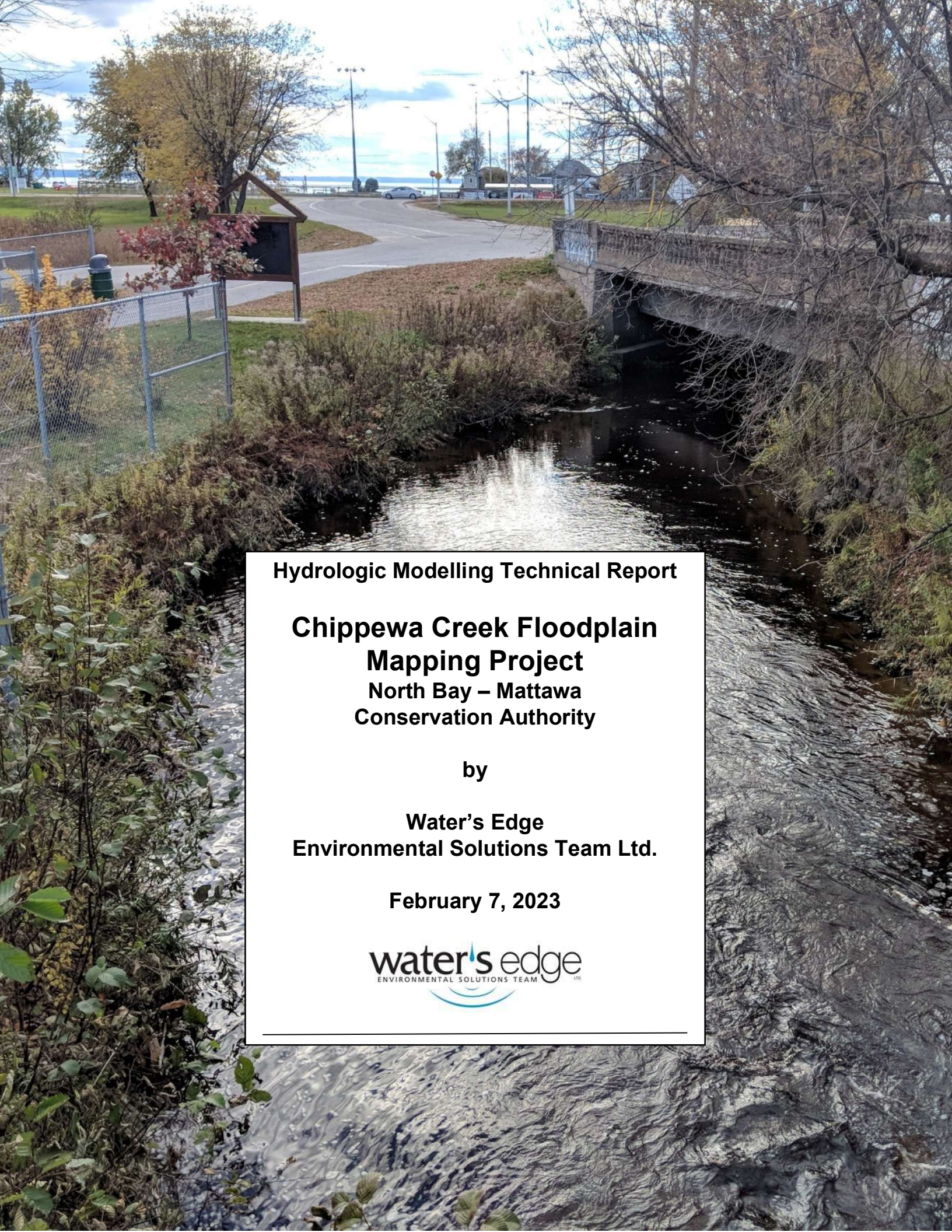

Hydrologic Modelling Technical Report

Chippewa Creek Floodplain Mapping Project

North Bay – Mattawa Conservation Authority

by

Water's Edge
Environmental Solutions Team Ltd.

February 7, 2023

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February 7, 2023
WE 18045

Mr. Kurtis Romanchuk, P.Eng.
North Bay-Mattawa Conservation Authority 15
Janey Ave.
North Bay, Ontario
P1C 1N1

Dear Mr. Romanchuk:

RE: Chippewa Creek Hydrologic Modelling, North Bay-Mattawa Conservation Authority

1. INTRODUCTION

Water's Edge was authorized by the North Bay-Mattawa Conservation Authority (NBMCA) to develop a hydrologic model of the Chippewa Creek Watershed following current design standards. HEC-HMS was used to develop the model. The model was run for the 5, 10, 25, 50, and 100-year return period storms, as well as the Timmins Regional Storm. Historic precipitation and flow data were used to calibrate the model. For each return period, multiple storm distributions and durations were used to ensure that the flood risk was properly characterized.

This report includes background information of the watershed, detailed methodology for developing the model, followed by a summary of the results.

2. BACKGROUND REVIEW

We have completed our assessment of the creek in accordance with the approved project Terms of Reference. Data sources for the analysis include:

- Reports and Geospatial data from NBMCA;
- KBM Resources Group LiDAR data and report;
- Physiography of Southern Ontario by Chapman & Putnam (digital data from Ministry of Northern Development and Mines (MNDM));
- Ontario Flow Assessment Tool (OFAT);
- Ontario Base Mapping (OBM);
- Site Survey and Field Assessments (Water's Edge, 2018, 2019); and, Discussions with NBMCA and City of North Bay staff.

The Chippewa Creek Watershed is the largest watershed in the City of North Bay, with headwaters just south of Cooks Mills, draining over the Laurentian Escarpment and through the urbanized section of North Bay before flowing into Lake Nipissing. The watershed is 39.8 km^2 according to the delineation in HECGeoHMS.

The main channel is about 21 km long with an average slope of 0.79 %. Floodplain mapping will be conducted for all of Eastview Creek, Johnson Creek downstream of Carmichael Dr., and in Chippewa Creek from just west of the golf course to Lake Nipissing. The watershed is shown in **Map 1**. Additional maps showing reach names and longest flowpaths are shown in **APPENDIX A.**

The land use in the watershed is approximately 50% treed and 50% community/infrastructure, with small amounts of exposed bedrock and open water, according to the Ontario Flow Assessment Tool (OFAT) (MNRF, 2020). The average annual temperature in the region is 4.6 ^oC and the average annual precipitation

is 978 mm. The mean annual flow at the outlet was determined to be 0.59 m^3/s using the MNRF (2003) method in OFAT.

3. METHODOLOGY

A hydrologic model of the Chippewa Creek Watershed was developed in HEC-HMS and run for the 5, 10, 25, 50, and 100-year return period storms using SCS Type II rainfall distributions. A 100-year, 4-hour event was also run using the Chicago Storm distribution. The Timmins storm was used as the Regional Event and areal reductions were used to account for the spatial variability of precipitation across large areas. A flood frequency analysis was conducted on the water level gauge on Chippewa Creek at Fisher St. operated by Water Survey Canada using peak flow data from 1974-2015. OFAT was also used to estimate return period flows for larger events that could not be accurately estimated based on the period of record of the Chippewa Creek water level data. The Chippewa Creek Watershed lies within Zone 3 of the Flood Hazard Criteria defined by the MNRF, which means that the higher of the Timmins storm and the 100-year flood should be used for design purposes (MNRF, 2002).

The model was calibrated using selected storms from the available hourly precipitation and flow data between 1974 and 1995. The calibrated model was then used to run the design storms and the Timmins storm. The highest peak flow associated with a given return period was used for hydraulic modelling. Future conditions were also modelled based on the planned development in the watershed.

3.1 Frequency Analysis

A single-station flood frequency analysis was conducted to provide flood return period estimates for Chippewa Creek. The flood magnitudes are considered to be accurate if the period of record is at least half as long as the return period flow that is being calculated (MNRF, 2002). Since the period of record on Chippewa Creek is 41 years, the 50-year return period flow is the largest that can be considered accurate.

The frequency analysis was conducted using the Consolidated Frequency Analysis (CFA) version 3.1 from Environment Canada. The program uses the hydraulic database from the ECCC Data Explorer as its data source. The analysis was conducted on the Chippewa Creek gauge at Fisher St., which is significantly upstream from the creek mouth. Therefore, the flows resulting from the frequency analysis do not represent the ultimate peak flows in the watershed but can still be used for calibration. The peak flows determined for Chippewa Creek at Fisher St. are shown in **Table 1**, with flows that were not considered reliable due to the period of record highlighted. A plot of the frequency analysis results is shown in **APPENDIX A.**

Table 1: Chippewa Creek Flood Frequency Analysis

Return Period (years)	Generalized Extreme Value (m^3/s)	3 Parameter Lognormal (m^3/s)	Log-Pearson Type 3 (m^3/s)
1.003	4.11	5.35	5.39
1.05	5.64	6.14	6.17
1.25	7.2	7.23	7.24
2	9.35	9.1	9.07
5	12.4	12.3	12.2
10	14.5	14.8	14.7
20	16.6	17.4	17.5

50	19.4	21.2	21.7
100	21.6	24.3	25.3
200	23.9	27.7	29.5
500	27.1	32.6	35.9

The lack of large events in the period of record can also skew the entire return period flow curve. Based on background report titled "Historic Flooding of Chippewa Creek" (1982), the floods within the period of record ranged from 1-3 out of 5 on a property damage severity scale, while eleven events were scored 4 or greater prior to the period of record. That document also indicated that the December 25, 1982 flood was about the 1:5-year flood, with a flow of 15.3 m^3/s. The 1984 Northland Engineering report titled "Chippewa Creek Flood and Erosion Control Study", indicated that Hurricane Audrey yielded approximately the 1:100-year flood in 1957. According to that report, Hurricane Audrey produced 125-150 mm of rainfall over four days which led to a peak flow of 34-43 m^3/s.

Based on the comparison of the flood frequency analysis and observed historical floods in North Bay, the flows produced from the flood frequency analysis are likely lower than they would be if the observed data extended further into the past. Therefore, it can reasonably be expected that the calibrated model will produce flows that are moderately higher than the flood frequency analysis.

To obtain more reliable estimates of the extreme events, OFAT was used to conduct regional flood frequency analysis, which incorporates data from other stations to produce a more robust estimate. OFAT also provides single station frequency analysis results using the same data that was used in CFA 3.1. The results produced in OFAT are shown in **Table 2**. It is noted that the primary multiple regression is the only method that is not affected by the short period of record and it's results generally agree with the observed flows including the 100-year flow that resulted from Hurricane Audrey. The other return period flows included in the primary multiple regression are significantly higher than the results of the single station flood frequency analysis and can be considered an upper bound on the return period flow estimates.

Table 2: OFAT Flood Frequency Analysis

Return Period (years)	Index Flood Flow (m^3/s)	Primary Multiple Regression (m^3/s)	Flood Flow Statistics (m^3/s)
1.25	7.47		
2	7.86	12.22	9.02
5	9.69	19.25	12.1
10	11.26	24.15	14.6
20	13.10	29.73	17.2
50	15.59	34.04	21
100	17.55	39.31	24.1
200	19.65		27.5
500	22.0		32.4

3.2 Terrain Model Development

The digital terrain model (DTM) used for watershed delineation was developed based on LiDAR point cloud data produced by KBM Resources Group in the fall of 2018 during snow-free, leaf-off conditions, with minimal flow in the creek. Survey data collected by Water's Edge was used for data verification by KBM. The point cloud data included all surface features including vegetation and buildings. For watershed delineation, it was necessary to remove the vegetation and buildings to accurately represent the surface drainage properties. The necessary geospatial information was obtained from the KBM report prior to data manipulation (KBM Resources Group, 2018).

To process the raw LiDAR point cloud data into the surface raster needed for hydrologic and hydraulic modelling, Whitebox GAT 3.4 was used. Whitebox is an open source GIS software package developed at the University of Guelph that includes advanced tools for LiDAR processing and raster creation. The first processing step was to create a raster from the point cloud data. The LiDAR point were classified as first return, second return, etc. based on the order that the reflected laser was detected by the sensor on the plane. To get an accurate representation of the ground surface and to eliminate most of the vegetation, the last return was used to define the elevation of the raster cell in which it lies. A 1m grid was adopted since it is computationally more difficult to process grids of finer resolutions over the relatively large scale of the watershed. The resulting raster had many gaps where there were not enough reflected LiDAR points to define a cell due to the refractive properties of the surface. Gaps were most common in open water areas. The fill tool was used in Whitebox to interpolate values for the missing data based on the surrounding areas. The final processing step was to remove off-terrain objects including buildings and vegetation. This tool analyzed the surface model to identify high slopes representative of the edges of buildings and trees and removed any object that was smaller than 30 m across and interpolated the resulting hole. The resulting surface was largely representative of the natural surface, but still included large buildings such as warehouses and the Northgate Mall. Increasing the threshold size beyond 30 m tended to remove some natural drainage features, which was not desired. This DTM was used as the basis for further manipulations for the hydrologic and hydraulic models.

3.3 Terrain Pre-processing

Following the development of the DTM, additional manipulations were necessary to prepare the surface for use in the hydrologic model. HEC-GeoHMS version 10.1 was used for pre-processing and model development within ArcGIS. The first step was to ensure that flow paths were accurately represented in the DTM. This was accomplished using shapefiles of the storm sewer network and the creek centerlines and burning-in a channel through apparent obstructions such as bridges. The next step was to fill in depressions without apparent outlets. This step ensures that every cell within the watershed contributes flow to the outlet and there is no depression storage to attenuate peak flows, resulting in a more conservative representation of surface conditions. Following the above steps, a linear workflow was followed that started with creating a flow direction raster that indicated which direction a given cell would drain to. Next, a flow accumulation raster was created that represented the number of upstream cells contributing to a given cell. A stream network was then defined based on a minimum number of contributing cells, in this case streams were defined if the upstream drainage area was greater than 50 ha. The streams were then segmented based on significant flow change locations, and catchments were delineated based on the flow change locations. The catchment grid was converted into a polygon shapefile and metadata was added providing information on the connectivity of adjacent catchments. The stream raster was also converted into a polyline shapefile. Shapefiles were necessary to allow modelling information to be represented spatially in the attribute tables.

DTMs are often corrected through a hydro-flattening procedure where breaklines are developed to represent the channel centerline and bottom on banks, which is then meshed into the terrain model to accurately represent the land surface and the channel bottom. This procedure was attempted, but due to the very low water levels in most of the watershed it appeared that the bottom of the channel had been captured. In some areas, the survey data points indicated a slightly higher elevation than the LiDAR. This error is likely because the surveyed water depth was smaller than the margin of error associated LiDAR

data. The difference in channel elevations between the survey data and the LiDAR data are small and unlikely to cause a significant difference in flows or water surface elevations, especially for the most extreme events.

3.4 Model Preparation

Following the preprocessing steps, the automatically delineated catchments needed to be divided further based on critical locations, such as at the Fisher St. flow gauge. Once the subcatchments were satisfactory, several parameters were extracted based on the surface properties, listed below:

- River length
- River slope
- Basin slope
- Longest flowpath
- Basin centroid
- Centroid elevation
- Centroidal longest flowpath
- TR-55 Time of Concentration parameters

A plot of the channel elevation is shown in **APPENDIX A**. Model characteristics used in calculations are shown in **APPENDIX B.** The listed parameters, except for the TR-55 parameters were stored in the attribute tables of the shapefiles. The TR-55 parameters were exported in an excel table. The full table including all input parameters can be seen in **APPENDIX E**.

3.4.1 Curve Number Grid

A Curve Number grid was created to assign each raster cell a Curve Number based on the soil and landuse characteristics of that point. Curve Numbers were selected from the TR-55 document from the NRCS (NRCS, 1986). This ensures accurate geospatial representation of runoff characteristics. Ontario soil survey data was used to define soil characteristics. The landuse data was adapted from City of North Bay land use data and MNRF forest cover data to produce the most accurate representation of current landuse conditions in North Bay. The City of North Bay data was not suitable on its own, as it included future land use classifications in the undeveloped parts of the watershed, with many forested areas identified as industrial above the escarpment. The MNRF data was also unsuitable on its own as it did not distinguish between residential, commercial, or industrial areas. To create an accurate landuse layer, the MNRF forest classifications were applied and the City of North Bay urban landuse data was used to fill in the gaps. This modification added significant portions of forest throughout the watershed, which appeared to be accurate based on satellite imagery. The landuse categories were then modified to match the NRCS landuse classifications to facilitate the assignment of Curve Numbers. Some assumptions were made based on the landuse description and the information needed to assign a Curve Number in the NRCS document. Landuses existed for commercial, industrial, open space/parks, forest, pasture, and water, but the remaining landuses required more information. All landuses were assumed to be in good condition. For residential districts, it was assumed that the average lot size was 1/8 of an acre based on lot measurements of several houses in the city from satellite imagery. It was assumed that rural areas could be represented by straight row crops in good condition without any additional best management practices (BMPs).

Following the preparation of the soil and landuse data, the layers were combined to create a layer that included both landuse and soil data. A lookup table was created to assign a Curve Number based on the landuse and the hydrologic soil group. The lookup table is shown in **Table 3**. The output yielded a Curve Number raster that was used to determine a weighted-average Curve Number for each subcatchment, which was then recorded in the attribute table of the subcatchment shapefile.

Table 3: Curve Number Lookup Table

Landuse	Hydrologic Soil Group			
	A	B	C	D
Commercial	89	92	94	95
Industrial/Institutional	81	88	91	93
Open Space/Park	39	61	74	80
Residential	77	85	90	92
Rural	67	78	85	89
Water	100	100	100	100
Forest	30	55	70	77
Pasture	39	61	74	80

3.4.2 Impervious Areas

The percentage of impervious areas in each subcatchment were determined using a similar method to the Curve Number grid. The landuse data was combined with the subcatchment layer and a Percent Impervious was assigned to each land use type, according to the average Percent Impervious area in the TR-55 document (NRCS, 1986). The impervious areas associated with each landuse are shown in **Table 4**.

Table 4: Percent Impervious Areas based on Landuse

Landuse	Average % Impervious
Commercial	85
Industrial/Institutional	72
Open Space/Park	0
Residential	65
Rural	0
Water	100
Forest	0
Pasture	0

3.5 HEC-HMS Model

Following the model preparation in HEC-GeoHMS, the basin model was exported and then imported into HEC-HMS 4.3. This step automatically assigned all data from the shapefile attribute tables to the appropriate locations in HEC-HMS. The main components of the hydrologic model are the loss method, the transform method, and the routing method. Each of these components are discussed below. Initial estimates of each parameter are shown in **APPENDIX B**.

3.5.1 Loss Method

The loss method selected was SCS Curve Number, due its relatively small data requirements and ease of calibration. The development of the Curve Number grid was described in section 3.4.1. In addition to the Curve Number and Percent Impervious determined previously, an Initial Abstraction was also calculated automatically in HEC-HMS. This calculation used the SCS method:

$$I = 0.2 * \frac{1000}{CN} - 10$$

3.5.2 Routing Method

The Muskingum-Cunge method for channel routing was selected because it is based on physical parameters and therefore do not require extensive calibration to use. According to the US Army Corps of Engineers, the Muskingum-Cunge routing method is applicable for use in large drainage networks with compound cross-sections (US Army Corps of Engineers, 1991). The Muskingum-Cunge method is a modification of the Muskingum method where the main channel and overbank flows are decoupled. The required data for Muskingum-Cunge includes the reach length, average slope, cross-section data, and Manning's roughness coefficients. The reach lengths and slopes were determined during preprocessing, and a representative cross-section was cut from the DTM for each reach. Manning's roughness coefficient (Manning's n) was assigned to the main channel as well as left- and right-overbank areas. Estimates of Manning's n were determined by analyzing the reach characteristics including riparian vegetation to determine the most appropriate roughness coefficient from Open Channel Hydraulics (Chow, 1959). The initial values of Manning's n were selected as 0.035 for the main channel and 0.08 for overbank areas.

