

Appendix M – Stormwater Management

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M.1 - Rainfall Totals and Distributions



Client: Zion Landfill, Inc.
 Project: Zion Landfill – Site 2 North Expansion
 Project #: 631020105
 Calculated By: SJW Date: 05/2022
 Checked By: DAM Date: 05/2022

TITLE: RAINFALL TOTALS AND DISTRIBUTIONS

Problem Statement

Determine the rainfall totals and distributions of the 24-hour and 1-hour storm events for the 2-year, 10-year, 25-year, and 100-year frequencies. The rainfall totals and distributions are used in the HydroCAD Version 10 (HydroCAD) computer model to determine rainfall runoff quantities.

Given

Rainfall data used for the Site 2 North Expansion area was obtained from Appendix I of the Lake County Watershed Development Ordinance (WDO) published by the Lake County Stormwater Management Commission, effective October 13, 2020 (see attached reference). The most recent version of the WDO includes updated rainfall depths obtained from the Illinois State Water Survey (ISWS) Bulletin 75 - Precipitation Frequency Study for Illinois authored by James R. Angel and Momcilo Markus in March 2020.

In addition to updating rainfall depths, the ISWS Bulletin 75 also provides an update to the companion distribution bulletin (Bulletin 70) that defines rainfall distributions. The rainfall distributions defined in Bulletin 70 are commonly known as “Huff distributions” named after the author of the bulletin. Bulletin 70 and consequently Bulletin 75 outlines that first-quartile distribution patterns are appropriate for use in short duration events (1-hour storms), while third-quartile distribution patterns are appropriate for long duration events (24-hour storms). These distribution patterns are programmed into HydroCAD based on the information provided in Appendix I of the WDO (see attached reference).

Results

The 24-hour and 1-hour storm events for the 2-year, 10-year, 25-year and 100-year frequencies for the “Northeast” climatic section of Illinois, where the proposed Site 2 North Expansion area is located, are summarized below.

Table 1 Estimated Rainfall		
Recurrence Interval	1-Hour (inches)	24-Hour (inches)
2-Year	1.57	3.34
10-Year	2.42	5.15
25-Year	3.03	6.45
100-Year	4.03	8.57

LAKE COUNTY
WATERSHED DEVELOPMENT ORDINANCE

OF

LAKE COUNTY, ILLINOIS

ORIGINAL EFFECTIVE DATE

October 18, 1992

Approved as Amended

By the

Lake County Board

July 12, 1994

August 10, 1999

October 10, 2000

August 14, 2001

November 8, 2005

January 10, 2006

October 10, 2006 (Appendix C)

November 18, 2008

July 10, 2012

June 11, 2013

October 13, 2015

October 13, 2020

Appendix I: Rainfall Depth Duration Frequency Tables for Lake County

Rainfall Depth Duration Frequency Tables for Lake County Rainfall is in Inches

Storm Duration	2-month	3-month	4-month	6-month	9-month	1-year	2-year	5-year	10-year	25-year	50-year	100-year	500-year
5 minutes	0.19	0.22	0.24	0.27	0.31	0.33	0.40	0.52	0.62	0.77	0.90	1.03	1.35
10 minutes	0.35	0.40	0.43	0.49	0.56	0.61	0.73	0.95	1.13	1.42	1.65	1.89	2.47
15 minutes	0.42	0.49	0.53	0.61	0.69	0.75	0.90	1.16	1.39	1.74	2.03	2.32	3.04
30 minutes	0.58	0.66	0.73	0.83	0.94	1.03	1.24	1.59	1.91	2.39	2.78	3.17	4.16
1 hour	0.74	0.84	0.93	1.05	1.20	1.30	1.57	2.02	2.42	3.03	3.53	4.03	5.28
2 hours	0.91	1.04	1.14	1.30	1.48	1.61	1.94	2.49	2.99	3.74	4.35	4.97	6.52
3 hours	1.00	1.15	1.26	1.44	1.63	1.77	2.14	2.75	3.30	4.13	4.80	5.49	7.20
6 hours	1.18	1.35	1.48	1.68	1.91	2.08	2.51	3.23	3.86	4.84	5.63	6.43	8.43
12 hours	1.37	1.56	1.71	1.95	2.21	2.41	2.91	3.74	4.48	5.61	6.53	7.46	9.78
18 hours	1.48	1.69	1.85	2.11	2.39	2.61	3.14	4.04	4.84	6.06	7.05	8.06	10.57
24 hours	1.57	1.80	1.97	2.24	2.55	2.77	3.34	4.30	5.15	6.45	7.50	8.57	11.24
48 hours	1.72	1.97	2.16	2.46	2.79	3.04	3.66	4.71	5.62	6.99	8.13	9.28	12.10
72 hours	1.87	2.14	2.34	2.67	3.03	3.30	3.97	5.08	6.05	7.49	8.64	9.85	12.81
120 hours	2.08	2.38	2.61	2.97	3.37	3.67	4.42	5.63	6.68	8.16	9.39	10.66	13.81
240 hours	2.63	3.01	3.30	3.76	4.27	4.65	5.60	7.09	8.25	9.90	11.26	12.65	16.00

