RAND ROAD & CHESTNUT AVENUE SITE IMPROVEMENTS

PRELIMINARY STORMWATER REPORT

ENGINEERING | SURVEYING | CONSTRUCTION

Contents:

Project:
Rand Road & Chestnut Avenue Site Improvements

Location:
Southeast Corner of Rand Road and Chestnut Avenue
Arlington Heights, Illinois

Prepared For:
Arlington Performance Center
315 W. Rand Road
Arlington Heights, IL 60004

Date:
September 21, 2023
February 16, 2024
April 12, 2024

Prepared By:
Kim Lask, P.E., PTOE, CFM
Haeger Project No.: 22-253

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1 PROJECT OVERVIEW

The total parcel area is 1.060 acres and is located at the southeast corner of Rand Road and Chestnut Avenue in Arlington Heights, Illinois. The property is bordered on the west by Chestnut Avenue, on the northeast by Rand Road, and on the southeast by a commercial development. The PIN's are 03-18-401-20 and 03-18-401-021.

The north side of the property is currently an auto repair center, and the south side is a single-family home. The proposed development will subdivide the property into two lots. Lot 1 contains the auto repair center (APC) that is proposed to remain. Parking and landscaping will be added. Lot 2 will contain a 5-unit row home development with associated parking lot, utilities, and underground detention basin that will serve Lot 2 and the disturbed area of Lot 1. Improvements on Chestnut Avenue include roadway widening with curb and gutter and sidewalk on the east side of the road. Improvements in the Rand Road right-of-way include replacing parkway pavement with green space and replacing sidewalk along the property frontage.

2 PROPOSED CONDITIONS

The development area is 0.625, and is reflected on the Proposed Drainage Exhibit in *Appendix C*. Below is a summary of the existing and proposed land coverage breakdown for the development area.

Table 1 – Land Coverage Comparison

Development Area	Area	Impervious Area		Pervious Area	
	(ac)	(ac)	(%)	(ac)	(%)
Existing Conditions	0.625	0.223	35.7	0.402	64.3
Proposed Development	0.625	0.378	60.5	0.247	39.5
Difference	---	*+0.155*		*-0.155*	

The impervious area will increase by 0.155 ac. (6,756 sf) with the proposed development.

3 STORMWATER DESIGN

Since the property is under three acres, stormwater detention is not required per Metropolitan Water Reclamation District's Watershed Management Ordinance (WMO). Stormwater detention is required in accordance with Village of Arlington Heights Village Engineer and Development Detention Calculation Verification spreadsheet. Detention was calculated for the entire subdivision area of 1.06 ac. which includes development area and existing area to remain unchanged. Based on the calculations, 0.392 ac.ft. of detention is required for the entire subdivision. Detention was also calculated for the development area of 0.625 ac. Based on the calculations, 0.205 ac.ft. of detention is required with a 1.29-inch restrictor.

An underground detention vault is proposed with a storage volume of 0.206 ac.ft. The remaining detention required, 0.187 ac.ft. (0.392 ac.ft. minus 0.205 ac.ft.) will be paid as fee-in-lieu of detention. The bottom of the detention vault is at elevation 687.4 and the high-water level is at 694.50. A minimum 2-inch restrictor will be

installed in an outlet control structure downstream of the detention vault. Storm sewer will be installed to collect runoff from the development area that will discharge to the underground detention vault. Calculations are included in *Appendix D*.

A portion of the APC site (0.268 ac.) currently sheet drains directly to Rand Road. Bioswales are proposed at the end islands to capture and filter over half of the runoff. See the Proposed Drainage Exhibit in *Appendix C* that illustrates the area that is tributary to the bioswales. Calculations are included in *Appendix D*.

4 VOLUME CONTROL FACILITIES

The entire development area will be tributary to the volume control basin. Volume control is provided for the development impervious area, 0.378 ac. The required volume control is 0.032 ac.ft., and the volume proposed is 0.033 ac.ft. See *Appendix D* for volume control calculations.

5 FLOOD PROTECTION, WETLANDS, AND RIPARIAN AREAS

Per FEMA mapping, there are no floodways, floodplains, or riparian areas located in the development area. There are no wetlands or special flood hazard areas located within 100' of the site. For additional information, please see the FEMA Exhibit and NWI Exhibit included in this submittal.

6 SITE STORMWATER PLAN IMPLEMENTATION SCHEDULE

The following sequence will be used in the construction of the site stormwater management system.

1) Installation of silt fence, erosion control measures and stabilized construction entrance.
2) Construction of detention vault and storm sewers.
3) Grading and paving including paved overflow routes.
3) Seeding and planting

The schedule is weather dependent. Excavation dependent activities require frost-free ground for proper construction. Planting should be completed in the correct season to maximize establishment rates.