3.5.3 Transform Method

The Clark Unit Hydrograph was used as the transform method in the model. This method uses linear reservoir storage calculations to determine how the input hydrograph is translated and attenuated through a subcatchment. The two input parameters needed for these calculations are the Time of Concentration and a Storage Coefficient. The initial estimate of the Time of Concentration in each subcatchment was determined using the TR-55 method in HEC-GeoHMS.

The Storage Coefficient is dependent on the Time of Concentration and was calculated following the method described by Sabol (1988):

$$\frac{T}{R} \quad 1.46 \quad 0.0867 \frac{L}{A}$$

Where, R is the Storage Coefficient (hr), L is the longest flow path (km) and A is the subcatchment area (km^2).

3.5.4 Detention Storage

A detention storage facility was identified in the basement of the Independent Grocer close to the Northgate Mall. No storage discharge relationship was available for the facility, but a total storage volume was available. It was assumed that all flow from Eastview Creek would flow into the facility until it was full at which point it would remain full for the rest of the storm and additional flows would bypass it. According to the MNRF Technical Guide on Flooding Hazard Limits, SWM ponds cannot be used to provide reduction in flood flows (MNRF, 2002). The guide also states that the unregulated flows should be used to determine the downstream flood hazard limit for minor reservoirs. The detention facility was included in the model for completeness but was disconnected from Eastview Creek for all design storms.

3.5.5 Precipitation Data

Once the basin had been set up in the model, the precipitation data was entered. The Environment Canada precipitation gauge at the North Bay Airport was used to develop the design storms. An Intensity-DurationFrequency curve was provided for the gauge, whose ordinates were used to determine rainfall volumes for the SCS and Chicago Storm distributions. For SCS design storms, the total rainfall volume was multiplied by the SCS Type II unit hyetograph of a specified duration to produce the hyetograph that was entered into the model.

The Chicago Storm distribution is more complicated and uses separate functions to define the rising and falling limbs of the hyetograph. Rather than a rainfall volume, the Chicago Storm distribution uses three dimensionless parameters, a, b, and c, that are derived from an IDF curve (Alegre, 2016). In addition to those parameters, the ratio of peak timing to the total storm duration is needed. This value is recommended to be 0.38 in Ontario, according to the MTO Drainage Design Manual (Ministry of Transportation Ontario, 1997). 4-hour duration Chicago Storm distributions for each return period were developed using this method. The Chicago Storm is useful for analysis as the return period for precipitation and the resulting flood area usually similar.

Table 5: Chicago Storm Parameters

Return Period (years)	2	5	10	25	50	100
A	455.34	570.60	649.63	752.39	831.54	911.02
B	4.33	3.19	2.78	2.43	2.26	2.14
C	0.71	0.70	0.70	0.70	0.70	0.70

3.6 Sensitivity Analysis

A sensitivity analysis was conducted to determine the relative effect of important model parameters. The Curve Numbers, Manning's n, and Time of Concentration coupled with the Storage Coefficient were adjusted to determine their relative impact on the peak flows of the model. The parameters were multiplied by 0.9, 1, and 1.1. The Storage Coefficients were recalculated based on the adjusted Time of Concentrations. The 100-year, 24-hour SCS storm was used for all sensitivity analysis runs. The sensitivity analysis is only used to identify the most sensitive parameters for adjustment in the calibration process. The percentage of impervious areas in each subcatchment are also linked to the Curve Numbers, so they will have a similar effect on the model that is scaled based on the overall proportion of impervious areas in the watershed.

It was found that the model peak flows were more than 10 times as sensitive to changes in the Curve Numbers than Manning's n and Time of Concentration. The sensitivity analysis results are shown in **Figure 1**. The parameter value adjustments for each sensitivity analysis run are shown in **APPENDIX D**.

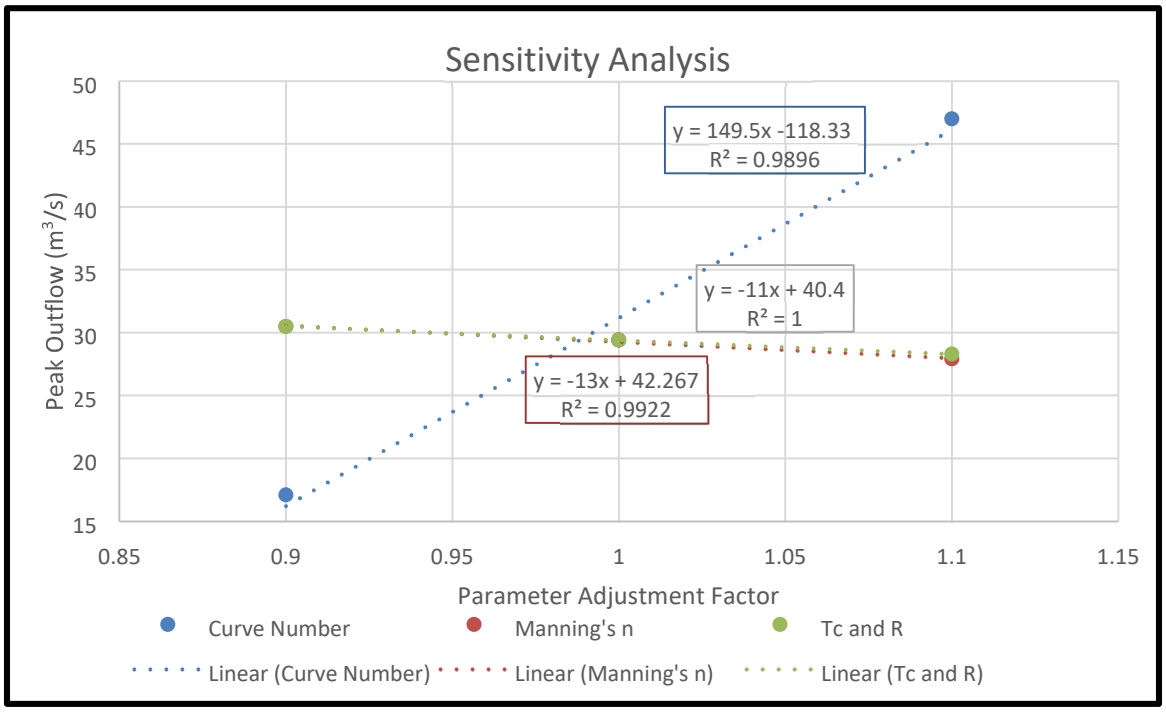

Figure 1: Sensitivity Analysis

3.7 Calibration

Ten calibration events were identified between 1974-2005, where hourly precipitation data was available and there was information on peak flow magnitudes and timing. Hourly flows were available from 19741995, which allowed for the hydrograph shape to be adjusted as well as the peak flows. The criteria for selecting calibration events included having both hourly data and peak flow information, no snow melt or freezing conditions, and the same antecedent moisture conditions. The antecedent moisture condition was determined by the sum of precipitation volumes over the previous five days and comparing the volume classifications from the TR-55 manual (NRCS, 1986). Most of the large events that occurred during the warm months were AMC I, or dry soil conditions. Therefore, all selected calibration events were also AMC I. The Curve Number adjustments were conducted by applying a factor to the AMC II Curve Number and converting it to AMC I. By taking this approach, the Curve Number adjustment factors will apply to all antecedent conditions.

The Curve Numbers, Percent Imperviousness, Time of Concentration and Storage Coefficients, and Manning's n were adjusted to match the peak flow and timing for each event and the adjustment factors for each parameter were recorded. Four of the storms were found to require unreasonable parameter adjustments in order to calibrate them, so they were eliminated from the analysis. It is likely that non-uniform rainfall across the watershed was present for these storms. The factor adjustments for each parameter of the remaining storms were averaged to represent average conditions in the watershed. When the model was run using the average parameters, the peak flows and timing matched well for three of the six storms but did not match for the other three storms. While calibrating and verifying data using the same storms is not ideal, there were very few other storms suitable for calibration that also had available information about peak flows, so this approach was determined to be the best method for determining reasonable parameter values. For additional information on calibration parameters and results, please see **APPENDIX C**.

4 RESULTS

A summary of the HEC-HMS modelling results for the design storms is presented here. For detailed data on flows in each reach, junction, and subcatchment, please see **APPENDIX F**. Peak flows at the outlet of Chippewa Creek and at the Fisher St. gauge are shown for each design storm in **Table 6**.

Table 6: Peak Flow Summary Table

Return Period (years)	Rainfall Depth (mm)	Duration (hours)	Distribution	Outlet Flow (m^3/s)	Fisher St. Flow (Junction 180) (m^3/s)
2	41.8	6	SCS Type II	14.5	13.1
2	51.4	12	SCS Type II	17.6	15.9
2	63.1	24	SCS Type II	20.5	18.6
2	37.0	4	Chicago	12.2	11.0
5	83.0	6	SCS Type II	21.4	19.5
5	67.4	12	SCS Type II	26.1	23.8
5	54.6	24	SCS Type II	30.7	28.1
5	48.3	4	Chicago	18.1	16.4
10	96.2	6	SCS Type II	26.3	24.0
10	78.0	12	SCS Type II	32.5	29.7
10	63.2	24	SCS Type II	38.2	35.1
10	55.7	4	Chicago	22.3	20.3
25	112.6	6	SCS Type II	33.1	30.3
25	91.2	12	SCS Type II	40.9	37.5
25	73.8	24	SCS Type II	48.1	44.3
25	65.1	4	Chicago	27.7	25.3
50	124.5	6	SCS Type II	38.6	35.4
50	100.9	12	SCS Type II	47.4	43.6
50	81.6	24	SCS Type II	55.7	51.3
50	72.0	4	Chicago	32.2	29.5
100	136.2	6	SCS Type II	44.1	40.6
100	110.4	12	SCS Type II	54.0	49.7
100	89.4	24	SCS Type II	63.2	58.4
100	78.9	4	Chicago	37.0	33.9
100	63.6	2	Chicago	27.5	25.0
>100	187.2	12	Timmins	124.0	115.6

4.1 Discussion

For the 2 to 50-year return period design storms, the Chicago Storm distribution yielded the peak flow that was closest to the results of the frequency analysis. The peak flows of the Chicago Storms were moderately higher than the corresponding peak flows in the frequency analysis. The 6-hour SCS Storm distributions produced peak flows that most closely matched the primary multiple regression results and the observed

historical peak flows from previous reports, while providing a small factor of safety. The Timmins storm yielded flows that were several times greater than the 500-year flows resulting from the frequency analysis and about three times greater than the 100-year flow from the primary multiple regression.

4.2 Selection of Design Storms for Hydraulic Modelling

The primary purpose of the hydrological model is to determine flow rates for use in hydraulic modelling. If the frequency analysis were known to be correct, the Chicago Storm peak flows would yield a somewhat conservative result that would be used in the hydraulic model. Historical observations and the results of the primary multiple regression show that the flood frequency analysis in North Bay significantly underestimates peak flows across all return period due to a lack of large events during the period of record. The same historical observations indicate that the primary multiple regression results obtained from OFAT are a better representation of the expected peak flows. The design storm that produces the same peak flow as the primary multiple regression at the flow gauge site would be a more reasonable estimate of the actual peak flows. The 6-hour SCS design storms produced peak flows that were slightly higher than the results of the primary multiple regression. Since the primary multiple regression is not limited by the short period of record of the streamflow records and provides the most conservative estimate of return period flows, we recommend that the 6-hour SCS storm be used for defining the flow rates for a given return period in the hydraulic model. This would define the 100-year flow at the Fisher St. gauge as 40.6 m^3/s, which is moderately higher than the 34.9 m^3/s flow as determined by Northland Engineering in the 1984 floodplain mapping project. The increased peak flow rate is likely due to the modified land use in the watershed, as well as the more deterministic nature of the computation methods used.

5. SUMMARY

In order to develop a HEC-HMS hydrologic model of the Chippewa Creek Watershed, Water's Edge conducted a background review to characterize the watershed, reviewed data provided by NBMCA and developed a methodology to develop the model using the available resources. LiDAR data was captured, processed, and used to delineate the watershed, subcatchments, and drainage network. SCS Curve Numbers were assigned to subcatchments based on the landuse and soil characteristics. The MuskingumCunge method was used for channel routing, using reach and channel geometry information from the LiDAR data. The Clark Unit Hydrograph was used as the hydrograph transform method in the model based on the Time of Concentrations calculated using the TR-55 method in HEC-GeoHMS. Design storm distributions were developed using the Environment Canada IDF curve for the North Bay Airport. The model was calibrated using available hourly flow and precipitation data.

Based on our review and modelling, we conclude that:

1. The 24-hour SCS design storms produced the largest peak flows, and are the most conservative estimate of return period flows;
2. The 4-hour Chicago Storm distributions best represent the flows determined in the frequency analysis;
3. The frequency analysis of the Fisher St. gauge is likely underestimating the peak flows due to the relatively short period of record;
4. The results of the OFAT primary multiple regression align well with reported large return period flows from before the flow gauge period of record;
5. The 6-hour SCS distribution best represents the reported flows and the primary multiple regression and should be used for hydraulic modelling.

Respectfully submitted,

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President, Sr. Water Resources Engineer

Tim Antonio, B.A.Sc., EIT,
Water Resources Scientist

Water's Edge Environmental Solutions Team Ltd.

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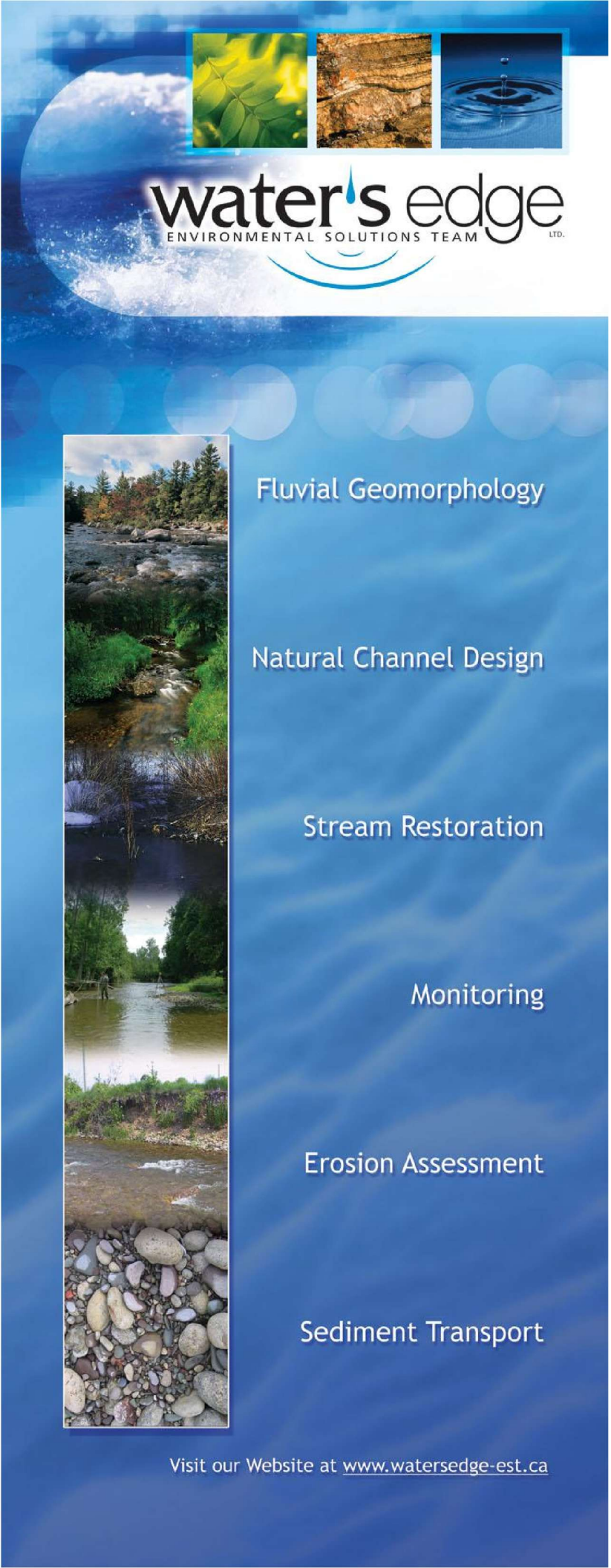
water's edge
ENVIRONMENTAL SOLUTIONS TEAM LTD.
Fluvial Geomorphology
Natural Channel Design
Stream Restoration
Monitoring
Erosion Assessment
Sediment Transport
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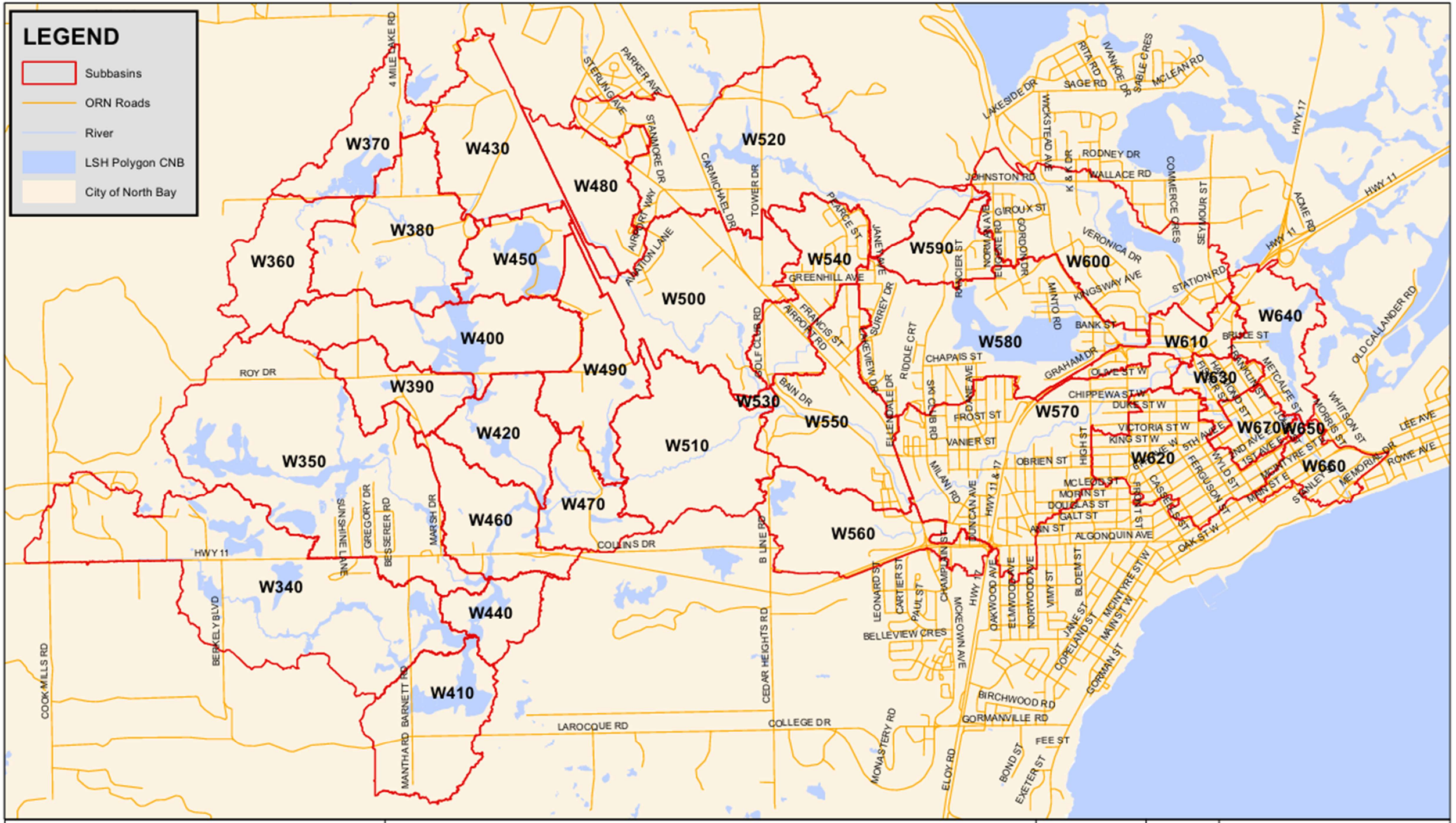
APPENDICES

