Appendix D: Flood Risk Analysis:

Flood Risk Calculations for Cascadilla Creek:

As discussed, data given by two Cornell graduates was utilized to determine the time of concentration via the Kirpich Method (see Appendix A: Time of Concentration). The curve number, longest flow path, area, and average slope along the longest flow path were also all given by data from the graduate students. Culvert capacity was calculated using Type III culvert analysis, as it was determined to be the most conservative estimate of culvert capacity.

With all the above-mentioned variables known, The synthetic hydrograph method (see Appendix B: Peak Discharge Analysis) was utilized to backsolve for the precipitation depth. The following equations were used to calculate precipitation depth:

- Runoff depth (Q) was determined by manipulating the known culvert capacity (q_{III}), time of concentration(t_c), and area (A) through uses of known relationships:

$$Q = \frac{(q_{III} * 2.937 * t_c * 3600))}{2 * A}$$

- The following equation was plugged into a solver in Matlab to solve for the precipitation depth (P) of each stream crossing.

$$Q - \frac{(P - I_a)^2}{P - I_a + S} * 0.0254 = 0$$

See MATLAB Appendix: Flood Risk Analysis for detailed Matlab code used to backsolve from the Synthetic Triangular Method with known and previously calculated variables. Download data set (1) and data set (2) to run this code.

After associated precipitation depth was found for each of the culvert capacities, return level was determined through comparison with the estimated region return levels for storms associated within the area using NRCC. NRCS return levels are described in Table D.1. Return levels for each culvert were evaluated by rounding the calculated precipitation depth to the nearest precipitation depths associated with a given return level. Table D.2 summarizes these findings.

Table D.1: NRCC return levels for Tompkins County.

NRCC Return Levels for Tompkins County									
Return Level (year)	1	2	5	10	25	50	100	200	500
Precipitation Depth (in)	0.99	2.34	2.9	3.41	4.23	4.98	5.87	6.92	8.6

Table D.2: Relevant culvert characteristics
utilized to find precipitation depth and return level in years.

Location	Longest Flow Path (ft)	Average Slope Along the Longest Flow Path	Area (m^3)	Curve Number	Capacity Q111 (m^3/s)	Percipitation Depth (in)	Return level
Bostwick Road	2112	0.087	106000	75.99	4.39	2.97	< 1 year
Enfield Main Road	11932.8	0.034	3108000	71.66	12.09	2.30	1-2 year
Connecticut Hill Road	7761.6	0.064	1683000	77.58	11.41	1.96	< 1 year
Leonard Road	6758.4	0.065	1580000	73.18	30.46	3.64	< 1 year
Butternut Creek Road	6916.8	0.061	725000	73.87	2.87	1.60	< 1 year
Stonehaven Circle Road	18744	0.038	6086000	74.23	38.31	3.30	1-2 year
Station Road	4012.8	0.127	570000	77.38	1.25	0.82	< 1 year
Valley View Road	11510.4	0.079	3445000	75.37	10.08	1.53	1-2 year
West Danby road (34)	11668.8	0.078	3496000	67.77	23.01	2.77	1-2 year
Smiley Hill Road	4382.4	0.083	699000	65.44	2.02	1.43	1 year
Ekroos Rd	24393.6	0.015	17068000	69.91	18.42	1.96	5-10 year
Ekroos Rd (2nd location)	24393.6	0.015	17068000	75.43	17.83	1.67	5-10 year
Vanostrand	2640	0.033	285000	73.43	1.09	1.26	1 year
Vanostrand Rd (2nd Location)	5808.01	0.062	518000	75.43	0.41	0.73	1-2 year
Douglas Rd	4540.8	0.034	647000	67.23	1.74	1.54	1-2 year
Fishkill Rd	14414.4	0.027	4584000	76.97	9.63	1.65	1-2 year
Thomas Road	4329.6	0.068	543,897.50	73.01	2.02	1.32	1 year
Curry	51849.6	0.017	29,784,863.27	83.75	48.08	2.22	5-10 year
Curry (2nd location)	51849.6	0.017	29,784,863.27	73.24	46.42	2.85	5-10 year
Genung Rd	2481.6	0.044	212,638.02	69.73	1.89	1.91	< 1 year
38 North	6652.8	0.04	751,096.55	58.95	3.20	2.54	1-2 year