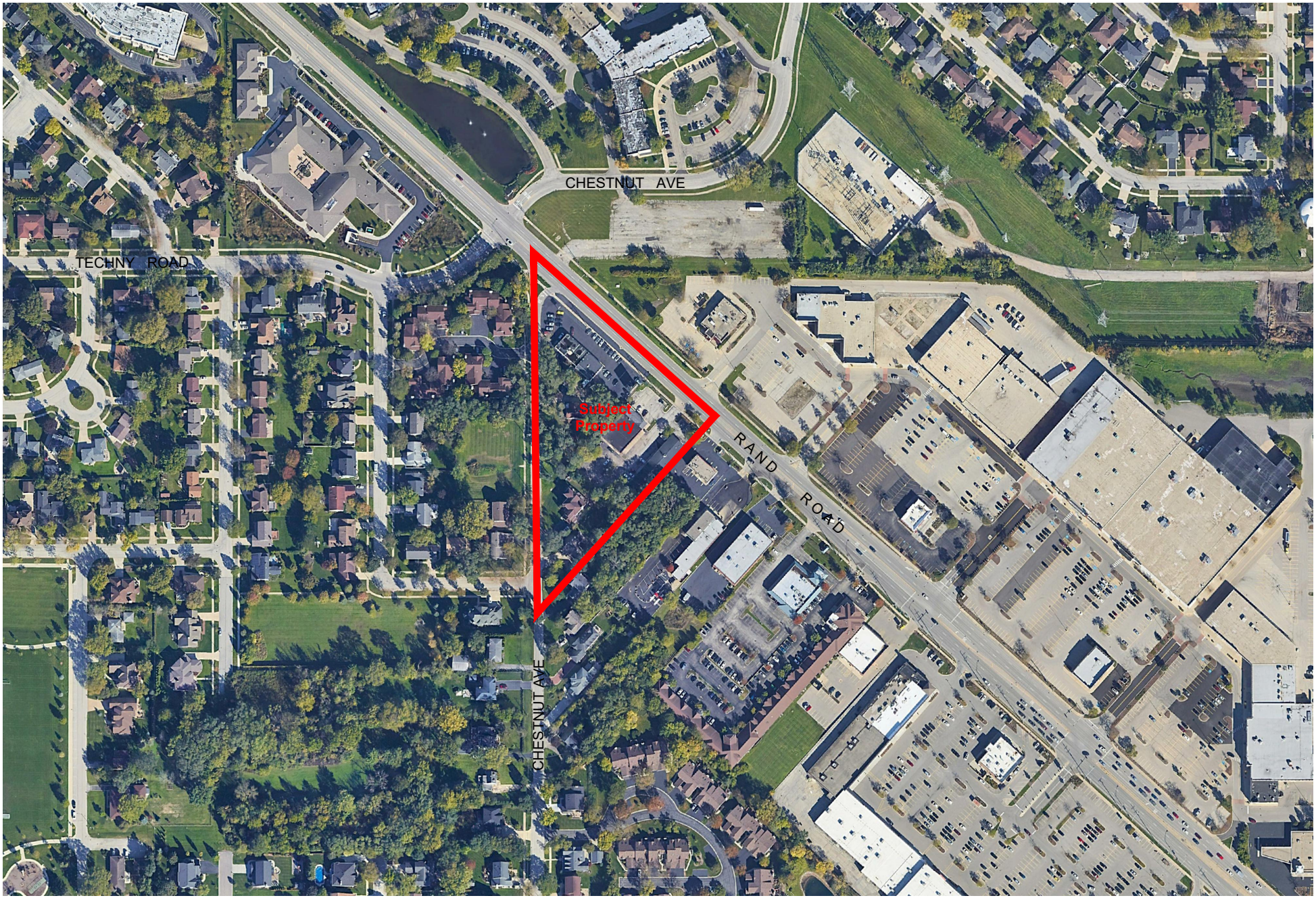
APPENDIX A – Exhibits

Aerial Exhibit

NRCS Exhibit

FEMA Exhibit

NWI Exhibit



NORTH

0 300

Scale: 1" = 300'

AERIAL EXHIBIT

RAND ROAD & CHESTNUT AVENUE
ARLINGTON HEIGHTS
ILLINOIS

HAEGER ENGINEERING
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Project Manager:	M L A
Engineer:	M L A
Date:	11.30.2022
Project No.	22-253
Sheet	1 / 1

