



**Summary Report**  
of the  
**Yorkville Raymond**  
**Drainage District**  
Mapping and Benefits  
Assessment  
September 13, 2023



Nielsen Madsen + Barber  
CIVIL ENGINEERS AND LAND SURVEYORS



## **INTRODUCTION**

The following report was prepared by Nielsen Madsen + Barber (NMB), at the request of the Racine County Board of Drainage Commissioners on behalf of the Yorkville Raymond Drainage District hereafter referred to as the “District”, to update the existing mapping and benefits of the parcels served by the District. The benefits were calculated using the method approved by the Department of Agriculture, Trade and Consumer Protection (DATCP) which is described in Chapter ATCP 48 of the Wisconsin Administrative Code.

## **YORKVILLE RAYMOND DRAINAGE DISTRICT**

The District encompasses parts of two municipalities within Racine County: the Village of Yorkville and the Village of Raymond. The District contains 4,798 acres of land consisting of 309 parcels and road right-of-way. The Village of Yorkville contains 3,233 acres and 185 parcels within the District. The Village of Raymond contains 1,565 acres and 124 parcels within the District. The land within the District is predominantly agricultural with areas of low, medium and high-density residential development as well as isolated commercial and manufacturing parcels.

The drainage system within the District includes four (4) branch tiles and four (4) branch ditches all of which drain to the West Branch Root River Canal. The branch ditches, and that portion of West Branch Root River Canal that is within the District, add up to a total of 64,739 linear feet (12.26 miles) of drainage way. The four (4) branch tiles have a total length of 11,550 linear feet (2.19 miles).

The District is obligated, under Section 88.63 of the State Statutes, to maintain and repair District facilities. The cost of maintenance and repair is assessed based upon the benefits each parcel receives per Section 88.23 of the State Statutes. Property owners are assigned, in part, a proportionate “charge” based on the amount of runoff “generated” by their property.

The amount of runoff a property generates depends on the percent of impervious surface, ground cover / condition, topography and soil type. The total impervious area and percentage of the parcel thereof are the most important factors in generating runoff. Impervious surfaces are defined as solid or semi-solid surfaces that prevent rainfall from infiltrating into the ground thus creating excess “runoff”. Runoff from lands with a high percentage of impervious surfaces is generally in greater quantities and at higher velocities than undeveloped (i.e. agricultural, forest, swamp) lands and typically includes increased pollutant loading.

While undeveloped properties typically generate a fraction of the runoff as compared to developed properties of comparable size, such undeveloped or agricultural properties contribute to the District-wide storm water runoff that must be managed. The undeveloped property in the District amounts to approximately 84.5% of the total area and is scattered throughout the District.

The District is a separate entity from the two municipalities within its boundary. Rights-of-way owned by the Federal Government, State of Wisconsin and local municipalities make up 0.00%, 0.37% and 1.07%, respectively, of the land within the District boundary. In accordance with ATCP 48.02(5)(b) the District assesses each municipality (including Racine County) directly for their respective road rights-of-way. The County will be assessed for their rights-of-way. However, in accordance with ATCP 48.02(5)(a), lands owned by the State of Wisconsin cannot be assessed unless the land is being used for agricultural purposes. Therefore, WisDOT will not be assessed for their road rights-of-way within the District.

There are several parcels within the District whose boundary extends to the centerline of the adjacent roadway. These parcel owners will be assessed for their entire parcel area, including what extends into the public roadway.

## **PARCEL DATABASE**

A database was created which included all parcels within the District boundary. This database was built upon the existing infrastructure developed and maintained by Racine County.

As part of Racine County's Real Estate Description department, the Real Property Lister Division maintains the real estate tax roll for all municipalities within Racine County with the exception of the City of Racine. The County-maintained data applicable to the District's database includes the owner's name, tax key ID number, parcel size, mailing address, land use classification codes and acreages. The "land use" portion of the data originates from the assessors of the municipalities and is of particular importance to the District's database in that it contains a breakdown (by area) of each land use type for each individual parcel.