References: ISWS Bulletin 75 Precipitation Frequency Study for Illinois
James R. Angel and Momcilo Markus
Illinois State Water Survey, March 2020

HUFF RAINFALL DISTRIBUTIONS

The Huff quartiles represent the typical rainfall distribution for 4 different storm duration ranges. The First quartile applies to storms less than or equal to 6 hours long. Second is for storms greater than 6 hours and less than or equal to 12 while the third is Huff quartile is for storms greater than 12 hours and less than or equal to 24 hours. Fourth quartile storms apply to storm durations greater than 24 hours.

AREA < 10 SM

AREA > 10 & AREA < 50

AREA > 50 & AREA < 400

Portion of the Storm	AREA < 10 SM				AREA > 10 & AREA < 50				AREA > 50 & AREA < 400			
	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	First Quartile	Second Quartile	Third Quartile	Fourth Quartile	First Quartile	Second Quartile	Third Quartile	Fourth Quartile
0/24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1/24	8.36	2.29	2.05	2.31	6.41	1.48	1.33	1.48	4.59	0.88	0.72	0.90
2/24	17.73	4.82	4.31	4.79	15.69	3.57	3.02	3.34	13.49	2.38	1.85	2.29
3/24	28.11	7.78	6.67	7.12	27.45	6.39	5.13	5.72	25.94	4.93	3.47	4.36
4/24	38.33	11.33	9.12	9.78	38.91	10.02	7.53	8.56	39.17	8.52	5.57	7.10
5/24	47.45	15.79	11.71	12.53	49.34	14.71	10.01	11.69	51.04	13.19	8.28	9.93
6/24	55.50	21.39	14.36	15.23	58.55	20.89	12.65	14.19	60.79	19.59	10.96	12.84
7/24	62.25	28.41	16.91	17.91	65.88	28.91	15.24	17.19	69.26	27.46	13.79	15.46
8/24	67.22	36.44	19.64	20.33	71.10	37.55	18.17	19.69	74.80	37.17	16.35	17.83
9/24	70.82	45.29	22.78	22.83	74.92	46.86	21.46	22.27	78.74	47.77	19.66	20.12
10/24	74.17	54.35	26.33	25.41	78.30	56.25	25.36	24.81	82.20	58.18	23.46	23.12
11/24	76.97	62.38	30.93	28.35	81.16	64.84	29.90	27.46	85.13	67.64	28.07	25.76
12/24	79.81	69.76	36.35	31.25	83.75	72.90	35.60	30.33	87.38	75.86	34.06	28.26
13/24	82.55	75.48	43.92	33.90	86.20	79.07	43.42	32.42	89.58	82.04	42.30	30.99
14/24	85.18	80.38	52.11	36.33	88.64	83.97	52.18	34.28	91.45	86.92	52.02	33.68
15/24	87.40	84.70	61.02	38.61	90.81	87.58	61.88	36.89	93.35	90.33	62.76	36.12
16/24	89.47	87.81	69.89	41.24	92.58	90.67	71.81	39.73	94.80	93.09	72.80	39.07
17/24	91.17	90.22	78.19	45.08	93.99	92.76	80.43	43.85	95.99	94.82	82.27	42.93
18/24	92.70	92.17	84.92	51.29	95.19	94.59	87.25	49.87	96.94	96.25	89.19	48.98
19/24	94.03	93.81	89.74	59.31	96.35	95.97	92.01	58.93	97.70	97.34	93.60	59.22
20/24	95.36	95.29	93.11	69.19	97.27	97.10	95.04	69.85	98.35	98.21	96.33	71.66
21/24	96.56	96.57	95.34	80.05	98.03	97.99	96.90	82.36	98.86	98.83	97.97	85.18
22/24	97.74	97.74	97.06	89.71	98.74	98.72	98.22	92.59	99.28	99.30	98.98	94.64
23/24	98.85	98.84	98.56	96.04	99.37	99.39	99.21	97.96	99.66	99.67	99.58	98.77
24/24	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

References: ISWS Bulletin 75 Precipitation Frequency Study for Illinois
James R. Angel and Momcilo Markus
Illinois State Water Survey, March 2020