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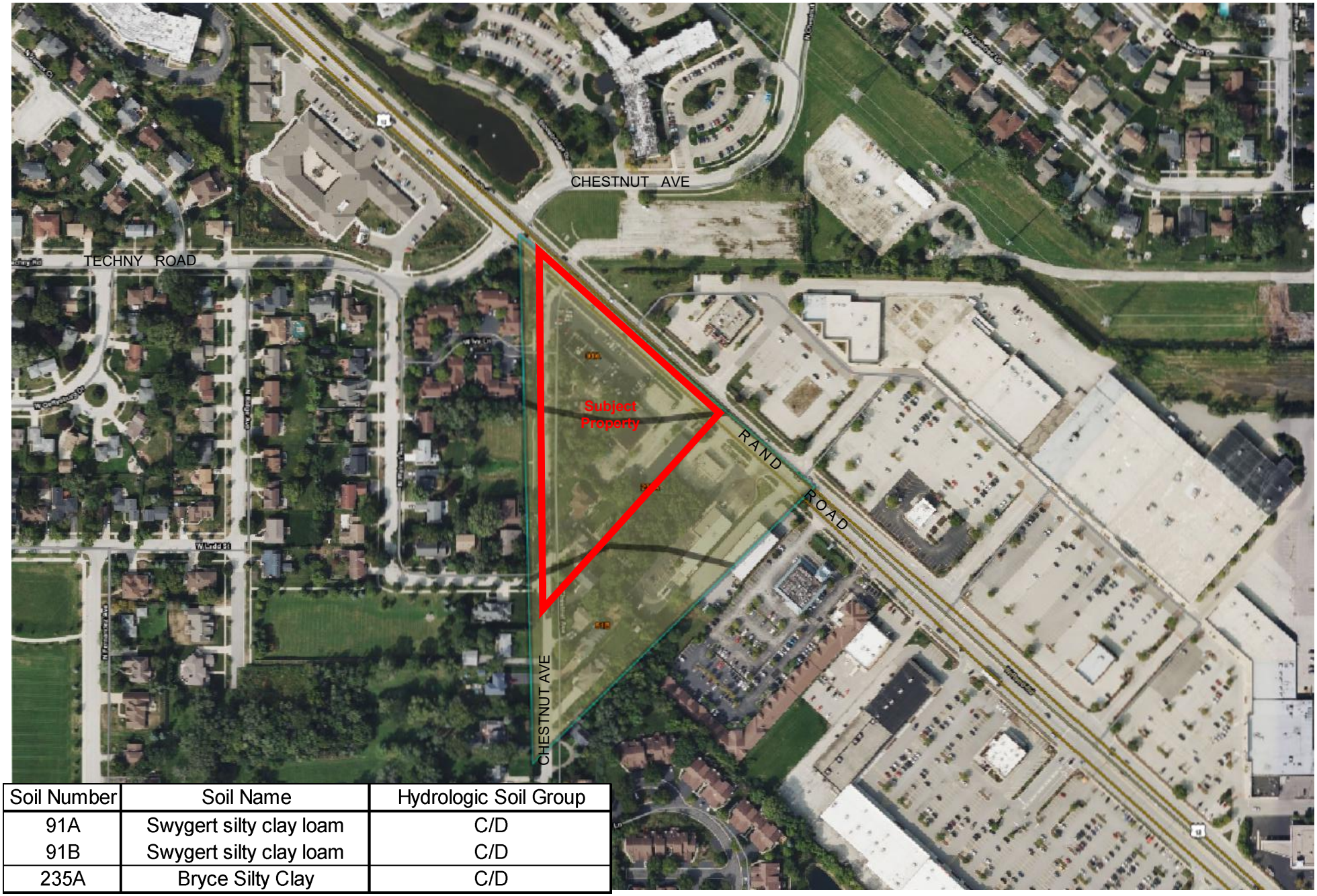

Soil Number	Soil Name	Hydrologic Soil Group
91A	Swygert silty clay loam	C/D
91B	Swygert silty clay loam	C/D
235A	Bryce Silty Clay	C/D

NORTH

0 300

Scale: 1" = 300'

NRCS SOILS EXHIBIT

RAND ROAD & CHESTNUT AVENUE
ARLINGTON HEIGHTS

ILLINOIS

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*Per FEMA FIRM Panel 17031C0201J
There are No Mapped Floodplains Located On-Site

NORTH
0 300
Scale: 1" = 300'