There are 16 land use classifications within the District. They are as follows:

- (1) High-Density Residential less than 1/3 Acre (G1)
- (2) Medium-Density Residential 1/3 Acre to 1 Acre (G1)
- (3) Low-Density Residential greater than 1 Acre (G1)
- (4) Commercial (G2)
- (5) Manufacturing (G3)
- (6) Agricultural (G4)
- (7) Swamp Land (G5)
- (8) Production Forest Land (G6)
- (9) Agricultural – Improved (G7)
- (10) State (X2)
- (11) County (X3)
- (12) Local / Institutional (X4)
- (13) Agricultural Forest (5M)
- (14) Woodland (W6)
- (15) Managed Forest, Closed (W8)
- (16) Road Right of Way (R/W)

A breakdown by land use of all parcels within the District is shown as follows:

### Breakdown of Land Use Classification by Area

District-wide Land Use Classification	Land Use Classification Code	Total Area (Acres)	Percentage of Total Area
Residential less than 1/3 Acre (High-Density)	G1	0.25	0.01%
Residential 1/3 Acre to 1 Acre (Medium-Density)	G1	23.39	0.49%
Residential greater than 1 Acre (Low-Density)	G1	472.01	9.84%
Commercial	G2	66.35	1.38%
Manufacturing	G3	19.64	0.41%
Agricultural	G4	3,320.62	69.21%
Swamp/Wasteland	G5	563.50	11.74%
Forest Land	5M / G6 / W6 / W8	95.29	1.99%
Agricultural - Improved	G7	62.13	1.29%
State	-	0.00	0%
County	-	0.00	0%
Local / Institutional	X4	1.31	0.03%
Local Road Right of Way	R/W	51.36	1.07%
State Road Right of Way	-	17.59	0.37%
US Road Right of Way	-	0.00	0%
District Corridor	DC	76.83	1.60%
Undefined	-	27.72	0.58%
	<b>Total</b>	<b>4798.00</b>	<b>100%</b>

### EXISTING BENEFITS ANALYSIS METHODOLOGY

The District has an existing methodology in place to determine the benefits for each parcel. This analysis was based on parcel runoff which is the product of two factors: parcel area (in acres) and the runoff coefficient as a function of underlying soil composition.

### PROPOSED BENEFITS ANALYSIS METHODOLOGY

NMB is proposing to use the same basic method as previous assessments, in which benefit points were determined by parcel size and runoff coefficient, for determining the total benefit points for each parcel. For assessment purposes, the individually calculated runoff amounts were used to determine the total “benefit points” for each

parcel. The District has assigned a minimum number of 400 benefit points for smaller residential and commercial parcels. These parcels typically contain more improvements and run the risk of suffering higher damages should the District system not be properly maintained. To determine the assessment rate for each parcel, the overall District assessment was divided by the total benefit points for all parcels producing a cost per benefit point. This cost was then multiplied by the total benefit points for each parcel, producing the overall assessment. This method can be utilized uniformly for all developed, undeveloped and agricultural parcels.

The runoff coefficient ranges from 0 to 1 and is the ratio of the amount of rainfall that is not absorbed by the surface to the total amount of rainfall during any given storm event. Parcels which have a larger proportion of “impervious” surface (streets, rooftops, sidewalks, patios, parking lots, driveways and other similar surfaces) will have a larger runoff coefficient than parcels which have a larger proportion of “pervious” surface (lawn, landscaping, agricultural lands and other similar surfaces).

NMB believes that the use of runoff coefficients satisfies the consideration requirements of ATCP 48.08(1)(c) through 48.08(1)(f). These considerations are as follows:

- 48.08(1)(c) – Consider the amount of drainage required by or provided to the assessed land.
- 48.08(1)(d) – Consider the thoroughness and reliability of drainage provided.
- 48.08(1)(e) – Consider the amount and frequency of flooding on the assessed land.
- 48.01(1)(f) – Consider the difficulty of draining the assessed land.

NMB is proposing to use runoff coefficient values as specified by Procedure 13-10-5 of the Wisconsin Department of Transportation’s Facilities Development Manual (FDM). The FDM has standard values for runoff coefficients based on land use, hydrologic soil group and land slope range. The vast majority of the land uses fall under one of these standard runoff coefficient values. However, the FDM does not have standard runoff coefficients for forest, agricultural-improved or swamp / wasteland. NMB used a commonly accepted average coefficient (0.13) for forested land and used the same value for agricultural improved as residential greater than 1 acre (0.25). Swamp / wasteland was neglected from the assessment and assigned a runoff coefficient of 0.00 per ATCP 48.06(4). The District corridor was neglected from the assessment per ATCP 48.08(3)(a). The FDM presents options for low intensity and high intensity design storm events. Low intensity design storm events have a 2 to 10-year design recurrence. High intensity design storm events have a 25 to 100-year design recurrence. Since the typical design storm for a study of this nature is a 10-year event, the low intensity option was used for the analysis. An average slope range of 2% to 6% was assumed for the entire District.