APPENDIX A: Maps and Additional Figures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ORN Roads
River
LSH Polygon CNB
City of North Bay
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W480
W520
W380
W360
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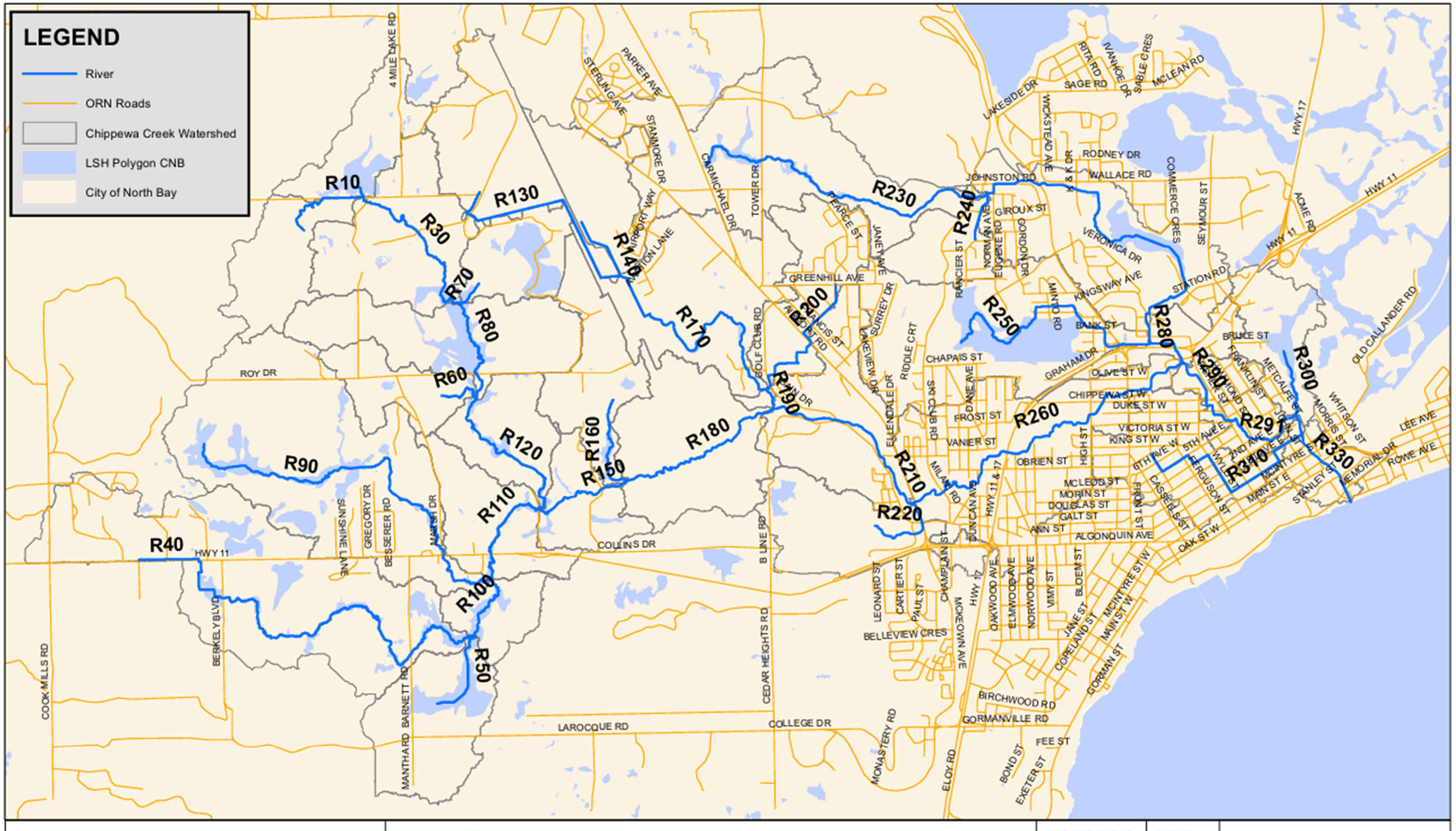
W540
W590
W600
W500
W400
W580
W640
W610
W490
W390
W530
W550
W630
W570
W420
W510
W670
W650
W350
W620
W660
W560
W470
W460
HWY 11
W340
W440
W410
0
500
1,000
2,000
Meters
NORTH BAY-MATTAWA CONSERVATION AUTHORITY
water's edge
ENVIRONMENTAL SOLUTIONS TEAM
PROJECT FILE NO.
18045
MAP NO.
1
DATE
October 9, 2019
Chippewa Creek
Floodplain Mapping Project
North Bay, Ontario
Subbasin Names


LEGEND
River
ORN Roads
Chippewa Creek Watershed
LSH Polygon CNB
City of North Bay
R10
R30
R70
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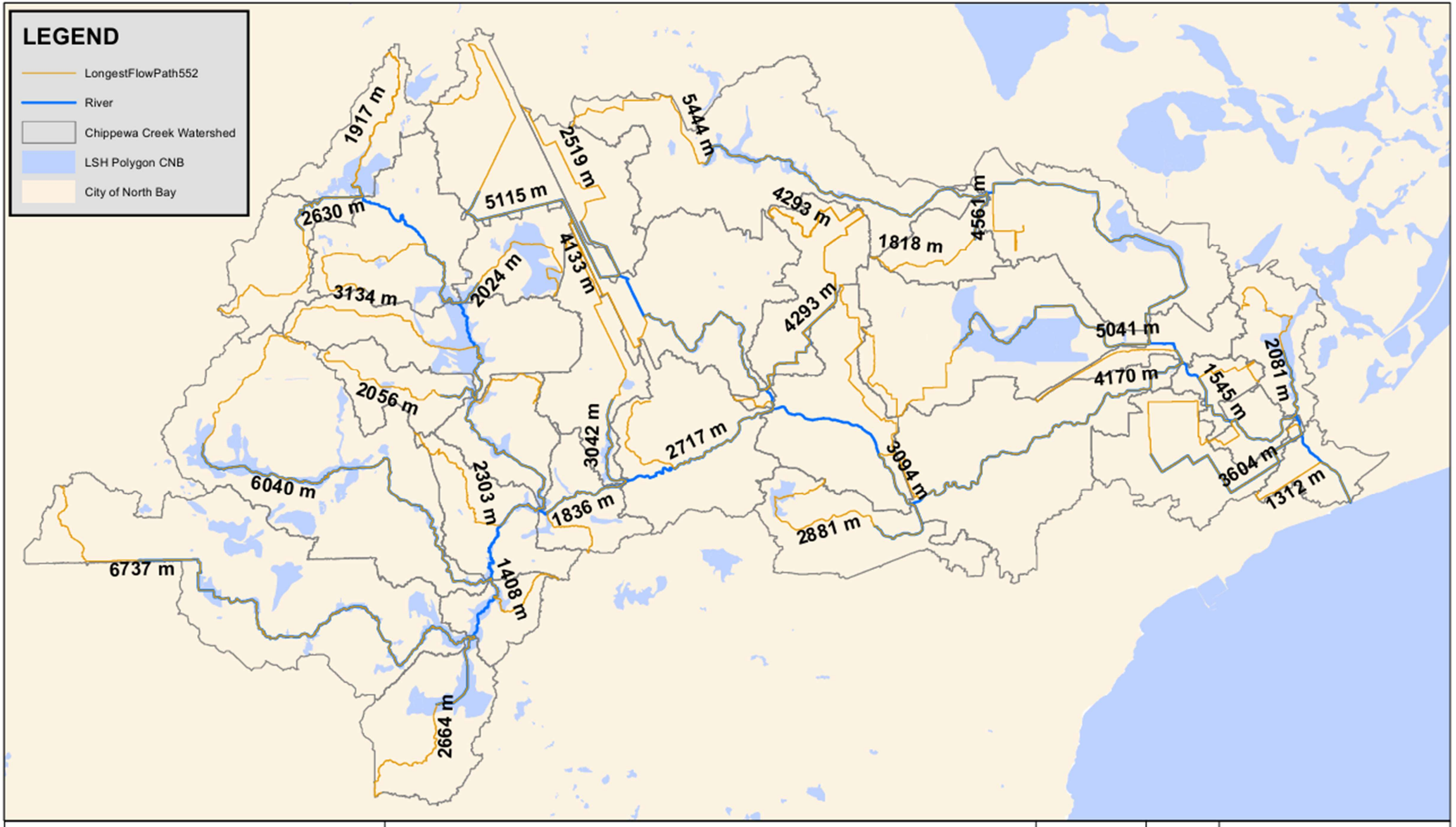
R90
R110
R100
R50
R40
R130
R140
R170
R200
R190
R180
R150
R160
R230
R240
R250
R280
R290
R260
R210
R220
R300
R291
R310
R330
4 MILE LAKE RD
ROY DR
HWY 11
COLLINS DR
B LINE RD
CEDAR HEIGHTS RD
COCKMILLS RD
BERKELY BLVD
MANTHARD RD
BARNETT RD
LAROCQUE RD
COLLEGE DR
PARKER AVE
STERLING AVE
STANMORE DR
MIRROR VIEW WAY
STATION LANE
CARMICHAEL DR
TOWER DR
PEARCE ST
JANEY AVE
GREENHILL AVE
ALBERT ST
FRANCIS ST
SURREY DR
LAKEVIEW DR
RIDDLE CRT
GOLF CLUB RD
SUNSHINE LANE
GREGORY DR
BESSERER RD
MARSH DR
MONASTERY RD
ELOY RD
MILANI RD
HWY 11 & 17
DUNCAN AVE
CHAMPLAIN ST
LEONARD ST
CARTER ST
PAUL ST
MCKEOWN AVE
BELLEVIEW CRES
OAKWOOD AVE
ELMWOOD AVE
NORWOOD AVE
VIMY ST
JANE ST
BLOEM ST
COPELAND ST
MCINTYRE ST W
MAIN ST W
GORMAN ST
BIRCHWOOD RD
GORMANVILLE RD
FEE ST
BOND ST
EXETER ST
LAKESIDE DR
WICKSTEAD AVE
RITA RD
SAGE RD
IVANHOE DR
SABLE CRES
MCLEAN RD
RODNEY DR
WALLACE RD
JOHNSTON RD
GIROUX ST
NORMAN AVE
EUGENE RD
CORDON DR
RANCIER ST
VERONICA DR
COMMERCE CRES
SEYMOUR ST
HWY 17
HWY 11
ACME RD
KINGSWAY AVE
MINTO RD
STATION RD
BANK ST
GRAHAM DR
CHAPAIS ST
SW CLUB RD
FROST ST
VANIER ST
OLIVE ST W
CHIPPEWA ST W
DUKE ST W
VICTORIA ST W
KING ST W
5TH AVE W
5TH AVE E
2ND AVE E
1ST AVE E
HIGH ST
OBRIEN ST
MCLEOD ST
MORIN ST
DOUGLAS ST
GALT ST
ANN ST
ALGONQUIN AVE
FRONT ST
CASSELS ST
FERGUSON ST
MCINTYRE ST E
MAIN ST E
OAK ST W
STANLEY ST
BRUCE ST
FRANKLIN ST
METCALFE ST
RICHMOND ST
OLD CALLANDER RD
WHITSON ST
MORRIS ST
LEE AVE
MEMORIAL DR
ROME AVE
0
500
1,000
2,000
Meters
NORTH BAY-MATTAWA CONSERVATION AUTHORITY
water's edge
ENVIRONMENTAL SOLUTIONS TEAM
PROJECT FILE NO.
18045
MAP NO.
2
DATE
October 9, 2019
Chippewa Creek
Floodplain Mapping Project
North Bay, Ontario
Reach Names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LongestFlowPath552
River
Chippewa Creek Watershed
LSH Polygon CNB
City of North Bay
1917 m
2630 m
5115 m
2519 m
5444 m
4293 m
4561 m
1818 m
4133 m
2024 m
3134 m
4293 m
5041 m
2081 m
4170 m
1545 m
2056 m
3042 m
2717 m
3094 m
2303 m
1836 m
3604 m
1312 m
6040 m
2881 m
6737 m
1408 m
2664 m
0
500
1,000
2,000
Meters
NORTH BAY-MATTAWA CONSERVATION AUTHORITY
water's edge
ENVIRONMENTAL SOLUTIONS TEAM
PROJECT FILE NO.
18045
MAP NO.
3
DATE
October 9, 2019
Chippewa Creek
Floodplain Mapping Project
North Bay, Ontario
Longest Flowpaths

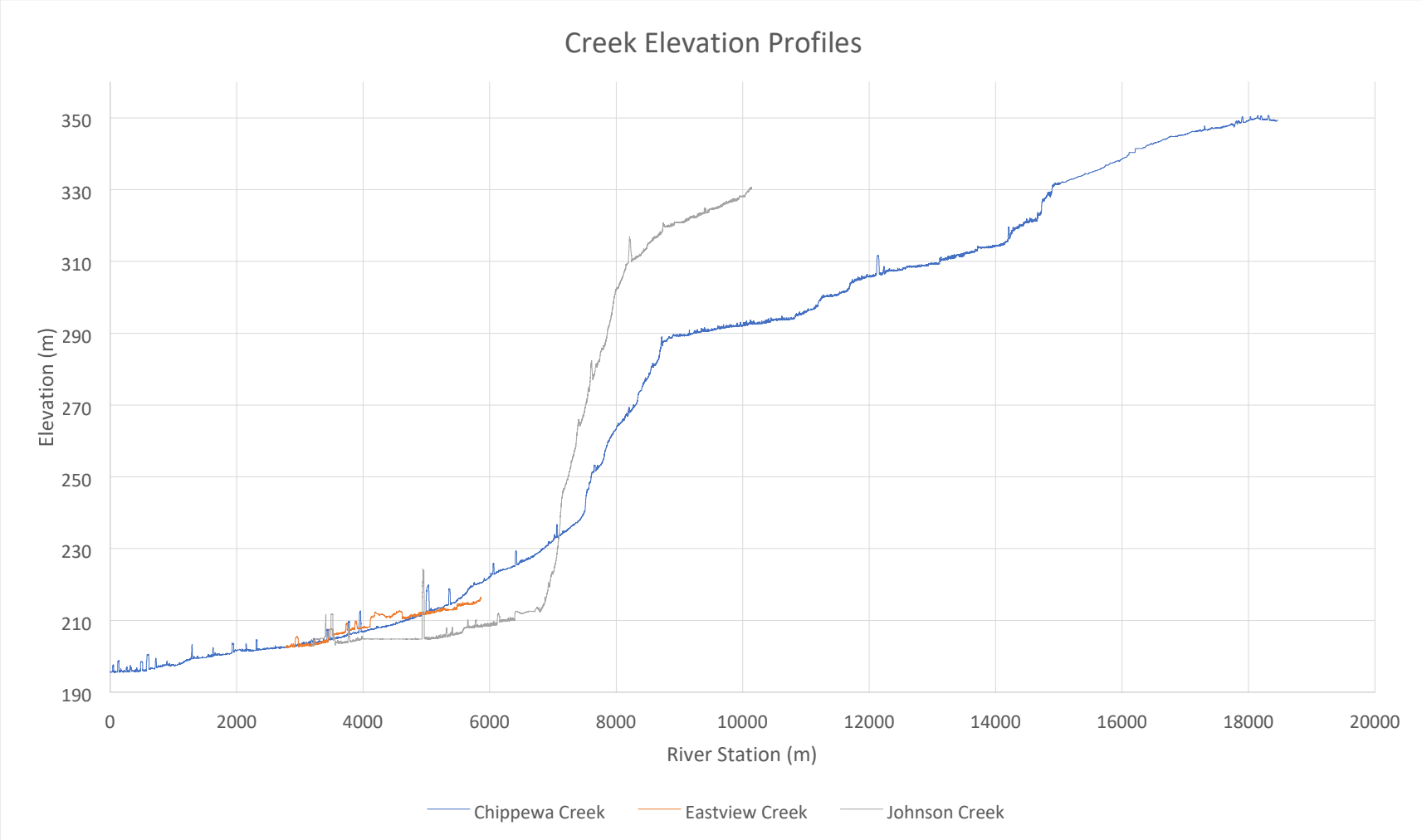

Figure 1: Creek Elevation Profiles

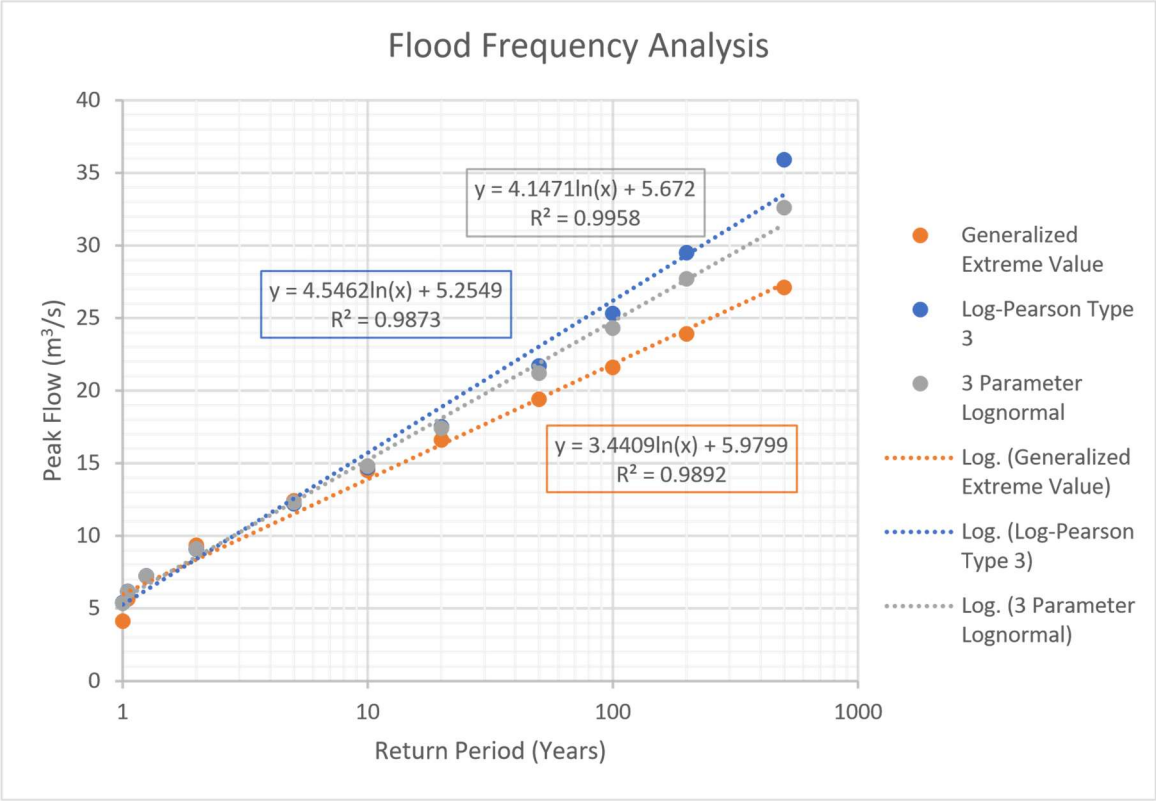

Figure 2: Flood Frequency Analysis Plot

APPENDIX B: Model Characteristics and Initial Parameter Estimates

Table 1: Subbasin Characteristics

Subbasin	Subbasin Area (km2)	Flow Path Slope (m/m)	Upstream Elevation (m)	Downstream Elevation (m)	Flow Length to Watershed Outlet (m)	Longest Flow Length (m)
W340	3.44	0.007	356.7	311.0	19985.1	6736.7
W350	3.41	0.011	371.8	307.5	18502.5	6040.2
W360	0.80	0.006	368.1	351.5	18780.1	2629.7
W370	0.74	0.018	386.9	351.5	18067.1	1916.6
W380	1.45	0.010	363.5	334.7	17053.7	2821.8
W390	0.63	0.022	371.4	326.5	15021.5	2056.3
W400	1.45	0.014	369.3	326.5	16099.7	3134.4
W410	1.18	0.008	333.1	310.7	15912.5	2664.1
W420	0.74	0.017	350.5	299.4	14235.3	2998.0
W430	1.26	0.006	385.7	353.1	16393.9	5115.1
W440	0.47	0.019	334.9	307.5	13870.6	1408.2
W450	0.67	0.014	363.6	334.7	16255.7	2023.7
W460	0.90	0.023	351.3	299.4	13541.0	2303.5
W470	0.63	0.019	328.3	292.7	12028.4	1835.9
W480	0.79	0.005	365.7	353.1	13798.1	2519.2
W490	0.97	0.022	360.5	292.5	13234.3	3041.9
W500	1.79	0.019	357.0	277.0	12650.4	4133.4
W510	1.58	0.031	354.5	270.1	11026.9	2716.9
W520	2.70	0.028	368.2	213.2	12211.6	5444.3
W530	0.04	0.060	306.5	270.1	8910.6	600.6
W540	0.97	0.014	338.6	277.0	12809.7	4292.7
W550	1.40	0.032	324.2	225.6	9547.0	3094.2
W560	1.11	0.033	321.0	225.7	9333.5	2880.7
W570	2.43	0.009	241.1	202.7	6945.6	4170.2