FEMA FLOODPLAIN EXHIBIT

RAND ROAD & CHESTNUT AVENUE
ARLINGTON HEIGHTS
ILLINOIS

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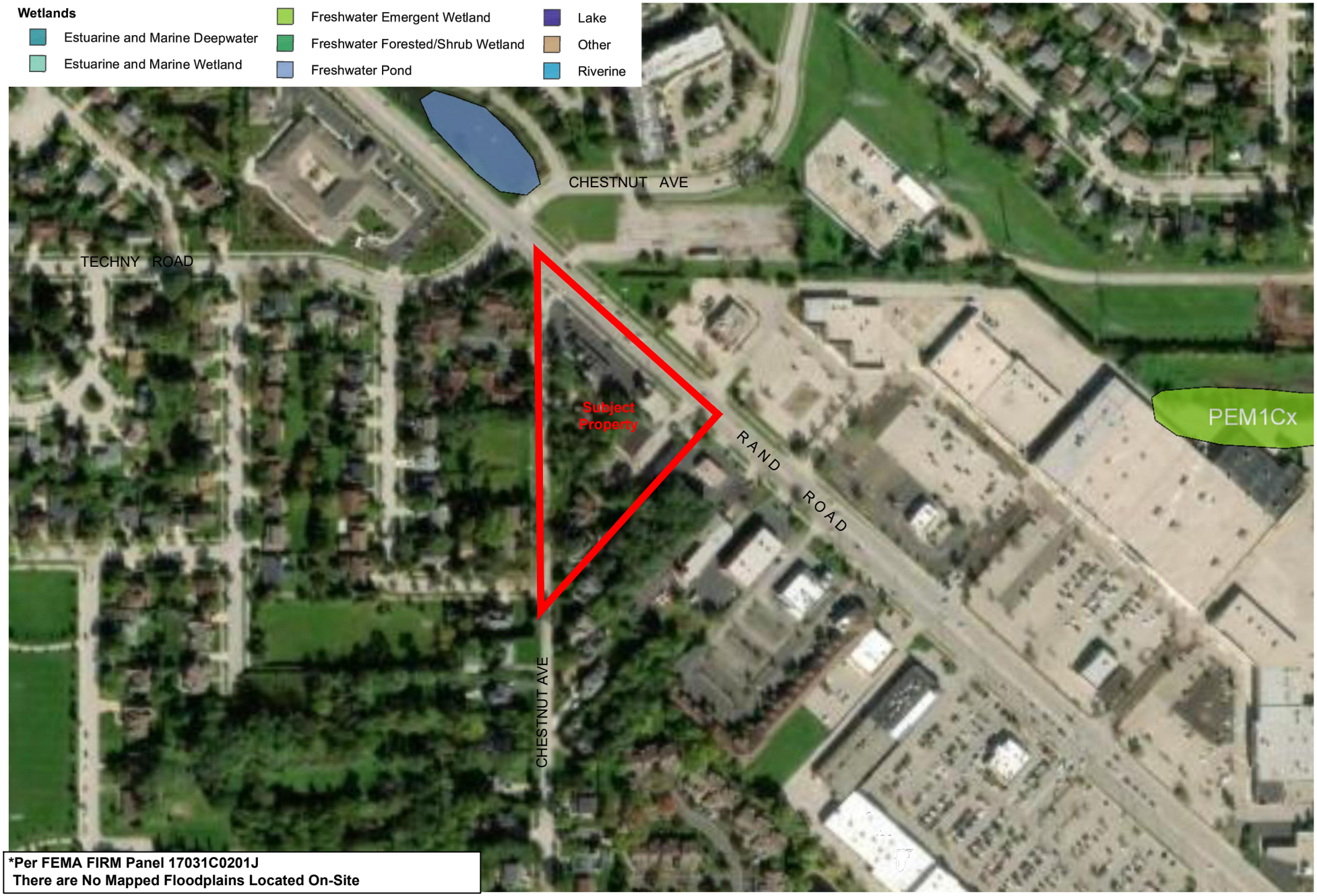

*Per FEMA FIRM Panel 17031C0201J
There are No Mapped Floodplains Located On-Site

NORTH
0 300
Scale: 1" = 300'

WETLAND EXHIBIT

RAND ROAD & CHESTNUT AVENUE
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ILLINOIS

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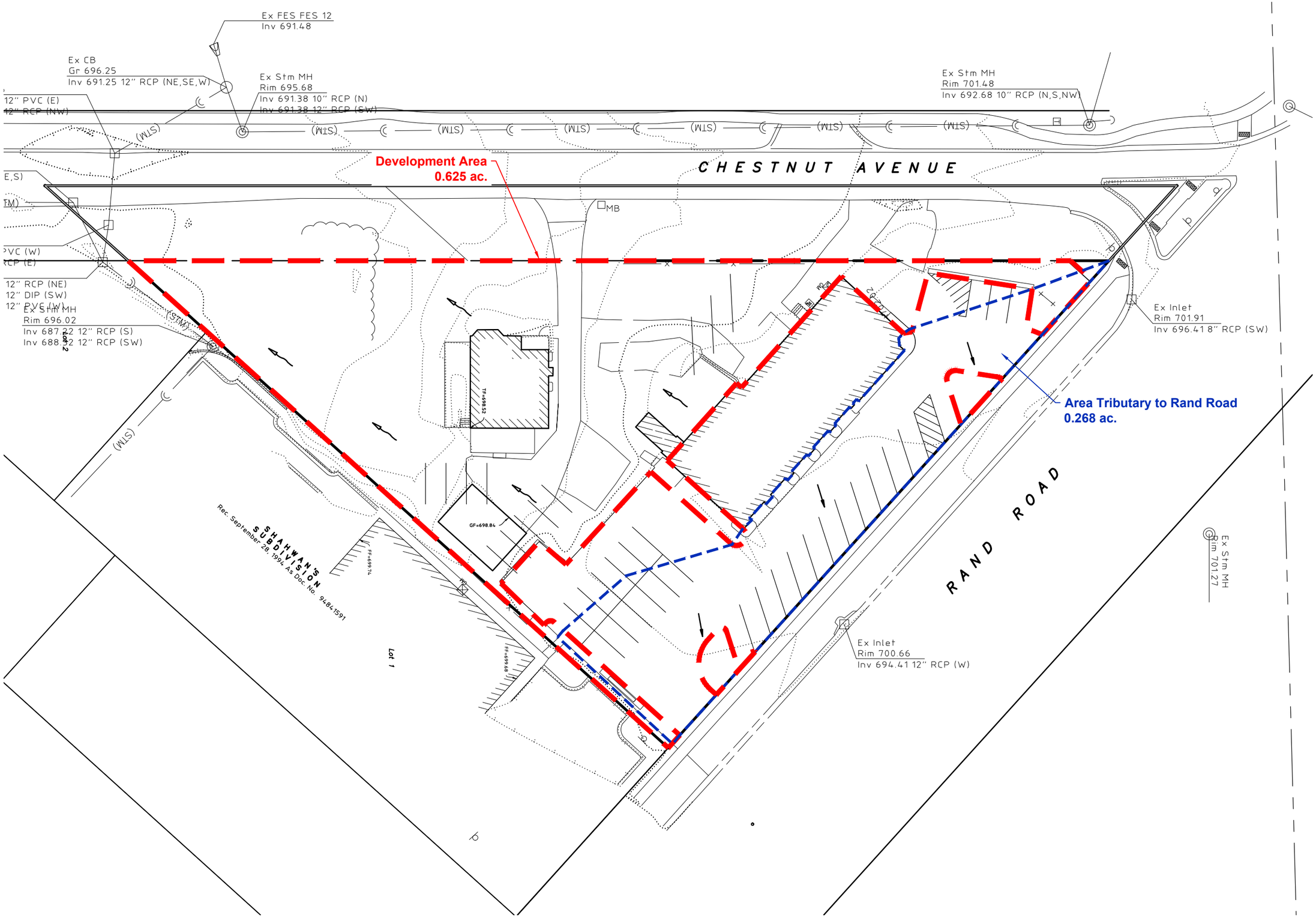
APPENDIX B – Existing Drainage Exhibit