Runoff coefficients for the remaining land uses within the District were generated based on individual calculations. This method was employed due to the land uses (and individual parcels) containing substantially different characteristics and levels of imperviousness. The land uses for which these individual runoff coefficients were

calculated are commercial, institutional, municipal (County) and the properties with common ownership (condominium, common element, common area and outlots). These parcel specific coefficients were calculated based on percentages of pervious and impervious surface, agricultural use, road right-of-way, forest land and water surface. Impervious surfaces were assigned a runoff coefficient of 0.95 and pervious surfaces were assigned a runoff coefficient of 0.17. Water surfaces were treated the same as swamp / wasteland since water bodies accept runoff rather than generate it.

A breakdown of the District land uses by area and percentage as well as the standard runoff coefficients which were used is as follows:

### Land Use Classifications for which Standard Runoff Coefficients were used

District-wide Land Use Classification	Land Use Classification Code	Total Area (Acres)	Percentage of Total Area	Runoff Coefficient
Residential less than 1/3 Acre (High-Density)	G1	0.25	0.01%	0.51
Residential 1/3 Acre to 1 Acre (Medium-Density)	G1	23.39	0.49%	0.33
Residential greater than 1 Acre (Low-Density)	G1	472.01	9.84%	0.25
Agricultural	G4	3320.62	69.21%	0.19
Swamp/Wasteland	G5	563.50	11.74%	0.00
Forest Land	G6 / 5M / W6 / W8	95.29	1.99%	0.13
Agricultural - Improved	G7	62.13	1.29%	0.25
Local Road Right of Way	R/W	51.36	1.07%	0.61
	<b>Total</b>	<b>4588.55</b>	<b>95.64%</b>	

A breakdown of the District land uses by area and percentage for the individually calculated runoff coefficients is as follows:

### Land Use Classifications for which Individual Runoff Coefficients were Calculated

District-wide Land Use Classification	Land Use Classification Code	Total Area (Acres)	Percentage of Total Area
Commercial	G2	66.35	1.38%
Manufacturing	G3	19.64	0.41%
County	-	0.00	0%
Institutional	X4	1.31	0.03%
	<b>Total</b>	<b>87.30</b>	<b>1.82%</b>

## VILLAGE OF UNION GROVE ASSESSMENT ANALYSIS

**The following information (pages 6-8) is an excerpt from a report by Nielsen Madsen + Barber dated December 8, 2021 titled “Summary Report of the Yorkville-Raymond Drainage District Benefits”. This report was presented at a hearing on December 15, 2022, and confirmed on August 8, 2023. An assessment of \$1,164,800 was made as to the Village of Union Grove based on that report.**

### PROPOSED BENEFITS ANALYSIS METHODOLOGY

NMB is proposing to use the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Technical Release 55 (TR-55) “Urban Hydrology for Small Watersheds” method to determine the runoff tributary to the District facilities from the Village of Raymond, Village of Union Grove, and Village of Yorkville. This methodology assumes the ‘benefits’ received by each municipality from the District facilities are the same as the runoff produced by that municipality.

TR-55 is a procedure for estimating runoff and peak discharges in watersheds based on cover type, hydrologic soil groups, Time of Concentration (Tc) and rainfall distribution curves. The District watershed boundary was determined using LiDAR contour data obtained from Racine County. The overall watershed boundary was broken up into 5 sub-basins with the downstream end of the sub-basin at: the upstream limits of the District facilities (Area 1), CTH C (Area 2), STH 20 (Area 3), Two Mile Road (Area 4) and CTH K (Area 5). These sub-basins were further broken down into each of the three municipalities.

#### Watershed Area per Municipality

	Area 1 (ac)	Area 2 (ac)	Area 3 (ac)	Area 4 (ac)	Area 5 (ac)	Total (ac)	(%)
<b>Raymond</b>	0	0	0	3,784	5,868	9,652	38.6
<b>Union Grove</b>	810	0	0	0	0	810	3.2
<b>Yorkville</b>	1,865	2,759	3,718	6,198	0	14,540	58.2
<b>Total</b>	2,675	2,759	3,718	9,982	5,868	25,002	100

The cover type was broken down into four categories: Agricultural / Park / Open Space (APO), Commercial / Industrial / Municipal (CIM), High Density Residential (HDR) and Low Density Residential (LDR). The cover types within the watershed boundary were determined using the Racine County aerial imagery from 2020. The soils within the watershed boundary are predominately classified as a Type C hydrologic soil group; therefore, Class C was assumed for the entire watershed boundary.