W580	2.33	0.021	310.8	203.0	8246.5	5041.4
W590	0.54	0.064	328.9	213.2	8585.3	1818.1
W600	2.00	0.004	223.4	203.0	7766.7	4561.5
W610	0.44	0.011	220.9	202.6	4467.4	1691.9
W620	1.11	0.006	220.4	197.5	4438.3	3604.3
W630	0.31	0.009	211.1	197.5	2468.7	1440.4
W640	0.73	0.007	212.5	197.5	3109.4	2081.1
W650	0.02	0.030	205.4	197.5	1095.4	261.5
W660	0.43	0.006	203.6	195.8	1311.7	1311.7
W670	0.31	0.005	211.4	203.4	3489.3	1545.2

Table 2: Reach Characteristics

Subbasin	Length (m)	Slope (m/m)
R290	830.9	0.003
R310	916.2	0.006
R80	1266.7	0.002
R190	207.0	0.014
R110	1224.9	0.005
R210	1857.2	0.009
R150	1045.0	0.009
R170	2761.8	0.004
R30	1918.6	0.004
R180	1882.4	0.006
R100	786.1	0.003
R120	1727.7	0.006
R260	3677.4	0.007
R280	3562.1	0.001
R270	429.6	0.007
R320	194.4	0.005
R330	834.0	0.001

Table 3: Initial Subbasin Parameter Estimates

Subbasin	CN (AMC II)	Percent Impervious	Time of Concentration (hours)	Storage Coefficient (hours)
W340	61.74	24.77	2.46	2.96
W350	37.58	18.00	1.73	2.08
W360	58.63	0.37	1.60	1.92
W370	70.97	9.88	0.83	0.80
W380	50.43	18.67	1.23	1.25
W390	58.36	50.62	0.68	0.77
W400	53.65	10.81	1.29	1.47
W410	47.10	12.32	1.31	1.39
W420	66.70	8.51	0.82	0.98
W430	79.66	47.39	2.63	3.16
W440	66.79	1.52	0.54	0.50
W450	61.45	22.44	0.92	0.98
W460	87.28	34.75	0.77	0.81
W470	81.00	7.04	0.57	0.57
W480	40.21	72.00	1.73	2.08
W490	60.13	31.78	1.04	1.24
W500	78.06	29.10	1.84	2.20
W510	79.99	5.65	0.60	0.57
W520	82.91	20.13	1.28	1.54
W530	50.77	14.13	0.16	0.19
W540	52.86	34.54	2.47	2.96
W550	61.16	27.74	0.89	1.02
W560	57.68	20.63	0.74	0.88
W570	78.58	57.89	1.08	1.29
W580	69.65	22.80	0.50	0.54
W590	55.52	58.21	1.86	2.23
W600	82.51	32.17	1.40	1.68
W610	54.84	71.76	0.93	1.04
W620	85.15	65.49	1.93	2.32
W630	68.25	56.47	1.25	1.50
W640	49.38	45.50	1.17	1.24
W650	72.57	31.33	0.12	0.11
W660	83.28	60.66	0.76	0.68

W670	64.50	59.41	1.41	1.60

Table 4: Initial Reach Parameter Estimates

Reach	Channel Manning's n	Floodplain Manning's n
R100	0.035	0.08
R110	0.035	0.08
R120	0.035	0.08
R150	0.035	0.08
R170	0.035	0.08
R180	0.035	0.08
R190	0.035	0.08
R210	0.035	0.08
R260	0.035	0.08
R270	0.035	0.08
R280	0.035	0.08
R290	0.035	0.08
R30	0.035	0.08
R310	0.035	0.08
R320	0.035	0.08
R330	0.035	0.08
R80	0.035	0.08

APPENDIX C: Model Calibration

This section includes details of the model calibration. **Table 5** shows the observed peak flow and timing from historical records, the acceptable ranges of peak flows and timing for each event, and the modelled peak flow and timing with the necessary parameter factors that were applied to the initial parameter estimates. Red text indicates that the storm was not used in the average parameter calculation. **Table 6** shows the parameter factors that were applied to the model; each factor was the average of the six storms remaining from **Table 5**. The Curve number factor was increased above the average to account for the increased development in the watershed since the calibration events. **Table 7** shows the calibrated model results after the factors in **Table 6** were applied.

Table 5: Calibration Parameter Adjustments for Individual Storms

Date	Target Peak cms)	Target Time	Max . Acceptable Peak (cms)	Min. Acceptable Peak (cms)	Min. Acceptable Time	Max. Acceptable Time	Model Peak cms)	Model Peak Time	Peak Criteria Met?	Time Criteria Met?	CN Factor	% Imp Factor	Tc Factor	N factor
25-Jul-77	9.46	5:45:00 AM	11.825	8.041	4:45:00 AM	6:45:00 AM	9.8	4:45:00 AM	YES	YES	0.8	0.5	2	2
15-Sep-78	10.3	3:15:00 AM	12.875	8.755	2:15:00 AM	4:15:00 AM	9.8	2:45:00 AM	YES	YES	1.05	0.7	5.5	2
29-Jul-86	10.8	12:30:00 AM	13.5	9.18	11:30:00 PM	1:30:00 AM	10.7	1:00:00 AM	YES	YES	0.8	0.6	2	2
14-Aug-88	10	5:30:00 AM	12.5	8.5	4:30:00 AM	6:30:00 AM	9.4	5:30:00 AM	YES	YES	0.6	0.4	1	1
10-Jun-89	14.8	1:00:00 AM	18.5	12.58	12:00:00 AM	2:00:00 AM	14.8	12:30:00 AM	YES	YES	1.1	0.7	3	2
18-May-90	14.2	11:00:00 AM	17.75	12.07	10:00:00 AM	12:00:00 PM	13.7	10:15:00 AM	YES	YES	1.15	0.7	5.5	2
27-Oct-91	6.55	3:45:00 AM	8.1875	5.5675	2:45:00 AM	4:45:00 AM	6.6	3:15:00 AM	YES	YES	1.12	0.7	3.5	2
31-Aug-93	5.71	9:15:00 AM	7.1375	4.8535	8:15:00 AM	10:15:00 AM	5.1	9:45:00 AM	YES	YES	0.15	0.15	0.5	0.6
30-Sep-99	7.4	6:00:00 AM	9.25	6.29	5:00:00 AM	7:00:00 AM	6.9	6:00:00 AM	YES	YES	1	0.7	11	3
18-May-04	7.18	7:45:00 AM	8.975	6.103	6:45:00 AM	8:45:00 AM	8.7	8:45:00 AM	YES	YES	0.8	0.8	0.8	0.8

Table 6: Calibrated Parameter Adjustment Factors

Parameter	Curve Number	Percent Impervious	Time of Concentration	Manning's n
Factor	1.1	0.65	3.58	2

Table 7: Model Validation Check

Date	Target Peak (cms)	Target Time	Max Peak (cms)	Min Peak (cms)	Min Time	Max Time	Calibrated Model Peak	Calibrated Model Time	Peak Criteria Met?	Time Criteria Met?
25-Jul-77	9.46	5:45:00 AM	11.825	8.041	4:15:00 AM	7:15:00 AM	18.7	5:45:00 AM	NO	YES
15-Sep-78	10.3	3:15:00 AM	12.875	8.755	1:45:00 AM	4:45:00 AM	15.1	1:00:00 AM	NO	NO
29-Jul-86	10.8	12:30:00 AM	13.5	9.18	11:00:00 PM	2:00:00 AM	16.6	6:15:00 AM	NO	NO
10-Jun-89	14.8	1:00:00 AM	18.5	12.58	11:30:00 PM	2:30:00 AM	12.6	1:15:00 AM	YES	YES
18-May-90	14.2	11:00:00 AM	17.75	12.07	9:30:00 AM	12:30:00 PM	13.1	9:30:00 AM	YES	YES
27-Oct-91	6.55	3:45:00 AM	8.1875	5.5675	2:15:00 AM	5:15:00 AM	5.9	3:30:00 AM	YES	YES

Table 8: Calibrated Subbasin Model Parameters

Subbasin	CN (AMC I)	CN (AMC II)	CN (AMC III)	Percent Impervious	Time of Concentration (hours)	Storage Coefficient (hours)
W340	47.06	67.91	82.96	16.10	8.82	10.61
W350	22.83	41.33	61.84	11.70	6.20	7.45
W360	43.27	64.49	80.69	0.24	5.73	6.88
W370	59.91	78.06	89.11	6.42	2.97	2.87
W380	34.35	55.47	74.13	12.14	4.41	4.48
W390	42.95	64.19	80.48	32.90	2.44	2.76
W400	37.68	59.01	76.80	7.02	4.62	5.27
W410	31.11	51.81	71.21	8.01	4.69	4.98
W420	53.65	73.37	86.37	5.53	2.94	3.51
W430	74.83	87.62	94.21	30.80	9.42	11.32
W440	53.77	73.47	86.43	0.99	1.94	1.79
W450	46.70	67.60	82.75	14.58	3.30	3.51
W460	90.99	96.01	98.22	22.59	2.76	2.90
W470	77.44	89.10	94.95	4.57	2.04	2.04
W480	24.99	44.24	64.60	46.80	6.20	7.45
W490	45.07	66.14	81.79	20.65	3.73	4.44
W500	71.85	85.87	93.32	18.92	6.59	7.88
W510	75.47	87.99	94.40	3.67	2.15	2.04
W520	81.33	91.21	95.98	13.08	4.59	5.52
W530	34.69	55.85	74.42	9.19	0.57	0.68
W540	36.85	58.15	76.17	22.45	8.85	10.61
W550	46.34	67.28	82.54	18.03	3.19	3.66
W560	42.16	63.44	79.97	13.41	2.65	3.15
W570	72.80	86.43	93.61	37.63	3.87	4.62
W580	57.92	76.62	88.29	14.82	1.79	1.94
W590	39.72	61.07	78.30	37.84	6.67	7.99
W600	80.50	90.76	95.76	20.91	5.02	6.02
W610	38.97	60.32	77.76	46.64	3.33	3.73
W620	86.12	93.66	97.14	42.57	6.92	8.31
W630	55.84	75.07	87.38	36.70	4.48	5.38
W640	33.30	54.31	73.22	29.58	4.19	4.44
W650	62.43	79.82	90.10	20.36	0.43	0.39
W660	82.10	91.61	96.17	39.43	2.72	2.44

W670	50.64	70.95	84.89	38.62	5.05	5.73

Table 9: Calibrated Reach Parameters

Reach	Channel Manning's n	Floodplain Manning's n
R100	0.07	0.16
R110	0.07	0.16
R120	0.07	0.16
R150	0.07	0.16
R170	0.07	0.16
R180	0.07	0.16
R190	0.07	0.16
R210	0.07	0.16
R260	0.07	0.16
R270	0.07	0.16
R280	0.07	0.16
R290	0.07	0.16
R30	0.07	0.16
R310	0.07	0.16
R320	0.07	0.16
R330	0.07	0.16
R80	0.07	0.16

APPENDIX D:
Sensitivity Analysis

Table 10: Time of Concentration and Storage Coefficient Sensitivity Analysis Adjustments

Initial Time of Concentration (hr)	Initial Storage Coefficient (hr)	Tc +10%	Storage Coeff. +10%	Tc -10%	Storage Coeff. -10%
2.46	2.96	2.706	3.256	2.214	2.664
1.31	1.39	1.441	1.529	1.179	1.251
1.73	2.08	1.903	2.288	1.557	1.872
0.54	0.5	0.594	0.55	0.486	0.45
1.6	1.92	1.76	2.112	1.44	1.728
0.83	0.8	0.913	0.88	0.747	0.72
1.23	1.25	1.353	1.375	1.107	1.125
0.92	0.98	1.012	1.078	0.828	0.882
1.29	1.47	1.419	1.617	1.161	1.323
0.68	0.77	0.748	0.847	0.612	0.693
0.77	0.81	0.847	0.891	0.693	0.729
0.82	0.98	0.902	1.078	0.738	0.882
1.04	1.24	1.144	1.364	0.936	1.116
0.57	0.57	0.627	0.627	0.513	0.513
2.63	3.16	2.893	3.476	2.367	2.844
1.73	2.08	1.903	2.288	1.557	1.872
1.84	2.2	2.024	2.42	1.656	1.98
2.47	2.96	2.717	3.256	2.223	2.664
0.6	0.57	0.66	0.627	0.54	0.513
0.16	0.19	0.176	0.209	0.144	0.171
0.89	1.02	0.979	1.122	0.801	0.918
0.74	0.88	0.814	0.968	0.666	0.792
1.28	1.54	1.408	1.694	1.152	1.386
0.5	0.54	0.55	0.594	0.45	0.486
1.4	1.68	1.54	1.848	1.26	1.512
1.86	2.23	2.046	2.453	1.674	2.007
1.08	1.29	1.188	1.419	0.972	1.161
0.93	1.04	1.023	1.144	0.837	0.936
1.17	1.24	1.287	1.364	1.053	1.116
1.1	1.32	1.21	1.452	0.99	1.188

1.93	2.32	2.123	2.552	1.737	2.088
0.12	0.11	0.132	0.121	0.108	0.099
0.76	0.68	0.836	0.748	0.684	0.612

Table 11: Curve Number Sensitivity Analysis Adjustments

CN (AMC II)	CN(AMC II) +10%	CN (AMC II) -10%
61.74	67.91	55.57
58.63	64.49	52.77
68.25	75.07	61.42
47.10	51.81	42.39
37.58	41.33	33.82
61.16	67.28	55.04
66.70	73.37	60.03
50.43	55.47	45.38
60.13	66.14	54.11
78.58	86.43	70.72
78.06	85.87	70.26
66.79	73.47	60.11
61.45	67.60	55.31
64.50	70.95	58.05
69.65	76.62	62.69
81.00	89.10	72.90
52.86	58.15	47.58
57.68	63.44	51.91
54.84	60.32	49.35
40.21	44.24	36.19
55.52	61.07	49.97
50.77	55.85	45.69
58.36	64.19	52.52
49.38	54.31	44.44
53.65	59.01	48.28
70.97	78.06	63.87
79.66	87.62	71.69
87.28	96.01	78.55
79.99	87.99	71.99

82.71	90.99	74.44
85.15	93.66	76.63
72.57	79.82	65.31
83.28	91.61	74.95

Table 12: Manning's n Sensitivity Analysis Adjustments

	Initial Manning's n	n +10%	n -10%
Main Channel	0.065	0.072	0.059
Overbank Areas	0.090	0.099	0.081