NORTH

0 40

Scale: 1" = 40'

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EXISTING DRAINAGE EXHIBIT

RAND ROAD AND CHESTNUT AVE PRELIMINARY ENGINEERING

ARLINGTON HEIGHTS, IL

Project Manager:	KML
Engineer:	KML
Date:	02-13-2024
Project No.	22-253
Sheet	1 / 1

Plot Date: Feb 19, 2024 - 9:03am Plotted By: kim-l
File Name: P:\2022\22253\Drawings\Exhibits\22253-Drainage Exhibit.dwg

APPENDIX C – Proposed Drainage Exhibit

Ex FES FES 12
Inv 691.48

Ex CB
Gr 696.25
Inv 691.25 12" RCP (NE,SE,W)

Ex Stm MH
Rim 695.68
Inv 691.38 10" RCP (N)
Inv 691.38 12" RCP (SW)

Ex Stm MH
Rim 701.48
Inv 692.68 10" RCP (N,S,NW)

12" PVC (E)
12" RCP (NW)

E,S)
TM)
VC (W)
CP (E)
12" RCP (NE)
12" DIP (SW)
12" PVC (W)

Ex Stm MH
Rim 696.02
Inv 687.22 12" RCP (S)
Inv 688.32 12" RCP (SW)

(STM)

CHESTNUT AVENUE

Development Area
0.625 ac.

Outlet Control Strucutre

Proposed Detention Vault
Detention Storage = 0.206 ac.ft.
Volume Control Storage = 0.033 ac.ft.
HWL = 694.50
Bottom of Vault = 686.90

FF=703.00
GF=698.30

Lot 2

Lot 1

FF=703.00
FF=702.98
FF=702.12
FF=702.09
FF=702.07
FF=702.06
FF=702.06
FF=702.03

701.5

Area Tributary to Rand Road
0.030 ac.

Proposed Bioswale

Ex Inlet
Rim 701.91
Inv 696.41 8" RCP (SW)

RAND ROAD

Area Tributary to
Proposed Bioswales

Ex Inlet
Rim 700.66
Inv 694.41 12" RCP (W)

Proposed Bioswale

Area Tributary to Rand Road
0.070 ac.

Ex Stm MH
Rim 701.27

SHAHWAN'S SUBDIVISION
Rec. September 28, 1994 As Doc. No. 94845591

FF=699.74
FF=699.68

Lot 1

NORTH
0 40
Scale: 1" = 40'

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PROPOSED DRAINAGE EXHIBIT

RAND ROAD AND CHESTNUT AVE PRELIMINARY ENGINEERING

ARLINGTON HEIGHTS, IL

Project Manager:	KML
Engineer:	KML
Date:	02-13-2024
Project No.	22-253
Sheet	1/1

Plot Date: Feb 19, 2024 - 9:02am Plotted By: kim-l
File Name: P:\2022\22253\Drawings\Exhibits\22253-Drainage Exhibit.dwg

APPENDIX D – Stormwater Management Calculations

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Detention Storage Calculations

Project: Rand Road and Chestnut Avenue
Location: Arlington Heights, IL
Project #: 22-253

Prepared: KML
Date: 2/14/2024

A. Existing Land Coverage

Existing Site (Redevelopment Area)	Sq. Ft	Acre	Percentage	CN	C-Value
Impervious Area =	9,713	0.223	35.7%	98.0	0.95
Pervious Area =	17,525	0.402	64.3%	80.0	0.50
Total Area =	**27,238**	**0.625**	**100.00%**	**86.4**	**0.66**