#### Land Cover by Municipality

APO (ac)	CIM (ac)	HDR (ac)	LDR (ac)	Total (ac)
-------------	-------------	-------------	-------------	---------------

<b>Raymond</b>	7,241	42	9	2,360	9,652
<b>Union Grove</b>	270	166	369	5	810
<b>Yorkville</b>	10,924	771	36	2,809	14,540
<b>Total</b>	18,435	979	414	5,174	25,002

The cover type and hydrologic soil group are used to determine the Runoff Curve Number (CN). NMB is proposing to use the Curve Number values as specified in TR-55 Table 2-2. The information relative to this report are listed in Appendix “A” of this report. The following Curve Numbers were used for each cover type:

- APO (CN 71)
- CIM (CN 92)\*
- HDR (CN 81)
- LDR (CN 77)

\* The CN is a composite of 91 & 94. A CN 81 was used for the Southern Wisconsin Center.

The Tc was determined using the NRCS Lag Method for each of the five sub-basins. The NOAA Atlas 14 rainfall data for Racine County was used for the rainfall distribution curve. A routing report for the TR-55 analysis can be found in Appendix “C” of this report. An overall watershed boundary exhibit can be found in Appendix “D” of this report.

The peak discharge for the 10-year, 24-hour rainfall event for each sub-basin are as follows:

<b>Calculated Runoff (Benefits) per Municipality</b>							
	Area 1 (ac)	Area 2 (ac)	Area 3 (ac)	Area 4 (ac)	Area 5 (ac)	Total (ac)	(%)
<b>Raymond</b>	0	0	0	1,481	1,651	3,132	36.8
<b>Union Grove</b>	442	0	0	0	0	442	5.2
<b>Yorkville</b>	557	726	1,233	2,426	0	4,942	58.0
<b>Total</b>	999	726	1,233	3,907	1,651	8,516	100

## **UNION GROVE WASTEWATER TREATMENT ANALYSIS**

The Village of Union Grove Sewer Utility has a sanitary sewer treatment plant which discharges its treated effluent into the West Branch Root River. Since the Sewer Utility utilizes District facilities to convey its effluent discharge it is appropriate that the Sewer Utility be included in the benefits analysis.

In order to calculate an appropriate assessment charge for the Village of Union Grove Sewer Utility, their annual discharge into District maintained facilities was compared with the overall runoff from the lands within the Drainage District, not the watershed. Annual treatment plant effluent flows from 2011 through 2020 were provided to NMB by the Wisconsin Department of Natural Resources (WDNR) in an email dated February 5, 2021. This information can be found in Appendix “B” of this



report. The effluent data was averaged and resulted in 383.1 million gallons average annual effluent for the facility.

The average annual precipitation for the District was determined using data from the U.S. Department of Commerce National Oceanic and Atmospheric Administration (NOAA) which maintains climate data including annual precipitation from stations across the country. One of NOAA's stations is located in the Village of Union Grove. Annual precipitation data from 1991 to 2020 for the Union Grove station was used to determine an average annual precipitation for the District. The resulting 30-year average annual precipitation was 34.89 inches.

The District contains 4,803 acres with an average runoff coefficient of 0.172. The product of the District area, the annual precipitation and the average runoff coefficient is the total average annual runoff. Per this calculation procedure, the average annual runoff is 782.6 million gallons for the Drainage District. When the average annual runoff is added to the 383.1 million gallons of effluent from the treatment plant the total annual flow produced by the District is 1.166 billion gallons. The average annual effluent from treatment plant is 32.86% of the total average annual flow produced from the District. Therefore, the Village of Union Grove Sewer Utility is responsible for 32.86% of the overall Yorkville-Raymond Drainage District assessment.

The assessment of the Sewer Utility is consistent with the other Drainage Districts represented by the Board. This method of analysis has been confirmed by the law firm Stafford Rosenbaum LLP in an opinion dated September 24, 2021.