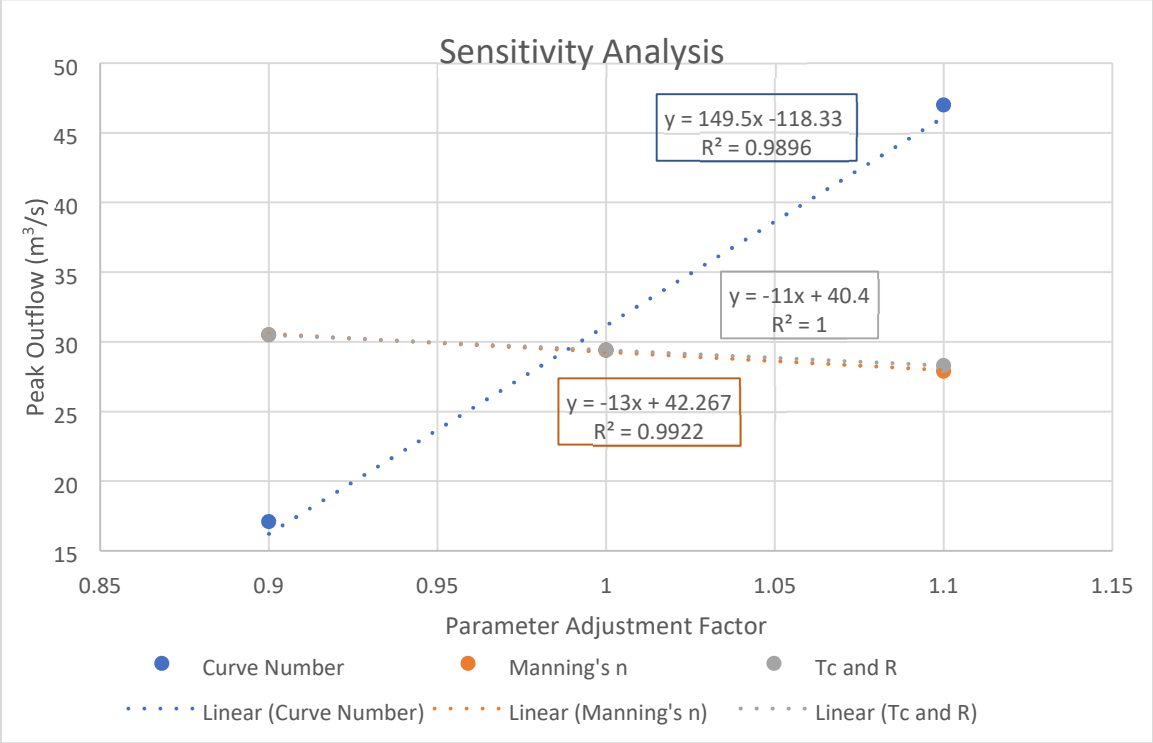

Figure 3: Sensitivity Analysis Plot

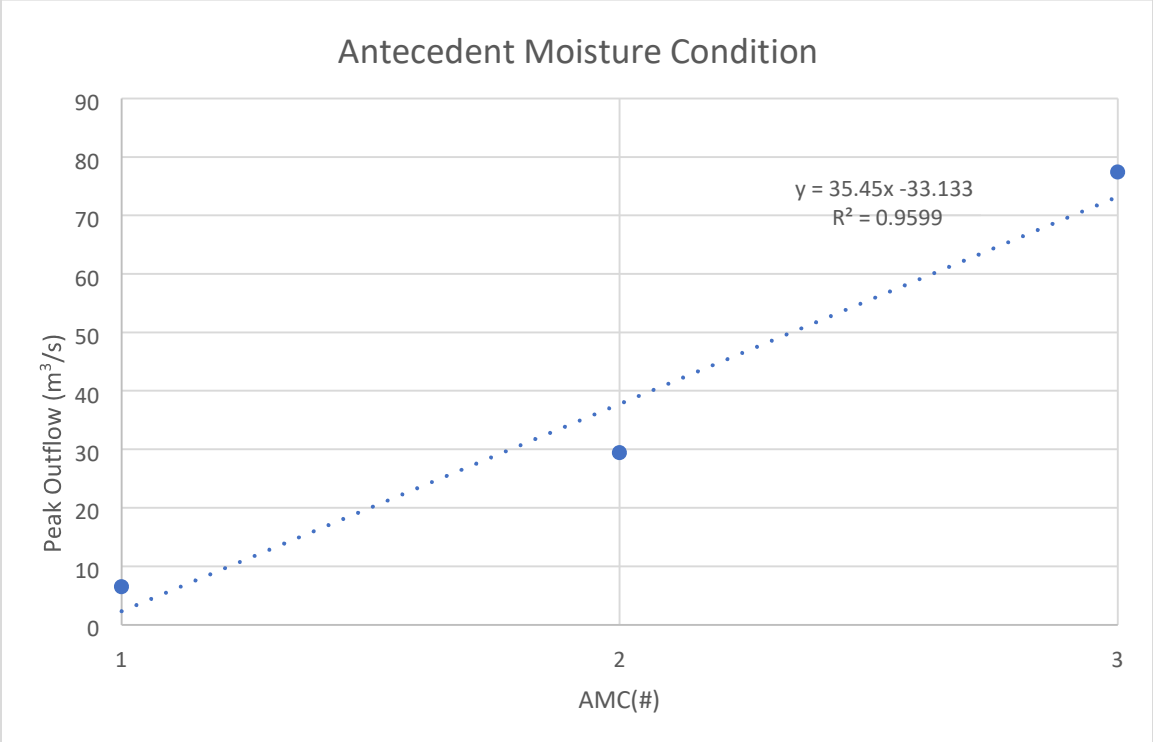

Figure 4: Sensitivity Analysis Plot - Antecedent Moisture Conditions

APPENDIX E: TR-55 Parameters

Table 13: TR-55 Time of Concentration Parameters

Watershed Name	W340	W350	W360	W370	W380	W390	W400	W410	W420	W430	W440	W450	W460	W470	W480	W490	W500	W510	W520	W530	W540	W550	W560	W570	W580	W590	W600	W610	W620	W630	W640	W650	W660	W670
Watershed ID	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
Sheet Flow Characteristics																																		
Manning's Roughness Coefficient	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Flow Length (ft)	100	100	100	100	100	100.0001	100.0002	100.001	99.9999	99.9999	100.002	100	100.002	100	100.001	99.9999	100.002	99.9998	100.001	100	100	100	100.0001	99.9999	99.9999	100	99.9999	99.9999	99.9999	100	100.0001	99.9999	100.0002	100
Two-Year 24-hour Rainfall (in)	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7
Land Slope (ft/ft)	0.0322	0.0171	0.0022	0.0469	0.0121	0.0489	0.0174	0.0266	0.0285	0.0177	0.0669	0.0226	0.0138	0.0308	0.0066	0.0233	0.0062	0.0876	0.2018	0.0666	0.0548	0.0138	0.0384	0.1325	0.0738	0.0679	0.0256	0.0361	0.3077	0.01	0.0292	0.0616	0.0166	0.01
Sheet Flow Tt (hr)	0.05	0.06	0.14	0.04	0.07	0.04	0.06	0.05	0.05	0.06	0.04	0.06	0.07	0.05	0.09	0.06	0.09	0.03	0.02	0.04	0.04	0.07	0.05	0.03	0.03	0.04	0.05	0.05	0.02	0.08	0.05	0.04	0.06	0.08
Shallow Concentrated Flow Characteristics																																		
Surface Description (1 - unpaved, 2 - paved)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Flow Length (ft)	4913	5659	5385	5604	5981	4990.4391	7725.7067	5628.2394	4142.127	9172.1392	3612.1437	5642.0144	5712.4537	2828.7335	5935.5505	6589.4282	6073.5236	4634.898	6688.9144	1651.1741	9061.597	7994.184	6632.949	1893.108	7716.031	4325.146	3355.792	4987.054	4620.341	4366.354	4390.408	506.8535	2624.085	4625.6
Watercourse Slope (ft/ft)	0.0042	0.0121	0.0054	0.0201	0.0122	0.0236	0.0155	0.0112	0.0193	0.01	0.0221	0.0141	0.0265	0.0354	0.0048	0.0166	0.0048	0.043	0.0155	0.0609	0.0047	0.0371	0.0383	0.0213	0.0392	0.0856	0.0097	0.0111	0.004	0.005	0.006	0.0389	0.0062	0.005
Average Velocity - computed (ft/s)	1.05	1.77	1.19	2.29	1.78	2.48	2.01	1.71	2.24	1.61	2.40	1.92	2.63	3.04	1.12	2.08	1.12	3.35	2.01	3.98	1.11	3.11	3.16	2.35	3.19	4.72	1.59	1.70	1.02	1.14	1.25	3.18	1.27	1.14
Shallow Concentrated Flow Tt (hr)	1.31	0.89	1.26	0.68	0.93	0.56	1.07	0.92	0.51	1.58	0.42	0.82	0.60	0.26	1.47	0.88	1.51	0.38	0.92	0.12	2.28	0.71	0.58	0.22	0.67	0.25	0.59	0.81	1.26	1.06	0.98	0.04	0.57	1.13
Channel Flow Characterisitics																																		
Cross-sectional Flow Area (ft2)	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Wetted Perimeter (ft)	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Hydraulic Radius - computed (ft)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Channel Slope (ft/ft)	0.0074	0.01	0.0079	0.001	0.0064	0.0148	0.0077	0.0025	0.0151	0.0018	0.0034	0.0148	0.0099	0.0044	0.0055	0.0339	0.0315	0.0164	0.0347	0.0549	0.0313	0.0122	0.0201	0.0062	0.005	0.0017	0.0028	0.0014	0.0037	0.001	0.0085	0.0012	0.005	0.0065
Manning's Roughness Coefficient	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Average Velocity - computed (ft/s)	4.27	4.97	4.41	1.57	3.97	6.04	4.36	2.48	6.10	2.11	2.90	6.04	4.94	3.29	3.68	9.14	8.81	6.36	9.25	11.64	8.79	5.49	7.04	3.91	3.51	2.05	2.63	1.86	3.02	1.57	4.58	1.72	3.51	4.00
Flow Length (ft)	17089	14057	3142	585	3177	1656.1137	2457.8447	3012.1378	5593.6688	7509.7337	908.0839	897.3988	1744.9282	3094.5051	2229.5111	3290.6312	7387.4797	4178.6796	11073.0434	219.4446	4922.168	2057.393	2718.111	11688.64	8724.019	1539.695	11509.67	463.7161	7104.862	603.32	2337.194	251.1272	1579.476	2982.85
Channel Flow Tt (hr)	1.11	0.79	0.20	0.10	0.22	0.08	0.16	0.34	0.25	0.99	0.09	0.04	0.10	0.26	0.17	0.10	0.23	0.18	0.33	0.01	0.16	0.10	0.11	0.83	0.69	0.21	1.22	0.07	0.65	0.11	0.14	0.04	0.12	0.21
Watershed Time of travel (hr)	**2.46**	**1.73**	**1.60**	**0.83**	**1.23**	**0.68**	**1.29**	**1.31**	**0.82**	**2.63**	**0.54**	**0.92**	**0.77**	**0.57**	**1.73**	**1.04**	**1.84**	**0.60**	**1.28**	**0.16**	**2.47**	**0.89**	**0.74**	**1.08**	**1.40**	**0.50**	**1.86**	**0.93**	**1.93**	**1.25**	**1.17**	**0.12**	**0.76**	**1.41**
Longest Flowpath (km)	**6.74**	**6.04**	**2.63**	**1.92**	**2.82**	**2.06**	**3.13**	**2.66**	**3.00**	**5.12**	**1.41**	**2.02**	**2.30**	**1.84**	**2.52**	**3.04**	**4.13**	**2.72**	**5.44**	**0.60**	**4.29**	**3.09**	**2.88**	**4.17**	**5.04**	**1.82**	**4.56**	**1.69**	**3.60**	**1.55**	**2.08**	**0.26**	**1.31**	**1.44**
Watershed Area	**3.44**	**3.41**	**0.80**	**0.74**	**1.45**	**0.63**	**1.45**	**1.18**	**0.74**	**1.26**	**0.47**	**0.67**	**0.90**	**0.63**	**0.79**	**0.97**	**1.79**	**1.59**	**2.70**	**0.04**	**0.97**	**1.40**	**1.11**	**2.43**	**2.33**	**0.54**	**2.00**	**0.44**	**1.11**	**0.31**	**0.73**	**0.02**	**0.43**	**0.31**
Storage Coefficient (hr)	**2.96**	**2.08**	**1.92**	**0.80**	**1.25**	**0.77**	**1.47**	**1.39**	**0.98**	**3.16**	**0.50**	**0.98**	**0.81**	**0.57**	**2.08**	**1.24**	**2.20**	**0.57**	**1.54**	**0.19**	**2.96**	**1.02**	**0.88**	**1.29**	**1.68**	**0.54**	**2.23**	**1.04**	**2.32**	**1.50**	**1.24**	**0.11**	**0.68**	**1.60**

APPENDIX F: HEC-HMS Simulation Run Summary Tables

2-Year 6-Hour SCS Storm

Hydrologic Element	Drainage Area (km^2)	Peak Discharge (m^3/s)	Time of Peak	Volume (mm)
R290	36.86993	12.9	01Jan2000, 08:15	13.83
R310	37.1781	13.1	01Jan2000, 08:15	13.87
J221	15.88691	3.4	01Jan2000, 07:30	7.73
J224	3.66235	0.9	01Jan2000, 06:45	5.78
J244	1.54126	0.4	01Jan2000, 06:00	5.46
J201	4.81074	1.7	01Jan2000, 10:15	18.82
R80	3.66235	0.8	01Jan2000, 08:00	5.78
J204	23.91821	6.5	01Jan2000, 06:45	11.07
J227	8.4966	1	01Jan2000, 09:15	6.16
R190	4.81074	1.7	01Jan2000, 10:15	18.82
W340	3.4401	0.5	01Jan2000, 11:15	8.52
W560	1.1142	0.3	01Jan2000, 05:30	6.47
W440	0.4666	0.2	01Jan2000, 05:15	5.16
W540	0.97038	0.2	01Jan2000, 11:15	9.34
W420	0.74364	0.2	01Jan2000, 06:15	6.79
W400	1.4529	0.1	01Jan2000, 07:15	3.16
W500	1.7868	0.8	01Jan2000, 09:15	19.98
R110	8.4966	1	01Jan2000, 09:45	6.16
R210	23.91821	6.5	01Jan2000, 07:00	11.07
W380	1.4513	0.3	01Jan2000, 07:00	5.08
R150	15.88691	3.4	01Jan2000, 07:45	7.73
W480	0.79406	0.4	01Jan2000, 08:45	19.58
R170	2.05356	0.8	01Jan2000, 11:30	22.29
W360	0.7978	0	01Jan2000, 09:30	1.35
W460	0.90416	1.6	01Jan2000, 05:30	33.75
J196	26.43551	7.3	01Jan2000, 07:00	10.78
J213	17.48204	4.2	01Jan2000, 06:30	8.3
J234	4.622	0.6	01Jan2000, 11:00	7.2
R30	1.54126	0.4	01Jan2000, 06:45	5.47
J237	5.74251	1.3	01Jan2000, 07:30	6.07
J216	2.05356	0.8	01Jan2000, 10:30	22.33
W450	0.66979	0.2	01Jan2000, 06:15	7.98
R180	17.48204	4.2	01Jan2000, 06:45	8.29

W550	1.4031	0.6	01Jan2000, 06:00	9.26
W430	1.2595	0.5	01Jan2000, 12:00	24.07
W530	0.040626	0	01Jan2000, 03:30	3.86
W410	1.1819	0.1	01Jan2000, 07:15	3.35
W510	1.5848	2	01Jan2000, 05:00	18.41
R100	4.622	0.6	01Jan2000, 11:15	7.2
W390	0.62726	0.5	01Jan2000, 05:15	14.56
R120	5.74251	1.3	01Jan2000, 08:00	6.08
W490	0.96854	0.4	01Jan2000, 06:30	10.01
W370	0.74346	0.4	01Jan2000, 06:00	9.88
W470	0.62659	0.9	01Jan2000, 05:00	20.08
W350	3.408	0.4	01Jan2000, 08:45	4.9
R260	26.43551	7.3	01Jan2000, 07:45	10.78
W520	2.6987	2.1	01Jan2000, 07:30	24.79
J189	3.23757	2.3	01Jan2000, 07:30	23.35
W590	0.53887	0.2	01Jan2000, 09:15	16.15
R280	3.23757	2.2	01Jan2000, 10:30	23.24
W580	2.3309	1.9	01Jan2000, 04:45	11.89
W600	1.9995	1.5	01Jan2000, 07:45	25.77
J186	7.56797	3.6	01Jan2000, 09:30	20.41
R270	7.56797	3.6	01Jan2000, 09:30	20.41
W610	0.43645	0.4	01Jan2000, 06:00	19.73
W570	2.43	2.3	01Jan2000, 06:45	25.45
J183	36.86993	12.9	01Jan2000, 08:00	13.83
W640	0.72932	0.3	01Jan2000, 06:45	12.38
J176	38.21733	13.5	01Jan2000, 08:15	13.87
W670	0.309904	0.2	01Jan2000, 07:45	18.33
W630	0.308175	0.2	01Jan2000, 07:15	18.97
J180	37.1781	13.1	01Jan2000, 08:15	13.87
R320	38.21733	13.5	01Jan2000, 08:15	13.87
W620	1.1093	0.8	01Jan2000, 09:30	32.98
W650	0.020214	0.1	01Jan2000, 03:30	15.71
J173	39.34684	14.3	01Jan2000, 08:30	14.41
R330	39.34684	14.2	01Jan2000, 08:45	14.4
W660	0.43119	0.8	01Jan2000, 05:30	30.36

Outlet1	39.77803	14.5	01Jan2000, 08:30	14.57
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

2-year 12-hour SCS Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	15.6	01Jan2000, 11:15	18.73
R310	37.1781	15.8	01Jan2000, 11:30	18.78
J221	15.88691	4	01Jan2000, 10:30	10.67
J224	3.66235	1.1	01Jan2000, 09:30	8.65
J244	1.54126	0.5	01Jan2000, 09:00	9.14
J201	4.81074	2.1	01Jan2000, 13:30	24.8
R80	3.66235	1	01Jan2000, 10:45	8.65
J204	23.91821	7.8	01Jan2000, 11:00	15.09
J227	8.4966	1.2	01Jan2000, 12:45	8.44
R190	4.81074	2.1	01Jan2000, 13:30	24.8
W340	3.4401	0.7	01Jan2000, 14:30	12.23
W560	1.1142	0.4	01Jan2000, 08:30	9.42
W440	0.4666	0.2	01Jan2000, 08:00	9.2
W540	0.97038	0.2	01Jan2000, 14:15	12.09
W420	0.74364	0.3	01Jan2000, 09:00	11.06
W400	1.4529	0.2	01Jan2000, 10:30	4.87
W500	1.7868	1	01Jan2000, 12:30	27.36
R110	8.4966	1.2	01Jan2000, 13:15	8.43
R210	23.91821	7.8	01Jan2000, 11:15	15.08
W380	1.4513	0.3	01Jan2000, 10:00	6.71
R150	15.88691	4	01Jan2000, 10:45	10.67
W480	0.79406	0.4	01Jan2000, 11:45	24.05
R170	2.05356	1	01Jan2000, 15:15	28.59
W360	0.7978	0.1	01Jan2000, 13:45	3.48
W460	0.90416	1.8	01Jan2000, 08:30	43.06
J196	26.43551	8.7	01Jan2000, 09:45	14.74
J213	17.48204	5	01Jan2000, 10:15	11.47

J234	4.622	0.8	01Jan2000, 14:15	10.17
R30	1.54126	0.5	01Jan2000, 09:30	9.15
J237	5.74251	1.6	01Jan2000, 10:30	8.84
J216	2.05356	1	01Jan2000, 14:00	28.69
W450	0.66979	0.3	01Jan2000, 09:00	11.71
R180	17.48204	5	01Jan2000, 10:45	11.46
W550	1.4031	0.7	01Jan2000, 09:00	13.17
W430	1.2595	0.6	01Jan2000, 15:00	31.61
W530	0.040626	0	01Jan2000, 06:30	5.27
W410	1.1819	0.1	01Jan2000, 10:15	4.19
W510	1.5848	2.4	01Jan2000, 08:00	25.98
R100	4.622	0.8	01Jan2000, 14:45	10.16
W390	0.62726	0.5	01Jan2000, 08:15	19.09
R120	5.74251	1.6	01Jan2000, 11:00	8.84
W490	0.96854	0.4	01Jan2000, 09:30	13.92
W370	0.74346	0.5	01Jan2000, 08:45	15.21
W470	0.62659	1	01Jan2000, 07:45	27.93
W350	3.408	0.5	01Jan2000, 11:45	6.01
R260	26.43551	8.7	01Jan2000, 10:30	14.73
W520	2.6987	2.5	01Jan2000, 10:15	33.23
J189	3.23757	2.7	01Jan2000, 10:30	31.13
W590	0.53887	0.2	01Jan2000, 12:15	20.63
R280	3.23757	2.6	01Jan2000, 13:30	31
W580	2.3309	2.3	01Jan2000, 07:45	17.32
W600	1.9995	1.8	01Jan2000, 10:45	34.23
J186	7.56797	4.8	01Jan2000, 12:30	27.64
R270	7.56797	4.8	01Jan2000, 12:45	27.64
W610	0.43645	0.4	01Jan2000, 09:00	24.92
W570	2.43	2.6	01Jan2000, 09:30	33.49
J183	36.86993	15.7	01Jan2000, 11:00	18.74
W640	0.72932	0.4	01Jan2000, 09:45	15.45
J176	38.21733	16.3	01Jan2000, 11:15	18.76
W670	0.309904	0.2	01Jan2000, 10:45	24.14
W630	0.308175	0.2	01Jan2000, 10:15	25.24
J180	37.1781	15.9	01Jan2000, 11:15	18.78