B. Proposed Land Coverage

Proposed Residential	Sq. Ft	Acre	Percentage	CN	C-Value
Impervious Area =	11,528	0.265	63.2%	98.0	0.90
Pervious Area =	6,701	0.154	36.8%	74.0	0.50
Total Area =	**18,229**	**0.418**	**100.00%**	**89.2**	**0.75**

Proposed Commercial Disturbed Area	Sq. Ft	Acre	Percentage	CN	C-Value
Impervious Area =	4,941	0.113	54.8%	98.0	0.90
Pervious Area =	4,068	0.093	45.2%	74.0	0.50
VC Area =	0	0.000	0.0%	70.0	0.10
Total Area =	**9,009**	**0.207**	**100.00%**	**87.2**	**0.72**

Total Proposed Redevelopment Area	Sq. Ft	Acre	Percentage	CN	C-Value
Impervious Area =	16,469	0.378	60.5%	98.0	0.90
Pervious Area =	10,769	0.247	39.5%	74.0	0.50
VC Area =	0	0.000	0.0%	70.0	0.10
Total Area =	**27,238**	**0.625**	**100.00%**	**88.5**	**0.74**

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Detention Storage Calculations

Project: Rand Road and Chestnut Avenue
Location: Arlington Heights, IL
Project #: 22-253

Prepared: KML
Date: 2/14/2024

C. Required Volume Control Storage

Development Impervious Area = 0.378 ac

Required Volume Control Storage = 0.032 ac-ft

Volume Control Storage Provided = **0.033 af**

Volume Type	Surface Area (sq.ft.)	Elevation	Depth (ft.)	Porosity	Storage Volume	Volume Provided (cu.ft.)
V_A: Vault Storage	1,263.00	687.70	0.3	1	1.00 x 0.5 x V_A	189.45
(Below the Outlet)	1,263.00	687.40				
V_B: Course	351.00	687.70	0.3	0.36	0.50 x 0.36 x V_B	18.95
Aggregate (Above	351.00	687.40				
V_C: Vault Storage	1,263.00	687.40	0.5	1	1.00 x V_C	631.50
(Below U.D. Invert)	1,263.00	686.90				
V_D: Course	1,615.00	686.90	1	0.36	0.36 x VD	581.4
Aggregate	1,615.00	685.90				
						1421.30
						0.033 af

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Detention Storage Calculations

Project: Rand Road and Chestnut Avenue
Location: Arlington Heights, IL
Project #: 22-253

Prepared: KML
Date: 2/14/2024

D. Detention Storage

Detention Storage Required (from Arlington Heights spreadsheet) = 0.205 ac.ft.

Detention Storage Provided in Underground Vault System = **0.206 ac.ft.**

Detention Storage Provided in Vault (50% Volume for 687.50 to 687.70)

Elevation (ft)	Volume / FT (cu.ft./ft)	Volume (cu.ft.)	Cummulative Volume (cu.ft.)	Cummulative Volume (ac.ft.)
687.40	1,263.00	0.0	0	0.000
687.70	1,263.00	378.9	378.90	0.009

Detention Storage Provided in Vault (100% Volume 687.7 to 694.5)

Elevation (ft)	Volume / FT (sq.ft.)	Volume (cu.ft.)	Cummulative Volume (cu.ft.)	Cummulative Volume (ac.ft.)
687.70	1,263.00	0.0	0	0.000
688.00	1,263.00	378.9	378.90	0.009
689.00	1,263.00	1263.0	1,641.90	0.038
690.00	1,263.00	1263.0	2,904.90	0.067
691.00	1,263.00	1263.0	4,167.90	0.096
692.00	1,263.00	1263.0	5,430.90	0.125
693.00	1,263.00	1263.0	6,693.90	0.154
694.00	1,263.00	1263.0	7,956.90	0.183
694.50	1,263.00	631.5	8,588.40	0.197

Total Stage - Storage for Detention Vault

Elevation (ft)	Total Volume (cu.ft.)	Total Volume (ac.ft.)
687.40	0.00	0.0
687.70	378.90	0.009
688.00	757.80	0.017
689.00	2,020.80	0.046
690.00	3,283.80	0.075
691.00	4,546.80	0.104
692.00	5,809.80	0.133
693.00	7,072.80	0.162
694.00	8,335.80	0.191
694.50	8,967.30	**0.206**

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Detention Storage Calculations

Project: Rand Road and Chestnut Avenue
Location: Arlington Heights, IL
Project #: 22-253

Prepared: KML
Date: 2/14/2024

E. Existing Runoff to Rand Road

Existing Area Tributary to Rand Road	Sq. Ft	Acre	Percentage	CN	C-Value
Impervious Area =	11,681	0.268	100.0%	98.0	0.95
Pervious Area =	0	0.000	0.0%	80.0	0.50
Total Area =	**11,681**	**0.268**	**100.00%**	**98.0**	**0.95**

Time of Concentration: 5 min.