### **PERCENTAGE OF BENEFITS PER MUNICIPALITY**

The Village of Union Grove Sewer Utility is responsible for 32.86% of the assessment, leaving 67.14% of the assessment to be split among the three municipalities. Based on the 'Calculated Runoff (Benefits) per Municipality' table, the Village of Raymond, Village of Union Grove and Village of Yorkville will be responsible for 36.8%, 5.2% and 58.0% of the remaining 67.14%, respectively. The total assessment for the Village of Union Grove will include the Sewer Utility and runoff percentages.

**Percentage of Assessment**

	(%)
<b>Raymond</b>	24.7
<b>Union Grove</b>	36.4
<b>Yorkville</b>	38.9
<b>Total</b>	100

# APPENDIX A

## WISDOT FDM RATIONAL COEFFICIENT TABLE

Facilities Development Manual

Procedure 13-10-5

**Detail A - Runoff Coefficients (C), Rational Formula**

Land Use	Percent Impervious Area	Hydrologic Soil Group											
		A			B			C			D		
		Slope Range Percent			Slope Range Percent			Slope Range Percent			Slope Range Percent		
		0-2	2-6	6 & over	0-2	2-6	6 & over	0-2	2-6	6 & over	0-2	2-6	6 & over
Industrial	90	0.67	0.68	0.68	0.68	0.68	0.69	0.68	0.69	0.69	0.69	0.69	0.70
		0.85	0.85	0.86	0.85	0.86	0.86	0.86	0.86	0.87	0.86	0.86	0.88
Commercial	95	0.71	0.71	0.72	0.71	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
		0.88	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.90	0.89	0.89	0.90
High Density Residential	60	0.47	0.49	0.50	0.48	0.50	0.52	0.49	0.51	0.54	0.51	0.53	0.56
		0.58	0.60	0.61	0.59	0.61	0.64	0.60	0.62	0.66	0.62	0.64	0.69
Med. Density Residential	30	0.25	0.28	0.31	0.27	0.30	0.35	0.30	0.33	0.38	0.33	0.36	0.42
		0.33	0.37	0.40	0.35	0.39	0.44	0.38	0.42	0.49	0.41	0.45	0.54
Low Density Residential	15	0.14	0.19	0.22	0.17	0.21	0.26	0.20	0.25	0.31	0.24	0.28	0.35
		0.22	0.26	0.29	0.24	0.28	0.34	0.28	0.32	0.40	0.31	0.35	0.46
Agriculture	5	0.08	0.13	0.16	0.11	0.15	0.21	0.14	0.19	0.26	0.18	0.23	0.31
		0.14	0.18	0.22	0.16	0.21	0.28	0.20	0.25	0.34	0.24	0.29	0.41
Open Space	2	0.05	0.10	0.14	0.08	0.13	0.19	0.12	0.17	0.24	0.16	0.21	0.28
		0.11	0.16	0.20	0.14	0.19	0.26	0.18	0.23	0.32	0.22	0.27	0.39
Freeways & Expressways	70	0.57	0.59	0.60	0.58	0.60	0.61	0.59	0.61	0.63	0.60	0.62	0.64
		0.70	0.71	0.72	0.71	0.72	0.74	0.72	0.73	0.76	0.73	0.75	0.78

**Detail B - Runoff Coefficients for Specific Land Use**

Land Use	Hydrologic Soil Group											
	A			B			C			D		
	Slope Range Percent			Slope Range Percent			Slope Range Percent			Slope Range Percent		
	0-2	2-6	6 & over	0-2	2-6	6 & over	0-2	2-6	6 & over	0-2	2-6	6 & over
Row Crops	.08	.16	.22	.12	.20	.27	.15	.24	.33	.19	.28	.38
	.22	.30	.38	.26	.34	.44	.30	.37	.50	.34	.41	.56
Median Strip turf	.19	.20	.24	.19	.22	.26	.20	.23	.30	.20	.25	.30
	.24	.26	.30	.25	.28	.33	.26	.30	.37	.27	.32	.40
Side Slope turf			.25			.27			.28			.30
			.32			.34			.36			.38
<b>PAVEMENT</b>												
Asphalt	.70 - .95											
Concrete	.80 - .95											
Brick	.70 - .80											
Drives, Walks	.75 - .85											
Roofs	.75 - .95											
Gravel Roads Shoulders	.40 - .60											

NOTE: The lower C values in each range should be used with the relatively low intensities associated with 2 to 10 year design recurrence intervals whereas the higher C values should be used for intensities associated with the longer 25 to 100 year design recurrence intervals.

Date August 8, 1997

Figure 2

1 of 1