R320	38.21733	16.3	01Jan2000, 11:30	18.76
W620	1.1093	1	01Jan2000, 12:30	41.95
W650	0.020214	0.1	01Jan2000, 06:15	22.01
J173	39.34684	17.2	01Jan2000, 11:30	19.41
R330	39.34684	17.2	01Jan2000, 12:00	19.39
W660	0.43119	0.9	01Jan2000, 08:15	39.2
Outlet1	39.77803	17.6	01Jan2000, 11:30	19.6
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

2-Year 24-Hour SCS Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	18.3	01Jan2000, 17:00	25.11
R310	37.1781	18.6	01Jan2000, 17:00	25.17
J221	15.88691	4.8	01Jan2000, 16:30	14.79
J224	3.66235	1.3	01Jan2000, 15:30	13.08
J244	1.54126	0.7	01Jan2000, 14:45	14.58
J201	4.81074	2.5	01Jan2000, 19:30	31.94
R80	3.66235	1.3	01Jan2000, 16:30	13.07
J204	23.91821	9.2	01Jan2000, 16:45	20.39
J227	8.4966	1.5	01Jan2000, 19:45	11.52
R190	4.81074	2.5	01Jan2000, 19:30	31.94
W340	3.4401	0.9	01Jan2000, 20:45	17.14
W560	1.1142	0.5	01Jan2000, 14:30	13.95
W440	0.4666	0.3	01Jan2000, 13:45	15.15
W540	0.97038	0.2	01Jan2000, 20:30	15.84
W420	0.74364	0.4	01Jan2000, 15:00	17.25
W400	1.4529	0.2	01Jan2000, 16:45	7.94
W500	1.7868	1.2	01Jan2000, 18:15	36.49
R110	8.4966	1.5	01Jan2000, 20:00	11.49
R210	23.91821	9.2	01Jan2000, 17:15	20.35
W380	1.4513	0.3	01Jan2000, 16:00	9.59
R150	15.88691	4.8	01Jan2000, 16:45	14.78

W480	0.79406	0.5	01Jan2000, 17:45	29.25
R170	2.05356	1.1	01Jan2000, 21:15	35.6
W360	0.7978	0.1	01Jan2000, 19:30	7.1
W460	0.90416	2	01Jan2000, 14:30	54.48
J196	26.43551	10.3	01Jan2000, 15:45	20
J213	17.48204	5.9	01Jan2000, 16:15	15.88
J234	4.622	1	01Jan2000, 20:30	14.28
R30	1.54126	0.7	01Jan2000, 15:30	14.58
J237	5.74251	1.9	01Jan2000, 16:15	13.11
J216	2.05356	1.1	01Jan2000, 20:15	35.86
W450	0.66979	0.3	01Jan2000, 15:00	17.18
R180	17.48204	5.8	01Jan2000, 16:45	15.84
W550	1.4031	0.8	01Jan2000, 15:00	18.83
W430	1.2595	0.8	01Jan2000, 21:00	40.04
W530	0.040626	0	01Jan2000, 12:30	7.93
W410	1.1819	0.2	01Jan2000, 16:15	5.97
W510	1.5848	2.9	01Jan2000, 14:00	35.75
R100	4.622	1	01Jan2000, 20:45	14.26
W390	0.62726	0.6	01Jan2000, 14:15	25.34
R120	5.74251	1.9	01Jan2000, 16:45	13.12
W490	0.96854	0.5	01Jan2000, 15:30	19.55
W370	0.74346	0.6	01Jan2000, 14:45	22.6
W470	0.62659	1.3	01Jan2000, 13:45	37.98
W350	3.408	0.5	01Jan2000, 17:45	7.31
R260	26.43551	10.3	01Jan2000, 16:30	19.95
W520	2.6987	3	01Jan2000, 16:15	43.81
J189	3.23757	3.2	01Jan2000, 16:15	40.93
W590	0.53887	0.3	01Jan2000, 18:15	26.48
R280	3.23757	3	01Jan2000, 19:15	40.72
W580	2.3309	2.9	01Jan2000, 13:30	24.76
W600	1.9995	2.1	01Jan2000, 16:45	44.78
J186	7.56797	5.6	01Jan2000, 18:30	36.88
R270	7.56797	5.6	01Jan2000, 18:30	36.88
W610	0.43645	0.4	01Jan2000, 15:00	31.81
W570	2.43	3	01Jan2000, 15:30	43.68

J183	36.86993	18.4	01Jan2000, 16:45	25.13
W640	0.72932	0.4	01Jan2000, 15:45	19.9
J176	38.21733	19.1	01Jan2000, 17:00	25.12
W670	0.309904	0.2	01Jan2000, 16:45	31.82
W630	0.308175	0.2	01Jan2000, 16:15	33.49
J180	37.1781	18.6	01Jan2000, 17:00	25.18
R320	38.21733	19.1	01Jan2000, 17:00	25.12
W620	1.1093	1.1	01Jan2000, 18:30	52.41
W650	0.020214	0.1	01Jan2000, 12:15	30.41
J173	39.34684	20.1	01Jan2000, 17:15	25.89
R330	39.34684	20.1	01Jan2000, 17:45	25.84
W660	0.43119	0.9	01Jan2000, 14:15	50.18
Outlet1	39.77803	20.5	01Jan2000, 17:15	26.11
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

5-Year 6-Hour SCS Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	19.2	01Jan2000, 08:00	20.54
R310	37.1781	19.5	01Jan2000, 08:15	20.6
J221	15.88691	5.2	01Jan2000, 07:30	11.82
J224	3.66235	1.4	01Jan2000, 06:45	9.78
J244	1.54126	0.7	01Jan2000, 06:00	10.55
J201	4.81074	2.5	01Jan2000, 10:00	27.1
R80	3.66235	1.4	01Jan2000, 07:45	9.79
J204	23.91821	9.7	01Jan2000, 07:00	16.63
J227	8.4966	1.4	01Jan2000, 09:30	9.36
R190	4.81074	2.5	01Jan2000, 10:15	27.1
W340	3.4401	0.8	01Jan2000, 11:30	13.77
W560	1.1142	0.6	01Jan2000, 05:45	10.57
W440	0.4666	0.3	01Jan2000, 05:00	10.73
W540	0.97038	0.2	01Jan2000, 11:15	13.29
W420	0.74364	0.4	01Jan2000, 06:15	12.67
W400	1.4529	0.3	01Jan2000, 07:30	5.62

W500	1.7868	1.2	01Jan2000, 09:15	30.04
R110	8.4966	1.4	01Jan2000, 09:45	9.36
R210	23.91821	9.7	01Jan2000, 07:30	16.62

W380	1.4513	0.4	01Jan2000, 07:15	7.41
R150	15.88691	5.2	01Jan2000, 07:45	11.82
W480	0.79406	0.5	01Jan2000, 08:45	25.57
R170	2.05356	1.1	01Jan2000, 11:45	31.08
W360	0.7978	0.1	01Jan2000, 09:00	4.39
W460	0.90416	2.2	01Jan2000, 05:30	46.2
J196	26.43551	11	01Jan2000, 07:00	16.26
J213	17.48204	6.4	01Jan2000, 07:15	12.69
J234	4.622	0.9	01Jan2000, 11:00	11.42
R30	1.54126	0.7	01Jan2000, 06:45	10.56
J237	5.74251	2.1	01Jan2000, 07:30	9.93
J216	2.05356	1.1	01Jan2000, 10:30	31.14
W450	0.66979	0.4	01Jan2000, 06:15	13.12
R180	17.48204	6.4	01Jan2000, 07:45	12.68
W550	1.4031	0.9	01Jan2000, 06:15	14.64
W430	1.2595	0.7	01Jan2000, 12:00	34.65
W530	0.040626	0	01Jan2000, 03:30	5.9
W410	1.1819	0.2	01Jan2000, 07:15	4.58
W510	1.5848	3.1	01Jan2000, 05:00	28.62
R100	4.622	0.9	01Jan2000, 11:15	11.42
W390	0.62726	0.7	01Jan2000, 05:15	20.74
R120	5.74251	2.1	01Jan2000, 08:00	9.93
W490	0.96854	0.6	01Jan2000, 06:45	15.39
W370	0.74346	0.6	01Jan2000, 06:00	17.15
W470	0.62659	1.3	01Jan2000, 05:00	30.65
W350	3.408	0.5	01Jan2000, 08:45	6.39
R260	26.43551	10.9	01Jan2000, 07:45	16.26
W520	2.6987	3.1	01Jan2000, 07:30	36.12
J189	3.23757	3.4	01Jan2000, 07:30	33.83
W590	0.53887	0.3	01Jan2000, 09:15	22.33
R280	3.23757	3.2	01Jan2000, 10:15	33.64

W580	2.3309	3.1	01Jan2000, 04:45	19.29
W600	1.9995	2.2	01Jan2000, 07:45	37.13
J186	7.56797	5.4	01Jan2000, 09:30	30.14
R270	7.56797	5.4	01Jan2000, 09:30	30.14
W610	0.43645	0.5	01Jan2000, 06:00	26.76
W570	2.43	3.2	01Jan2000, 06:45	36.26
J183	36.86993	19.3	01Jan2000, 07:45	20.55
W640	0.72932	0.4	01Jan2000, 06:45	16.6
J176	38.21733	20.1	01Jan2000, 08:15	20.57
W670	0.309904	0.2	01Jan2000, 07:45	26.2
W630	0.308175	0.3	01Jan2000, 07:15	27.45
J180	37.1781	19.5	01Jan2000, 08:00	20.6
R320	38.21733	20.1	01Jan2000, 08:15	20.57
W620	1.1093	1.1	01Jan2000, 09:30	45.18
W650	0.020214	0.1	01Jan2000, 03:30	24.25
J173	39.34684	21.1	01Jan2000, 08:15	21.26
R330	39.34684	21	01Jan2000, 08:30	21.23
W660	0.43119	1.1	01Jan2000, 05:30	42.21
Outlet1	39.77803	21.4	01Jan2000, 08:15	21.46
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

5-Year 12-Hour SCS Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	23.5	01Jan2000, 12:00	27.93
R310	37.1781	23.8	01Jan2000, 12:15	28
J221	15.88691	6.3	01Jan2000, 10:30	16.7
J224	3.66235	1.8	01Jan2000, 09:30	14.97
J244	1.54126	0.9	01Jan2000, 09:00	16.88
J201	4.81074	3.1	01Jan2000, 13:30	35.73
R80	3.66235	1.8	01Jan2000, 10:30	14.97
J204	23.91821	11.9	01Jan2000, 11:00	22.87
J227	8.4966	1.9	01Jan2000, 13:00	13.16
R190	4.81074	3.1	01Jan2000, 13:30	35.73

W340	3.4401	1.1	01Jan2000, 14:30	19.96
W560	1.1142	0.7	01Jan2000, 08:30	15.86
W440	0.4666	0.5	01Jan2000, 07:45	17.59
W540	0.97038	0.3	01Jan2000, 14:30	18.09
W420	0.74364	0.5	01Jan2000, 09:00	19.77
W400	1.4529	0.3	01Jan2000, 10:45	9.33
W500	1.7868	1.5	01Jan2000, 12:15	40.63
R110	8.4966	1.9	01Jan2000, 13:30	13.14
R210	23.91821	11.9	01Jan2000, 11:30	22.85
W380	1.4513	0.5	01Jan2000, 10:15	10.88
R150	15.88691	6.3	01Jan2000, 10:45	16.69
W480	0.79406	0.6	01Jan2000, 11:45	31.53
R170	2.05356	1.4	01Jan2000, 15:15	39.79
W360	0.7978	0.2	01Jan2000, 13:00	8.81
W460	0.90416	2.5	01Jan2000, 08:30	58.72
J196	26.43551	13.2	01Jan2000, 11:00	22.47

J213	17.48204	7.7	01Jan2000, 10:15	17.88
J234	4.622	1.3	01Jan2000, 14:30	16.61
R30	1.54126	0.9	01Jan2000, 09:30	16.89
J237	5.74251	2.6	01Jan2000, 10:15	14.95
J216	2.05356	1.4	01Jan2000, 14:15	39.93
W450	0.66979	0.5	01Jan2000, 09:15	19.43
R180	17.48204	7.7	01Jan2000, 11:00	17.86
W550	1.4031	1.1	01Jan2000, 09:00	21.13
W430	1.2595	0.9	01Jan2000, 15:00	45.23
W530	0.040626	0	01Jan2000, 06:30	9.14
W410	1.1819	0.2	01Jan2000, 10:30	6.86
W510	1.5848	3.7	01Jan2000, 08:00	39.48
R100	4.622	1.3	01Jan2000, 14:45	16.6
W390	0.62726	0.8	01Jan2000, 08:15	27.84
R120	5.74251	2.6	01Jan2000, 10:45	14.95
W490	0.96854	0.7	01Jan2000, 09:30	21.85
W370	0.74346	0.8	01Jan2000, 08:45	25.53
W470	0.62659	1.6	01Jan2000, 07:45	41.8

W350	3.408	0.6	01Jan2000, 11:45	7.88
R260	26.43551	13.2	01Jan2000, 12:00	22.44
W520	2.6987	3.7	01Jan2000, 10:15	47.84
J189	3.23757	4	01Jan2000, 10:15	44.75
W590	0.53887	0.3	01Jan2000, 12:15	29.26
R280	3.23757	3.8	01Jan2000, 13:00	44.55
W580	2.3309	3.8	01Jan2000, 07:45	27.71
W600	1.9995	2.6	01Jan2000, 10:45	48.86
J186	7.56797	7.1	01Jan2000, 12:15	40.5
R270	7.56797	7.1	01Jan2000, 12:30	40.5
W610	0.43645	0.6	01Jan2000, 09:00	34.5
W570	2.43	3.7	01Jan2000, 09:30	47.54
J183	36.86993	23.5	01Jan2000, 11:45	27.94
W640	0.72932	0.5	01Jan2000, 09:45	21.73
J176	38.21733	24.4	01Jan2000, 12:15	27.93
W670	0.309904	0.3	01Jan2000, 10:45	34.87
W630	0.308175	0.3	01Jan2000, 10:15	36.71
J180	37.1781	23.8	01Jan2000, 12:00	28.01
R320	38.21733	24.4	01Jan2000, 12:15	27.93
W620	1.1093	1.3	01Jan2000, 12:30	57.32
W650	0.020214	0.1	01Jan2000, 06:15	33.68
J173	39.34684	25.7	01Jan2000, 12:15	28.77
R330	39.34684	25.7	01Jan2000, 12:30	28.73
W660	0.43119	1.2	01Jan2000, 08:15	54.29
Outlet1	39.77803	26.1	01Jan2000, 12:00	29
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

5-Year 24-Hour SCS Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	27.7	01Jan2000, 17:45	37.51
R310	37.1781	28.1	01Jan2000, 18:00	37.58
J221	15.88691	7.6	01Jan2000, 16:15	23.44
J224	3.66235	2.3	01Jan2000, 15:30	22.58

J244	1.54126	1.2	01Jan2000, 14:45	25.83
J201	4.81074	3.5	01Jan2000, 19:30	46.05
R80	3.66235	2.2	01Jan2000, 16:30	22.57
J204	23.91821	14.1	01Jan2000, 17:00	31.05
J227	8.4966	2.3	01Jan2000, 20:00	18.28
R190	4.81074	3.5	01Jan2000, 19:30	46.04
W340	3.4401	1.4	01Jan2000, 20:45	27.93
W560	1.1142	0.9	01Jan2000, 14:30	23.62
W440	0.4666	0.7	01Jan2000, 13:45	27.29
W540	0.97038	0.3	01Jan2000, 20:30	24.45
W420	0.74364	0.7	01Jan2000, 14:45	29.71
W400	1.4529	0.5	01Jan2000, 16:45	15.26
W500	1.7868	1.8	01Jan2000, 18:15	53.63
R110	8.4966	2.3	01Jan2000, 20:30	18.23
R210	23.91821	14.1	01Jan2000, 17:15	31
W380	1.4513	0.6	01Jan2000, 16:15	16.43
R150	15.88691	7.6	01Jan2000, 16:30	23.42
W480	0.79406	0.6	01Jan2000, 17:45	39.02
R170	2.05356	1.6	01Jan2000, 21:30	49.67
W360	0.7978	0.2	01Jan2000, 18:15	15.55
W460	0.90416	2.7	01Jan2000, 14:30	74.13
J196	26.43551	15.8	01Jan2000, 17:00	30.65
J213	17.48204	9.3	01Jan2000, 16:15	25
J234	4.622	1.6	01Jan2000, 20:30	23.59
R30	1.54126	1.1	01Jan2000, 15:30	25.85
J237	5.74251	3.3	01Jan2000, 16:15	22.35
J216	2.05356	1.6	01Jan2000, 20:15	50.04
W450	0.66979	0.6	01Jan2000, 15:00	28.38
R180	17.48204	9.3	01Jan2000, 17:00	24.94

W550	1.4031	1.3	01Jan2000, 15:00	30.28
W430	1.2595	1.1	01Jan2000, 21:00	56.99
W530	0.040626	0	01Jan2000, 12:30	14.46
W410	1.1819	0.3	01Jan2000, 16:30	10.97
W510	1.5848	4.4	01Jan2000, 13:45	53.36

R100	4.622	1.6	01Jan2000, 20:45	23.55
W390	0.62726	0.9	01Jan2000, 14:15	37.51
R120	5.74251	3.3	01Jan2000, 16:45	22.35
W490	0.96854	0.8	01Jan2000, 15:30	30.92
W370	0.74346	1.1	01Jan2000, 14:45	36.87
W470	0.62659	1.9	01Jan2000, 13:45	55.95
W350	3.408	0.6	01Jan2000, 17:45	9.89
R260	26.43551	15.8	01Jan2000, 17:45	30.58
W520	2.6987	4.3	01Jan2000, 16:15	62.48
J189	3.23757	4.6	01Jan2000, 16:15	58.45
W590	0.53887	0.4	01Jan2000, 18:15	38.26
R280	3.23757	4.4	01Jan2000, 19:00	58.14
W580	2.3309	4.7	01Jan2000, 13:30	39.06
W600	1.9995	3	01Jan2000, 16:45	63.45
J186	7.56797	8.3	01Jan2000, 18:00	53.67
R270	7.56797	8.3	01Jan2000, 18:15	53.66
W610	0.43645	0.6	01Jan2000, 15:00	44.76
W570	2.43	4.2	01Jan2000, 15:30	61.78
J183	36.86993	27.7	01Jan2000, 17:30	37.54
W640	0.72932	0.6	01Jan2000, 15:45	29.04
J176	38.21733	28.8	01Jan2000, 18:00	37.49
W670	0.309904	0.3	01Jan2000, 16:45	46.28
W630	0.308175	0.4	01Jan2000, 16:15	48.82
J180	37.1781	28.1	01Jan2000, 17:45	37.61
R320	38.21733	28.8	01Jan2000, 18:00	37.49
W620	1.1093	1.5	01Jan2000, 18:30	71.5
W650	0.020214	0.1	01Jan2000, 12:15	46.07
J173	39.34684	30.2	01Jan2000, 18:00	38.45
R330	39.34684	30.2	01Jan2000, 18:15	38.38
W660	0.43119	1.3	01Jan2000, 14:15	69.31
Outlet1	39.77803	30.7	01Jan2000, 17:45	38.71
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