Storm Event	Rainfall Intensity (in/hr)	Exist. Runoff to Rand Road (cfs)
10-Year	7.44	1.895
50-Year	10.80	2.751
100-Year	12.36	3.149

F. Proposed Runoff to Rand Road

Proposed Area Tributary to Rand Road	Sq. Ft	Acre	Percentage	CN	C-Value
Impervious Area =	3,910	0.090	90.2%	98.0	0.95
Pervious Area =	427	0.010	9.8%	80.0	0.50
Total Area =	**4,337**	**0.100**	**100.00%**	**96.2**	**0.91**

Time of Concentration: 5 min.

Storm Event	Rainfall Intensity (in/hr)	Prop. Runoff to Rand Road (cfs)
10-Year	7.44	0.671
50-Year	10.80	0.974
100-Year	12.36	1.115

Proposed Area Tributary to Bioswales	Sq. Ft	Acre	Percentage	CN	C-Value
Impervious Area =	6,744	0.155	91.7%	98.0	0.95
Pervious Area =	607	0.014	8.3%	80.0	0.50
Total Area =	**7,351**	**0.169**	**100.00%**	**96.5**	**0.91**

Time of Concentration: 5 min.

Storm Event	Rainfall Intensity	Prop. Runoff
10-Year	7.44	1.146
50-Year	10.80	1.664
100-Year	12.36	1.904

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Detention Storage Calculations

Project: Rand Road and Chestnut Avenue
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Prepared: KML
Date: 2/14/2024

G. Storage in Bioswales on APC Site

Volume Type	Surface Area (sq.ft.)	Elevation	Depth (ft.)	Porosity	Storage Volume	Volume Provided
V_A: Surface Storage	286.10	700.50	1	1	1.00 x 0.5 x V_A	87.50
	63.90	699.50				
V_B: Soil Media Mix	63.90	699.50	1.5	0.25	0.50 x 0.25 x VB	11.98
	63.90	698.00				
V_C: Course Aggregate (Above	63.90	698.00	0	0.36	0.50 x 0.36 x VC	0.00
	63.90	698.00				
V_D: Course Aggregate	63.90	698.00	1	0.36	0.36 x VD	23.004
	63.90	697.00				
						122.49
						0.003 af

4/11/2024

Development

Detention Calculation Verification: PC # 23-

Site Requirements (Entire Subdivision)

Site Area =	1.060	Acres	Pervious=	0.247 Acres
Allowed Release Rate (Area x 0.18cfs/Ac) =	0.191	cfs	Impervious=	0.813 Acres
Weighted "C" Factor =	0.845		Water=	0.000 Acres
			Synth Turf=	0.000 Acres

A	B	C	D	E	F	G	H	J	K
Runoff Factor "C"	Storm Duration		**Updated** Rainfall Intensity "I"	Site Area "A"	Inflow Rate (CxIxA)	Release Rate	Storage Rate	Storage Required	
	(min)	(hrs)	(in/hr)	(acres)	(cfs)	(cfs)	(cfs)	(cu-ft)	(Ac-ft)
0.845	5	0.083	12.34	1.060	11.05	0.191	10.86	3246	0.075
0.845	10	0.167	10.80	1.060	9.67	0.191	9.48	5701	0.131
0.845	15	0.25	9.26	1.060	8.29	0.191	8.10	7293	0.167
0.845	20	0.33	7.97	1.060	7.14	0.191	6.95	8254	0.189
0.845	30	0.50	6.34	1.060	5.68	0.191	5.49	9878	0.227
0.845	40	0.67	5.27	1.060	4.72	0.191	4.53	10925	0.251
0.845	50	0.83	4.52	1.060	4.05	0.191	3.86	11526	0.265
0.845	60	1.00	4.03	1.060	3.61	0.191	3.42	12307	0.283
0.845	90	1.50	3.03	1.060	2.71	0.191	2.52	13624	0.313
0.845	120	2.00	2.49	1.060	2.23	0.191	2.04	14683	0.337
0.845	180	3.00	1.83	1.060	1.64	0.191	1.45	15640	0.359
0.845	240	4.00	1.48	1.060	1.33	0.191	1.13	16339	0.375
0.845	300	5.00	1.25	1.060	1.12	0.191	0.93	16715	0.384
0.845	360	6.00	1.07	1.060	0.96	0.191	0.77	16576	0.381
0.845	420	7.00	0.97	1.060	0.87	0.191	0.68	17081	0.392
0.845	480	8.00	0.87	1.060	0.78	0.191	0.59	16942	0.389
0.845	540	9.00	0.79	1.060	0.71	0.191	0.52	16738	0.384
0.845	600	10.00	0.72	1.060	0.64	0.191	0.45	16341	0.375
0.845	660	11.00	0.67	1.060	0.60	0.191	0.41	16201	0.372
0.845	720	12.00	0.62	1.060	0.56	0.191	0.36	15739	0.361
0.845	1080	18.00	0.45	1.060	0.40	0.191	0.21	13742	0.315
0.845	1440	24.00	0.36	1.060	0.32	0.191	0.13	11357	0.261
					A*D*E		F-G	C*H*3600	J/43560

