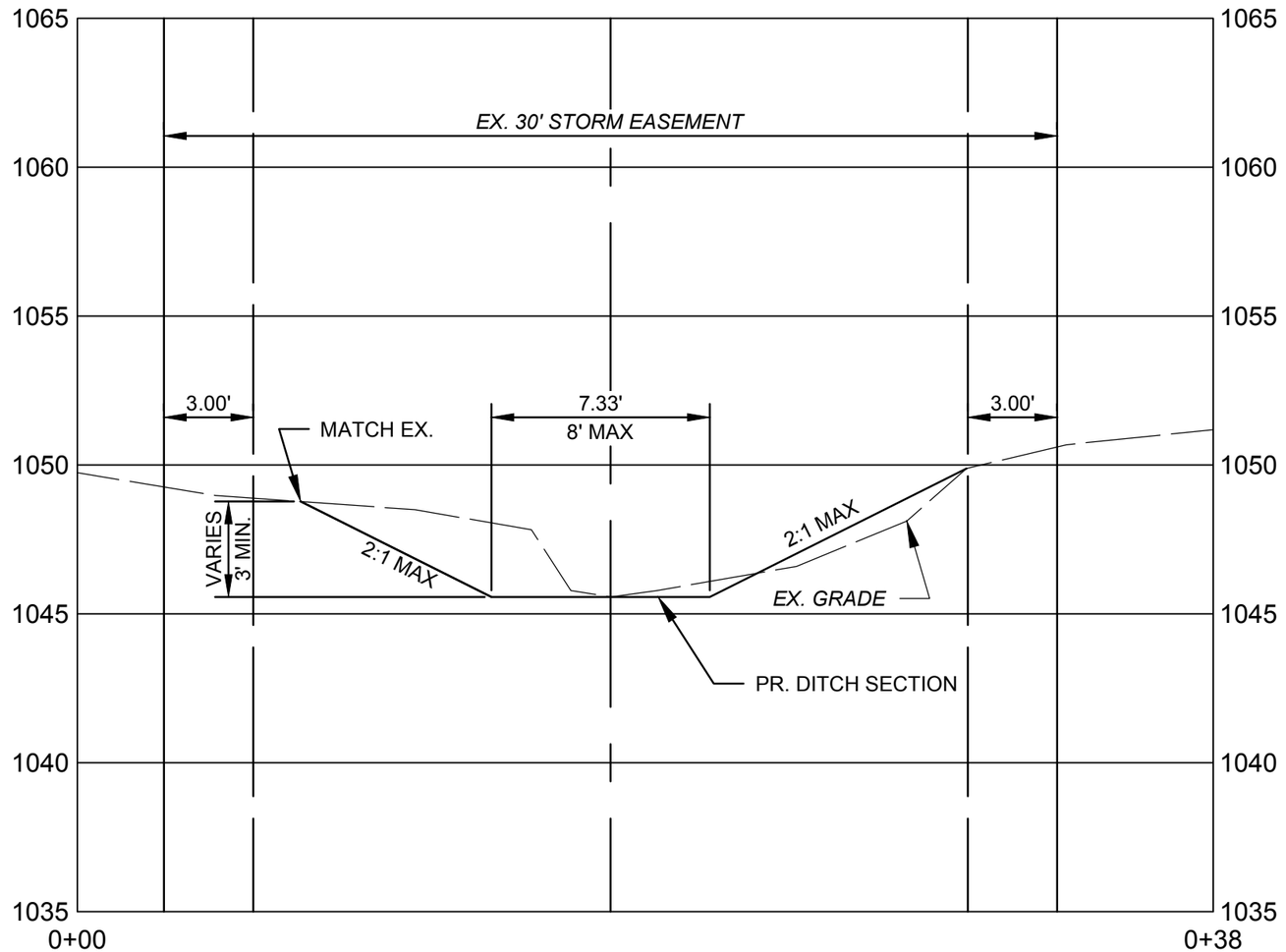
FIGURE 2



ALTERNATIVE 2 - DITCH CAPACITY IMPROVEMENT

ALT 2 DITCH IMPROVEMENTS INCLUDES IMPROVEMENTS TO INCREASE CAPACITY INCLUDING THE FOLLOWING ITEMS:

- RESTORE GEOMETRY PER WINTERBERRY HEIGHTS SUBDIVISION RECORD PLANS
- PROVIDE 3' ACCESS ON EITHER SIDE OF DITCH
- CENTER DITCH ON CENTER OF EASEMENT

FIGURE 2A

NO DETENTION REQUIRED DOWNSTREAM FOR IMPROVEMENTS

DETENTION ON A PARCEL WITHIN THIS GENERAL AREA. REQUIRED DETENTION SIZE = 4 AC-FT

ALTERNATE 3 - DETENTION IMPROVEMENTS

UPGRADES TO INCLUDE DETENTION WITHIN MAJOR FLOOD PATH. THIS ALTERNATE INCLUDES IMPROVEMENTS IN ALT. 1.

STORM SEWERS - 10 YR
CULVERTS - 25 YR
ROAD OVER TOP - 100 YR
DITCH IMPROVEMENTS

Key:

- General Flood Call
- Stormwater in Basement
- Sanitary Sewer in Basement
- Sanitary Sewer & Stormwater in Basement

OSBORN ENGINEERING

OHIO HUDSON

ALTERNATE 3 - DETENTION IMPROVEMENTS
BRUNSWICK LANE DRAINAGE AREA STUDY
J20242357.000

N

0 400 800 Feet

COORDINATE SYSTEM: NAD 1983 2011 STATEPLANE OHIO NORTH FIPS 3401 FT US

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FIGURE 3