10-Year 6-Hour SCS Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	23.6	01Jan2000, 08:15	25.46
R310	37.1781	24	01Jan2000, 08:15	25.52
J221	15.88691	6.6	01Jan2000, 07:15	15.03
J224	3.66235	1.9	01Jan2000, 06:45	13.14
J244	1.54126	0.9	01Jan2000, 06:00	14.66
J201	4.81074	3	01Jan2000, 10:00	32.97
R80	3.66235	1.9	01Jan2000, 07:45	13.14
J204	23.91821	12.1	01Jan2000, 07:45	20.78
J227	8.4966	1.8	01Jan2000, 09:30	11.89
R190	4.81074	3	01Jan2000, 10:15	32.97
W340	3.4401	1.1	01Jan2000, 11:30	17.93
W560	1.1142	0.7	01Jan2000, 05:45	13.99
W440	0.4666	0.5	01Jan2000, 05:00	15.2
W540	0.97038	0.3	01Jan2000, 11:15	16.5
W420	0.74364	0.6	01Jan2000, 06:00	17.3
W400	1.4529	0.4	01Jan2000, 07:45	7.98
W500	1.7868	1.5	01Jan2000, 09:15	37.15
R110	8.4966	1.8	01Jan2000, 10:00	11.88
R210	23.91821	12.1	01Jan2000, 08:00	20.77
W380	1.4513	0.5	01Jan2000, 07:15	9.61
R150	15.88691	6.6	01Jan2000, 07:30	15.03
W480	0.79406	0.6	01Jan2000, 08:45	29.56
R170	2.05356	1.3	01Jan2000, 11:45	37.11
W360	0.7978	0.1	01Jan2000, 09:00	7.21
W460	0.90416	2.6	01Jan2000, 05:30	54.57
J196	26.43551	13.6	01Jan2000, 07:15	20.39
J213	17.48204	8.1	01Jan2000, 07:15	16.11
J234	4.622	1.2	01Jan2000, 11:00	14.87
R30	1.54126	0.9	01Jan2000, 06:45	14.69
J237	5.74251	2.8	01Jan2000, 07:15	13.17
J216	2.05356	1.3	01Jan2000, 10:45	37.19
W450	0.66979	0.5	01Jan2000, 06:15	17.23

R180	17.48204	8.1	01Jan2000, 08:00	16.1
W550	1.4031	1.1	01Jan2000, 06:15	18.87
W430	1.2595	0.9	01Jan2000, 11:45	42
W530	0.040626	0	01Jan2000, 03:30	7.95
W410	1.1819	0.2	01Jan2000, 07:30	5.99
W510	1.5848	3.9	01Jan2000, 05:00	35.82
R100	4.622	1.2	01Jan2000, 11:15	14.87
W390	0.62726	0.8	01Jan2000, 05:15	25.4
R120	5.74251	2.8	01Jan2000, 07:45	13.18
W490	0.96854	0.7	01Jan2000, 06:45	19.6
W370	0.74346	0.9	01Jan2000, 06:00	22.66
W470	0.62659	1.7	01Jan2000, 05:00	38.06
W350	3.408	0.6	01Jan2000, 08:45	7.39
R260	26.43551	13.6	01Jan2000, 08:00	20.38
W520	2.6987	3.8	01Jan2000, 07:30	43.93
J189	3.23757	4.1	01Jan2000, 07:30	41.1
W590	0.53887	0.3	01Jan2000, 09:15	26.94
R280	3.23757	3.9	01Jan2000, 10:00	40.88
W580	2.3309	4	01Jan2000, 04:45	24.82
W600	1.9995	2.7	01Jan2000, 07:45	44.94
J186	7.56797	6.7	01Jan2000, 09:15	37.01
R270	7.56797	6.7	01Jan2000, 09:15	37.01
W610	0.43645	0.6	01Jan2000, 06:00	31.86
W570	2.43	3.9	01Jan2000, 06:45	43.76
J183	36.86993	23.7	01Jan2000, 07:45	25.47
W640	0.72932	0.5	01Jan2000, 07:00	19.94
J176	38.21733	24.7	01Jan2000, 08:15	25.47
W670	0.309904	0.3	01Jan2000, 07:45	31.92
W630	0.308175	0.3	01Jan2000, 07:15	33.57
J180	37.1781	24	01Jan2000, 08:00	25.53
R320	38.21733	24.7	01Jan2000, 08:15	25.47
W620	1.1093	1.3	01Jan2000, 09:30	53.41
W650	0.020214	0.1	01Jan2000, 03:30	30.48
J173	39.34684	25.9	01Jan2000, 08:15	26.26
R330	39.34684	25.8	01Jan2000, 08:45	26.22

W660	0.43119	1.3	01Jan2000, 05:30	50.27
Outlet1	39.77803	26.3	01Jan2000, 08:15	26.48
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

Hydrologic Element	Drainage Area (km^2)	Peak Discharge (m^3/s)	Time of Peak	Volume (mm)
R290	36.86993	29.4	01Jan2000, 12:00	34.61
R310	37.1781	29.7	01Jan2000, 12:00	34.68
J221	15.88691	8.1	01Jan2000, 10:15	21.34

J224	3.66235	2.4	01Jan2000, 09:30	20.04

10-year 12-hour SCS Storm

J244	1.54126	1.2	01Jan2000, 09:00	22.89
J201	4.81074	3.7	01Jan2000, 13:30	43.43
R80	3.66235	2.4	01Jan2000, 10:30	20.04
J204	23.91821	14.9	01Jan2000, 11:00	28.62
J227	8.4966	2.4	01Jan2000, 13:15	16.81
R190	4.81074	3.7	01Jan2000, 13:30	43.42
W340	3.4401	1.5	01Jan2000, 14:30	25.9
W560	1.1142	0.9	01Jan2000, 08:30	21
W440	0.4666	0.7	01Jan2000, 07:45	24.06
W540	0.97038	0.4	01Jan2000, 14:30	22.83
W420	0.74364	0.7	01Jan2000, 09:00	26.41
W400	1.4529	0.5	01Jan2000, 10:45	13.22
W500	1.7868	1.9	01Jan2000, 12:15	49.88
R110	8.4966	2.4	01Jan2000, 13:45	16.79
R210	23.91821	14.9	01Jan2000, 11:15	28.6
W380	1.4513	0.6	01Jan2000, 10:15	14.52
R150	15.88691	8.1	01Jan2000, 10:45	21.33
W480	0.79406	0.6	01Jan2000, 11:45	36.79
R170	2.05356	1.6	01Jan2000, 15:15	47.54
W360	0.7978	0.2	01Jan2000, 12:30	13.34
W460	0.90416	2.9	01Jan2000, 08:30	69.2
J196	26.43551	16.7	01Jan2000, 11:00	28.21
J213	17.48204	9.9	01Jan2000, 10:15	22.77
J234	4.622	1.7	01Jan2000, 14:15	21.71
R30	1.54126	1.2	01Jan2000, 09:30	22.92
J237	5.74251	3.5	01Jan2000, 10:15	19.87
J216	2.05356	1.6	01Jan2000, 14:15	47.71
W450	0.66979	0.6	01Jan2000, 09:15	25.4
R180	17.48204	9.8	01Jan2000, 11:00	22.75
W550	1.4031	1.4	01Jan2000, 09:00	27.23
W430	1.2595	1.1	01Jan2000, 15:00	54.59
W530	0.040626	0.1	01Jan2000, 06:30	12.62

W410	1.1819	0.3	01Jan2000, 10:45	9.51
W510	1.5848	4.6	01Jan2000, 08:00	48.88
R100	4.622	1.7	01Jan2000, 14:45	21.69
W390	0.62726	1	01Jan2000, 08:15	34.32
R120	5.74251	3.5	01Jan2000, 10:45	19.88
W490	0.96854	0.9	01Jan2000, 09:30	27.9
W370	0.74346	1.1	01Jan2000, 08:45	33.14
W470	0.62659	2	01Jan2000, 07:45	51.39
W350	3.408	0.7	01Jan2000, 11:45	9.2
R260	26.43551	16.7	01Jan2000, 11:45	28.19
W520	2.6987	4.5	01Jan2000, 10:15	57.81
J189	3.23757	4.8	01Jan2000, 10:15	54.12
W590	0.53887	0.4	01Jan2000, 12:15	35.62
R280	3.23757	4.6	01Jan2000, 13:00	53.85
W580	2.3309	4.9	01Jan2000, 07:30	35.33
W600	1.9995	3.1	01Jan2000, 10:45	58.83
J186	7.56797	8.8	01Jan2000, 12:00	49.46
R270	7.56797	8.8	01Jan2000, 12:15	49.47
W610	0.43645	0.7	01Jan2000, 09:00	41.4
W570	2.43	4.5	01Jan2000, 09:30	57.19
J183	36.86993	29.4	01Jan2000, 11:45	34.62
W640	0.72932	0.6	01Jan2000, 09:45	26.59
J176	38.21733	30.5	01Jan2000, 12:00	34.59
W670	0.309904	0.3	01Jan2000, 10:45	42.59
W630	0.308175	0.4	01Jan2000, 10:15	44.9
J180	37.1781	29.7	01Jan2000, 12:00	34.69
R320	38.21733	30.5	01Jan2000, 12:00	34.59
W620	1.1093	1.5	01Jan2000, 12:30	67.64
W650	0.020214	0.1	01Jan2000, 06:15	42.03
J173	39.34684	32	01Jan2000, 12:00	35.52
R330	39.34684	31.9	01Jan2000, 12:15	35.47
W660	0.43119	1.4	01Jan2000, 08:15	64.49
Outlet1	39.77803	32.5	01Jan2000, 12:00	35.79
Reservoir-	0	0	01Jan2000, 00:00	n/a

Independent Groce				

10-Year 24-Hour SCS Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	34.7	01Jan2000, 17:30	46.44
R310	37.1781	35.1	01Jan2000, 17:45	46.52
J221	15.88691	9.7	01Jan2000, 16:15	30.09
J224	3.66235	3	01Jan2000, 15:30	29.93
J244	1.54126	1.5	01Jan2000, 14:45	34.32
J201	4.81074	4.3	01Jan2000, 19:30	55.94
R80	3.66235	3	01Jan2000, 16:15	29.9
J204	23.91821	17.7	01Jan2000, 16:45	38.92
J227	8.4966	3	01Jan2000, 20:00	23.69
R190	4.81074	4.3	01Jan2000, 19:30	55.93
W340	3.4401	1.9	01Jan2000, 20:45	36.01
W560	1.1142	1.2	01Jan2000, 14:30	31.09
W440	0.4666	0.9	01Jan2000, 13:45	36.35
W540	0.97038	0.4	01Jan2000, 20:30	31.09
W420	0.74364	1	01Jan2000, 14:45	38.94
W400	1.4529	0.7	01Jan2000, 16:45	21.28
W500	1.7868	2.2	01Jan2000, 18:15	65.43
R110	8.4966	3	01Jan2000, 20:30	23.62
R210	23.91821	17.7	01Jan2000, 17:00	38.86
W380	1.4513	0.8	01Jan2000, 16:15	22.08
R150	15.88691	9.7	01Jan2000, 16:30	30.07
W480	0.79406	0.7	01Jan2000, 17:45	46.13
R170	2.05356	1.9	01Jan2000, 21:30	59.43
W360	0.7978	0.3	01Jan2000, 18:00	22.35
W460	0.90416	3.2	01Jan2000, 14:30	87.23
J196	26.43551	20	01Jan2000, 16:45	38.53
J213	17.48204	11.8	01Jan2000, 16:00	31.95
J234	4.622	2.2	01Jan2000, 20:30	30.75

R30	1.54126	1.5	01Jan2000, 15:30	34.33
J237	5.74251	4.4	01Jan2000, 16:15	29.52
J216	2.05356	1.9	01Jan2000, 20:15	59.88
W450	0.66979	0.8	01Jan2000, 15:00	36.81
R180	17.48204	11.8	01Jan2000, 16:45	31.88
W550	1.4031	1.7	01Jan2000, 15:00	38.83
W430	1.2595	1.3	01Jan2000, 21:00	68.54
W530	0.040626	0.1	01Jan2000, 12:30	19.94
W410	1.1819	0.4	01Jan2000, 16:45	15.43
W510	1.5848	5.5	01Jan2000, 13:45	65.47
R100	4.622	2.2	01Jan2000, 20:45	30.69
W390	0.62726	1.1	01Jan2000, 14:15	46.4
R120	5.74251	4.4	01Jan2000, 16:30	29.52
W490	0.96854	1	01Jan2000, 15:30	39.4
W370	0.74346	1.4	01Jan2000, 14:45	47.15
W470	0.62659	2.3	01Jan2000, 13:45	68.24
W350	3.408	0.8	01Jan2000, 17:45	12.45
R260	26.43551	20	01Jan2000, 17:30	38.43
W520	2.6987	5.1	01Jan2000, 16:15	75.11
J189	3.23757	5.5	01Jan2000, 16:15	70.41
W590	0.53887	0.5	01Jan2000, 18:15	46.84
R280	3.23757	5.3	01Jan2000, 18:45	70.05
W580	2.3309	6.1	01Jan2000, 13:30	49.33
W600	1.9995	3.6	01Jan2000, 16:45	76.08
J186	7.56797	10.1	01Jan2000, 17:45	65.26
R270	7.56797	10.1	01Jan2000, 18:00	65.26
W610	0.43645	0.7	01Jan2000, 15:00	54.02
W570	2.43	5.1	01Jan2000, 15:30	74.11
J183	36.86993	34.7	01Jan2000, 17:15	46.47
W640	0.72932	0.7	01Jan2000, 15:45	35.99
J176	38.21733	36	01Jan2000, 17:30	46.4
W670	0.309904	0.4	01Jan2000, 16:45	56.54
W630	0.308175	0.5	01Jan2000, 16:15	59.62
J180	37.1781	35.1	01Jan2000, 17:30	46.54
R320	38.21733	36	01Jan2000, 17:45	46.39

W620	1.1093	1.7	01Jan2000, 18:30	84.27
W650	0.020214	0.2	01Jan2000, 12:15	57.1
J173	39.34684	37.7	01Jan2000, 17:45	47.46
R330	39.34684	37.6	01Jan2000, 18:00	47.38
W660	0.43119	1.6	01Jan2000, 14:15	82.15
Outlet1	39.77803	38.2	01Jan2000, 17:30	47.75
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

25-Year 6-Hour SCS Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	30	01Jan2000, 08:30	31.99
R310	37.1781	30.3	01Jan2000, 08:30	32.06
J221	15.88691	8.6	01Jan2000, 07:15	19.5
J224	3.66235	2.6	01Jan2000, 06:45	17.97
J244	1.54126	1.3	01Jan2000, 06:00	20.45
J201	4.81074	3.7	01Jan2000, 10:00	40.6
R80	3.66235	2.5	01Jan2000, 07:30	17.96
J204	23.91821	15.5	01Jan2000, 07:45	26.39
J227	8.4966	2.3	01Jan2000, 09:45	15.4
R190	4.81074	3.7	01Jan2000, 10:00	40.6
W340	3.4401	1.5	01Jan2000, 11:30	23.71
W560	1.1142	1	01Jan2000, 05:45	18.9
W440	0.4666	0.7	01Jan2000, 05:00	21.43
W540	0.97038	0.4	01Jan2000, 11:15	21.08
W420	0.74364	0.8	01Jan2000, 06:00	23.72
W400	1.4529	0.5	01Jan2000, 07:45	11.61
W500	1.7868	1.9	01Jan2000, 09:15	46.33
R110	8.4966	2.3	01Jan2000, 10:00	15.39
R210	23.91821	15.5	01Jan2000, 08:00	26.38
W380	1.4513	0.7	01Jan2000, 07:15	13.01
R150	15.88691	8.6	01Jan2000, 07:30	19.5
W480	0.79406	0.7	01Jan2000, 08:45	34.7

R170	2.05356	1.6	01Jan2000, 11:45	44.85
W360	0.7978	0.2	01Jan2000, 08:45	11.47
W460	0.90416	3.1	01Jan2000, 05:30	65.06
J196	26.43551	17.4	01Jan2000, 07:45	25.98
J213	17.48204	10.5	01Jan2000, 07:15	20.83
J234	4.622	1.6	01Jan2000, 11:00	19.79
R30	1.54126	1.3	01Jan2000, 06:45	20.48
J237	5.74251	3.8	01Jan2000, 07:15	17.85
J216	2.05356	1.6	01Jan2000, 10:45	44.95
W450	0.66979	0.7	01Jan2000, 06:15	22.97
R180	17.48204	10.5	01Jan2000, 08:00	20.82
W550	1.4031	1.5	01Jan2000, 06:15	24.76
W430	1.2595	1.1	01Jan2000, 11:45	51.41
W530	0.040626	0.1	01Jan2000, 03:45	11.17
W410	1.1819	0.3	01Jan2000, 07:30	8.39
W510	1.5848	4.9	01Jan2000, 05:00	45.14
R100	4.622	1.6	01Jan2000, 11:15	19.78
W390	0.62726	1.1	01Jan2000, 05:15	31.7
R120	5.74251	3.8	01Jan2000, 07:45	17.86
W490	0.96854	0.9	01Jan2000, 06:45	25.44
W370	0.74346	1.2	01Jan2000, 06:00	30.08
W470	0.62659	2.1	01Jan2000, 05:00	47.57
W350	3.408	0.7	01Jan2000, 08:45	8.64
R260	26.43551	17.4	01Jan2000, 08:15	25.96
W520	2.6987	4.7	01Jan2000, 07:30	53.85
J189	3.23757	5	01Jan2000, 07:30	50.41
W590	0.53887	0.4	01Jan2000, 09:15	33.15
R280	3.23757	4.8	01Jan2000, 10:00	50.12
W580	2.3309	5.3	01Jan2000, 04:45	32.27
W600	1.9995	3.3	01Jan2000, 07:45	54.88
J186	7.56797	8.4	01Jan2000, 09:00	45.88
R270	7.56797	8.4	01Jan2000, 09:00	45.88
W610	0.43645	0.7	01Jan2000, 06:15	38.63
W570	2.43	4.8	01Jan2000, 06:45	53.36
J183	36.86993	30	01Jan2000, 08:15	32

W640	0.72932	0.7	01Jan2000, 07:00	24.61
J176	38.21733	31.2	01Jan2000, 08:30	31.98
W670	0.309904	0.4	01Jan2000, 07:45	39.49
W630	0.308175	0.4	01Jan2000, 07:15	41.62
J180	37.1781	30.3	01Jan2000, 08:30	32.07
R320	38.21733	31.2	01Jan2000, 08:30	31.98
W620	1.1093	1.6	01Jan2000, 09:30	63.77
W650	0.020214	0.2	01Jan2000, 03:30	38.69
J173	39.34684	32.7	01Jan2000, 08:45	32.88
R330	39.34684	32.6	01Jan2000, 09:00	32.83
W660	0.43119	1.5	01Jan2000, 05:30	60.45
Outlet1	39.77803	33.1	01Jan2000, 08:30	33.13
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

25-Year 12-Hour SCS Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	37.1	01Jan2000, 11:45	43.41
R310	37.1781	37.6	01Jan2000, 11:45	43.5
J221	15.88691	10.5	01Jan2000, 10:15	27.8
J224	3.66235	3.2	01Jan2000, 09:30	27.12
J244	1.54126	1.6	01Jan2000, 09:00	31.12
J201	4.81074	4.6	01Jan2000, 13:30	53.39
R80	3.66235	3.2	01Jan2000, 10:30	27.09
J204	23.91821	18.9	01Jan2000, 10:45	36.36
J227	8.4966	3.2	01Jan2000, 13:15	22.07
R190	4.81074	4.6	01Jan2000, 13:30	53.39
W340	3.4401	2	01Jan2000, 14:30	33.99
W560	1.1142	1.3	01Jan2000, 08:30	28.18
W440	0.4666	0.9	01Jan2000, 07:45	32.85
W540	0.97038	0.5	01Jan2000, 14:30	29.43
W420	0.74364	1	01Jan2000, 08:45	35.38
W400	1.4529	0.7	01Jan2000, 10:45	18.92
W500	1.7868	2.4	01Jan2000, 12:15	61.71