Max Volume = 0.392 Acre-Ft
= 17,081 cu-ft

Orifice Computation

		Free Flow	Submerged Flow
1) Allowed Release Rate, Q(cfs)	0.191		
2) High Water Elevation	694.50	694.50	0.00
3) Outfall Water Elevation	688.22	-	0.00
4) Invert Elevation	688.00	688.00	0.00
5) Diameter of Restrictor (inch)	1.44	2	
6) Cross Section Area (sq ft)	-	0.022	0.000
7) Head (ft) h =	6.44	6.42	0.00
8) Discharge Coefficient	0.61	0.61	0.00

Square Edge 0.79 - 0.82
Round Edge 0.93 - 0.98
Sharp Edge 0.58 - 0.64 <-- Most common=0.61
Projecting 0.50

Q = C*a*(sqrt 2*g*h)

Orifice area: $a = \frac{Q}{C*(\text{sqrt } 2*g*h)}$

Q (cfs) = 0.27 0.000

a(sq ft) = 0.015 dia(in) = 1.68

9/21/2023

Development
Detention Calculation Verification: PC # 23-

Site Requirements

Site Area =	0.625	Acres	Pervious=	0.247 Acres
Allowed Release Rate (Area x 0.18cfs/Ac) =	0.113	cfs	Impervious=	0.378 Acres
Weighted "C" Factor =	0.772		Water=	0.000 Acres
			Synth Turf=	0.000 Acres

A	B	C	D	E	F	G	H	J	K
Runoff Factor "C"	Storm Duration		**Updated** Rainfall Intensity "I"	Site Area "A"	Inflow Rate (CxIxA)	Release Rate	Storage Rate	Storage Required	
	(min)	(hrs)	(in/hr)	(acres)	(cfs)	(cfs)	(cfs)	(cu-ft)	(Ac-ft)
0.772	5	0.083	12.34	0.625	5.95	0.113	5.84	1745	0.040
0.772	10	0.167	10.80	0.625	5.21	0.113	5.10	3065	0.070
0.772	15	0.25	9.26	0.625	4.47	0.113	4.35	3919	0.090
0.772	20	0.33	7.97	0.625	3.85	0.113	3.73	4434	0.102
0.772	30	0.50	6.34	0.625	3.06	0.113	2.95	5303	0.122
0.772	40	0.67	5.27	0.625	2.54	0.113	2.43	5861	0.135
0.772	50	0.83	4.52	0.625	2.18	0.113	2.07	6179	0.142
0.772	60	1.00	4.03	0.625	1.94	0.113	1.83	6593	0.151
0.772	90	1.50	3.03	0.625	1.46	0.113	1.35	7284	0.167
0.772	120	2.00	2.49	0.625	1.20	0.113	1.09	7837	0.180
0.772	180	3.00	1.83	0.625	0.88	0.113	0.77	8316	0.191
0.772	240	4.00	1.48	0.625	0.71	0.113	0.60	8656	0.199
0.772	300	5.00	1.25	0.625	0.60	0.113	0.49	8822	0.203
0.772	360	6.00	1.07	0.625	0.52	0.113	0.40	8711	0.200
0.772	420	7.00	0.97	0.625	0.47	0.113	0.36	8947	0.205
0.772	480	8.00	0.87	0.625	0.42	0.113	0.31	8835	0.203
0.772	540	9.00	0.79	0.625	0.38	0.113	0.27	8689	0.199
0.772	600	10.00	0.72	0.625	0.35	0.113	0.23	8438	0.194
0.772	660	11.00	0.67	0.625	0.32	0.113	0.21	8327	0.191
0.772	720	12.00	0.62	0.625	0.30	0.113	0.19	8042	0.185
0.772	1080	18.00	0.45	0.625	0.22	0.113	0.10	6747	0.155
0.772	1440	24.00	0.36	0.625	0.17	0.113	0.06	5244	0.120
					A*D*E		F-G	C*H*3600	J/43560

Max Volume = 0.205 Acre-Ft
= 8,947 cu-ft

Orifice Computation

			Free Flow	Submerged Flow
1) Allowed Release Rate, Q(cfs)		0.113		
2) High Water Elevation		694.50	694.50	0.00
3) Outfall Water Elevation		688.22	-	0.00
4) Invert Elevation		688.00	688.00	0.00
5) Diameter of Restrictor (inch)		1.29	2	
6) Cross Section Area (sq ft)		-	0.022	0.000
7) Head (ft)	h =	6.45	6.42	0.00
8) Discharge Coefficient		0.61	0.61	0.00

Square Edge 0.79 - 0.82
Round Edge 0.93 - 0.98
Sharp Edge 0.58 - 0.64 <-- Most common=0.61
Projecting 0.50

Q = C*a*(sqrt 2*g*h)

Orifice area: $a = \frac{Q}{C*(\text{sqrt } 2*g*h)}$

Q (cfs) = 0.27 0.000

a(sq ft) = 0.009 dia(in) = 1.29