R110	8.4966	3.2	01Jan2000, 13:45	22.04
R210	23.91821	18.9	01Jan2000, 11:00	36.34
W380	1.4513	0.9	01Jan2000, 10:15	19.86
R150	15.88691	10.5	01Jan2000, 10:30	27.79
W480	0.79406	0.8	01Jan2000, 11:45	43.78
R170	2.05356	2	01Jan2000, 15:15	57.48
W360	0.7978	0.4	01Jan2000, 12:15	19.86
W460	0.90416	3.5	01Jan2000, 08:30	82.27

J196	26.43551	21.4	01Jan2000, 10:45	35.95
J213	17.48204	12.7	01Jan2000, 10:15	29.53
J234	4.622	2.3	01Jan2000, 14:15	28.79
R30	1.54126	1.6	01Jan2000, 09:30	31.16
J237	5.74251	4.7	01Jan2000, 10:15	26.76
J216	2.05356	2	01Jan2000, 14:15	57.69
W450	0.66979	0.8	01Jan2000, 09:00	33.55
R180	17.48204	12.7	01Jan2000, 10:45	29.5
W550	1.4031	1.8	01Jan2000, 09:00	35.52
W430	1.2595	1.4	01Jan2000, 15:00	66.46
W530	0.040626	0.1	01Jan2000, 06:30	17.78
W410	1.1819	0.4	01Jan2000, 10:45	13.66
W510	1.5848	5.8	01Jan2000, 07:45	60.86
R100	4.622	2.3	01Jan2000, 14:30	28.76
W390	0.62726	1.2	01Jan2000, 08:15	42.98
R120	5.74251	4.7	01Jan2000, 10:45	26.76
W490	0.96854	1.1	01Jan2000, 09:30	36.12
W370	0.74346	1.4	01Jan2000, 08:45	43.21
W470	0.62659	2.4	01Jan2000, 07:45	63.57
W350	3.408	0.8	01Jan2000, 11:45	11.51
R260	26.43551	21.4	01Jan2000, 11:30	35.91
W520	2.6987	5.4	01Jan2000, 10:15	70.38
J189	3.23757	5.8	01Jan2000, 10:15	66
W590	0.53887	0.5	01Jan2000, 12:15	44.09
R280	3.23757	5.6	01Jan2000, 12:45	65.67
W580	2.3309	6.4	01Jan2000, 07:30	45.39

W600	1.9995	3.8	01Jan2000, 10:45	71.41
J186	7.56797	10.8	01Jan2000, 12:00	60.94
R270	7.56797	10.8	01Jan2000, 12:00	60.94
W610	0.43645	0.8	01Jan2000, 09:00	50.47
W570	2.43	5.5	01Jan2000, 09:30	69.43
J183	36.86993	37.1	01Jan2000, 11:30	43.43
W640	0.72932	0.8	01Jan2000, 09:45	33.29
J176	38.21733	38.6	01Jan2000, 11:45	43.38
W670	0.309904	0.4	01Jan2000, 10:45	52.68
W630	0.308175	0.5	01Jan2000, 10:15	55.53
J180	37.1781	37.5	01Jan2000, 11:45	43.51
R320	38.21733	38.6	01Jan2000, 11:45	43.37
W620	1.1093	1.8	01Jan2000, 12:30	80.54
W650	0.020214	0.2	01Jan2000, 06:15	52.88
J173	39.34684	40.4	01Jan2000, 11:45	44.43
R330	39.34684	40.2	01Jan2000, 12:00	44.37
W660	0.43119	1.7	01Jan2000, 08:15	77.29
Outlet1	39.77803	40.9	01Jan2000, 11:45	44.73
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

25-Year 24-Hour SCS Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	43.8	01Jan2000, 17:15	58.1
R310	37.1781	44.3	01Jan2000, 17:30	58.19
J221	15.88691	12.7	01Jan2000, 16:15	39.18
J224	3.66235	4	01Jan2000, 15:30	39.94
J244	1.54126	2	01Jan2000, 14:45	45.67
J201	4.81074	5.3	01Jan2000, 19:30	68.63
R80	3.66235	4	01Jan2000, 16:15	39.9
J204	23.91821	22.6	01Jan2000, 16:30	49.39
J227	8.4966	4	01Jan2000, 20:00	31.28
R190	4.81074	5.3	01Jan2000, 19:30	68.61
W340	3.4401	2.4	01Jan2000, 20:30	46.79

W560	1.1142	1.6	01Jan2000, 14:30	41.26
W440	0.4666	1.2	01Jan2000, 13:45	48.41
W540	0.97038	0.6	01Jan2000, 20:30	40.15
W420	0.74364	1.3	01Jan2000, 14:45	51.17
W400	1.4529	1	01Jan2000, 16:30	29.78
W500	1.7868	2.7	01Jan2000, 18:15	80.36
R110	8.4966	4	01Jan2000, 20:30	31.2
R210	23.91821	22.6	01Jan2000, 17:00	49.31
W380	1.4513	1.1	01Jan2000, 16:15	30.09
R150	15.88691	12.7	01Jan2000, 16:30	39.15
W480	0.79406	0.8	01Jan2000, 17:45	55.53
R170	2.05356	2.3	01Jan2000, 21:15	71.88
W360	0.7978	0.5	01Jan2000, 17:45	31.82
W460	0.90416	3.7	01Jan2000, 14:30	103.49
J196	26.43551	25.6	01Jan2000, 16:45	49.02
J213	17.48204	15.4	01Jan2000, 16:00	41.39
J234	4.622	2.9	01Jan2000, 20:30	40.46
R30	1.54126	2	01Jan2000, 15:30	45.68
J237	5.74251	5.9	01Jan2000, 16:15	39.33
J216	2.05356	2.3	01Jan2000, 20:15	72.41
W450	0.66979	1	01Jan2000, 15:00	48.09

R180	17.48204	15.4	01Jan2000, 16:45	41.3
W550	1.4031	2.2	01Jan2000, 15:00	50.24
W430	1.2595	1.6	01Jan2000, 21:00	83.06
W530	0.040626	0.1	01Jan2000, 12:30	27.77
W410	1.1819	0.6	01Jan2000, 16:45	22.03
W510	1.5848	6.8	01Jan2000, 13:45	80.75
R100	4.622	2.9	01Jan2000, 20:45	40.39
W390	0.62726	1.4	01Jan2000, 14:15	58.12
R120	5.74251	5.9	01Jan2000, 16:30	39.32
W490	0.96854	1.4	01Jan2000, 15:30	50.71
W370	0.74346	1.8	01Jan2000, 14:45	60.53
W470	0.62659	2.8	01Jan2000, 13:45	83.71
W350	3.408	1	01Jan2000, 18:00	16.58

R260	26.43551	25.6	01Jan2000, 17:15	48.88
W520	2.6987	6.2	01Jan2000, 16:15	90.92
J189	3.23757	6.7	01Jan2000, 16:15	85.47
W590	0.53887	0.6	01Jan2000, 18:15	58.14
R280	3.23757	6.4	01Jan2000, 18:45	85
W580	2.3309	7.9	01Jan2000, 13:30	62.67
W600	1.9995	4.3	01Jan2000, 16:45	91.88
J186	7.56797	12.5	01Jan2000, 17:45	79.94
R270	7.56797	12.5	01Jan2000, 17:45	79.94
W610	0.43645	0.9	01Jan2000, 15:00	66.09
W570	2.43	6.2	01Jan2000, 15:30	89.6
J183	36.86993	43.8	01Jan2000, 17:15	58.14
W640	0.72932	0.9	01Jan2000, 15:45	45.42
J176	38.21733	45.5	01Jan2000, 17:30	58.04
W670	0.309904	0.5	01Jan2000, 16:45	69.81
W630	0.308175	0.6	01Jan2000, 16:15	73.48
J180	37.1781	44.3	01Jan2000, 17:15	58.23
R320	38.21733	45.5	01Jan2000, 17:30	58.04
W620	1.1093	2	01Jan2000, 18:30	100.15
W650	0.020214	0.2	01Jan2000, 12:15	71.25
J173	39.34684	47.5	01Jan2000, 17:30	59.23
R330	39.34684	47.3	01Jan2000, 17:45	59.13
W660	0.43119	1.9	01Jan2000, 14:15	98.17
Outlet1	39.77803	48.1	01Jan2000, 17:30	59.55
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

50-Year 6-Hour SCS Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	35	01Jan2000, 08:30	37.05
R310	37.1781	35.4	01Jan2000, 08:30	37.13
J221	15.88691	10.1	01Jan2000, 07:15	23.1
J224	3.66235	3.1	01Jan2000, 06:45	21.91
J244	1.54126	1.5	01Jan2000, 06:00	25.07

J201	4.81074	4.3	01Jan2000, 10:00	46.41
R80	3.66235	3.1	01Jan2000, 07:30	21.89
J204	23.91821	18.1	01Jan2000, 07:30	30.79
J227	8.4966	2.7	01Jan2000, 09:45	18.29
R190	4.81074	4.3	01Jan2000, 10:00	46.41
W340	3.4401	1.7	01Jan2000, 11:30	28.3
W560	1.1142	1.2	01Jan2000, 05:45	22.89
W440	0.4666	0.9	01Jan2000, 05:00	26.39
W540	0.97038	0.4	01Jan2000, 11:15	24.78
W420	0.74364	1	01Jan2000, 06:00	28.8
W400	1.4529	0.7	01Jan2000, 07:45	14.7
W500	1.7868	2.2	01Jan2000, 09:15	53.25
R110	8.4966	2.7	01Jan2000, 10:15	18.27
R210	23.91821	18.1	01Jan2000, 08:00	30.78
W380	1.4513	0.8	01Jan2000, 07:15	15.9
R150	15.88691	10.1	01Jan2000, 07:30	23.09
W480	0.79406	0.7	01Jan2000, 08:45	38.69
R170	2.05356	1.8	01Jan2000, 11:45	50.68
W360	0.7978	0.3	01Jan2000, 08:45	15.04
W460	0.90416	3.5	01Jan2000, 05:30	72.78
J196	26.43551	20.5	01Jan2000, 07:30	30.38
J213	17.48204	12.3	01Jan2000, 07:00	24.61
J234	4.622	2	01Jan2000, 11:00	23.77
R30	1.54126	1.5	01Jan2000, 06:45	25.11
J237	5.74251	4.6	01Jan2000, 07:15	21.68
J216	2.05356	1.8	01Jan2000, 10:45	50.79
W450	0.66979	0.8	01Jan2000, 06:15	27.56
R180	17.48204	12.3	01Jan2000, 07:45	24.6
W550	1.4031	1.8	01Jan2000, 06:15	29.43
W430	1.2595	1.2	01Jan2000, 11:45	58.42
W530	0.040626	0.1	01Jan2000, 03:45	13.94
W410	1.1819	0.4	01Jan2000, 07:45	10.56
W510	1.5848	5.7	01Jan2000, 05:00	52.13
R100	4.622	2	01Jan2000, 11:15	23.75
W390	0.62726	1.2	01Jan2000, 05:15	36.63

R120	5.74251	4.6	01Jan2000, 07:45	21.68
W490	0.96854	1.1	01Jan2000, 06:45	30.08
W370	0.74346	1.4	01Jan2000, 06:00	35.84
W470	0.62659	2.4	01Jan2000, 05:00	54.7
W350	3.408	0.8	01Jan2000, 08:45	9.77
R260	26.43551	20.5	01Jan2000, 08:15	30.36
W520	2.6987	5.3	01Jan2000, 07:15	61.24
J189	3.23757	5.7	01Jan2000, 07:30	57.37
W590	0.53887	0.5	01Jan2000, 09:15	37.99
R280	3.23757	5.4	01Jan2000, 10:00	57.04
W580	2.3309	6.3	01Jan2000, 04:45	38.03
W600	1.9995	3.7	01Jan2000, 07:45	62.26
J186	7.56797	9.6	01Jan2000, 08:45	52.56
R270	7.56797	9.6	01Jan2000, 09:00	52.56
W610	0.43645	0.8	01Jan2000, 06:15	43.83
W570	2.43	5.4	01Jan2000, 06:45	60.52
J183	36.86993	35	01Jan2000, 08:15	37.06
W640	0.72932	0.8	01Jan2000, 07:00	28.36
J176	38.21733	36.4	01Jan2000, 08:30	37.03
W670	0.309904	0.4	01Jan2000, 07:45	45.3
W630	0.308175	0.5	01Jan2000, 07:15	47.76
J180	37.1781	35.4	01Jan2000, 08:30	37.14
R320	38.21733	36.4	01Jan2000, 08:30	37.03
W620	1.1093	1.8	01Jan2000, 09:30	71.41
W650	0.020214	0.2	01Jan2000, 03:30	44.96
J173	39.34684	38.1	01Jan2000, 08:30	38
R330	39.34684	37.9	01Jan2000, 08:45	37.94
W660	0.43119	1.7	01Jan2000, 05:30	67.99
Outlet1	39.77803	38.6	01Jan2000, 08:30	38.27
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	43.1	01Jan2000, 11:30	50.16
R310	37.1781	43.6	01Jan2000, 11:45	50.26
J221	15.88691	12.4	01Jan2000, 10:15	32.94

J224	3.66235	3.9	01Jan2000, 09:30	32.74

50-Year 12-Hour SCS Storm

J244	1.54126	1.9	01Jan2000, 08:45	37.56
J201	4.81074	5.2	01Jan2000, 13:30	60.89
R80	3.66235	3.8	01Jan2000, 10:15	32.71
J204	23.91821	22.1	01Jan2000, 10:45	42.38
J227	8.4966	3.8	01Jan2000, 13:15	26.35
R190	4.81074	5.2	01Jan2000, 13:30	60.89
W340	3.4401	2.3	01Jan2000, 14:30	40.29
W560	1.1142	1.5	01Jan2000, 08:30	33.88
W440	0.4666	1.2	01Jan2000, 07:45	39.69
W540	0.97038	0.6	01Jan2000, 14:30	34.66
W420	0.74364	1.2	01Jan2000, 08:45	42.33
W400	1.4529	0.9	01Jan2000, 10:45	23.6
W500	1.7868	2.7	01Jan2000, 12:15	70.51
R110	8.4966	3.8	01Jan2000, 14:00	26.32
R210	23.91821	22.1	01Jan2000, 11:00	42.35
W380	1.4513	1	01Jan2000, 10:15	24.25
R150	15.88691	12.4	01Jan2000, 10:30	32.93
W480	0.79406	0.9	01Jan2000, 11:45	49.17
R170	2.05356	2.2	01Jan2000, 15:15	64.92
W360	0.7978	0.5	01Jan2000, 12:00	25.15
W460	0.90416	3.9	01Jan2000, 08:30	91.84
J196	26.43551	25	01Jan2000, 10:45	41.97
J213	17.48204	15	01Jan2000, 10:00	34.89
J234	4.622	2.8	01Jan2000, 14:15	34.39
R30	1.54126	1.9	01Jan2000, 09:30	37.61
J237	5.74251	5.7	01Jan2000, 10:15	32.26
J216	2.05356	2.2	01Jan2000, 14:15	65.16
W450	0.66979	1	01Jan2000, 09:00	39.93
R180	17.48204	15	01Jan2000, 10:45	34.85
W550	1.4031	2.2	01Jan2000, 09:00	41.99
W430	1.2595	1.5	01Jan2000, 15:00	75.24

W530	0.040626	0.1	01Jan2000, 06:30	22.06
W410	1.1819	0.6	01Jan2000, 10:45	17.2
W510	1.5848	6.7	01Jan2000, 07:45	69.78
R100	4.622	2.8	01Jan2000, 14:30	34.36
W390	0.62726	1.4	01Jan2000, 08:15	49.66
R120	5.74251	5.7	01Jan2000, 10:30	32.26
W490	0.96854	1.3	01Jan2000, 09:30	42.53
W370	0.74346	1.7	01Jan2000, 08:45	50.88
W470	0.62659	2.8	01Jan2000, 07:45	72.6
W350	3.408	1	01Jan2000, 12:00	13.66
R260	26.43551	25	01Jan2000, 11:30	41.93
W520	2.6987	6.2	01Jan2000, 10:15	79.64
J189	3.23757	6.6	01Jan2000, 10:15	74.81
W590	0.53887	0.6	01Jan2000, 12:15	50.62
R280	3.23757	6.3	01Jan2000, 12:45	74.42
W580	2.3309	7.6	01Jan2000, 07:30	53.05
W600	1.9995	4.3	01Jan2000, 10:45	80.67
J186	7.56797	12.4	01Jan2000, 11:45	69.49
R270	7.56797	12.4	01Jan2000, 12:00	69.49
W610	0.43645	0.9	01Jan2000, 09:00	57.39
W570	2.43	6.2	01Jan2000, 09:30	78.49
J183	36.86993	43.1	01Jan2000, 11:15	50.18
W640	0.72932	0.9	01Jan2000, 10:00	38.58
J176	38.21733	44.8	01Jan2000, 11:30	50.12
W670	0.309904	0.5	01Jan2000, 10:45	60.32
W630	0.308175	0.6	01Jan2000, 10:15	63.54
J180	37.1781	43.6	01Jan2000, 11:30	50.27
R320	38.21733	44.8	01Jan2000, 11:45	50.12
W620	1.1093	2	01Jan2000, 12:30	90
W650	0.020214	0.2	01Jan2000, 06:15	61.07
J173	39.34684	46.8	01Jan2000, 11:45	51.25
R330	39.34684	46.6	01Jan2000, 12:00	51.18
W660	0.43119	1.9	01Jan2000, 08:15	86.69
Outlet1	39.77803	47.4	01Jan2000, 11:30	51.56

Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

50-Year 24-Hour SCS Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	50.7	01Jan2000, 17:15	66.95
R310	37.1781	51.3	01Jan2000, 17:15	67.05
J221	15.88691	15	01Jan2000, 16:15	46.28
J224	3.66235	4.9	01Jan2000, 15:30	47.74
J244	1.54126	2.4	01Jan2000, 14:45	54.38
J201	4.81074	6	01Jan2000, 19:30	78.08
R80	3.66235	4.8	01Jan2000, 16:15	47.68
J204	23.91821	26.3	01Jan2000, 16:30	57.39
J227	8.4966	4.8	01Jan2000, 20:00	37.32
R190	4.81074	6	01Jan2000, 19:30	78.07
W340	3.4401	2.9	01Jan2000, 20:30	55.06
W560	1.1142	1.9	01Jan2000, 14:30	49.18
W440	0.4666	1.5	01Jan2000, 13:45	57.61
W540	0.97038	0.7	01Jan2000, 20:30	47.21
W420	0.74364	1.6	01Jan2000, 14:45	60.48
W400	1.4529	1.2	01Jan2000, 16:30	36.56
W500	1.7868	3.1	01Jan2000, 18:15	91.36
R110	8.4966	4.8	01Jan2000, 20:30	37.22
R210	23.91821	26.3	01Jan2000, 16:45	57.31
W380	1.4513	1.3	01Jan2000, 16:15	36.51
R150	15.88691	14.9	01Jan2000, 16:30	46.24
W480	0.79406	0.9	01Jan2000, 17:45	62.72
R170	2.05356	2.6	01Jan2000, 21:15	81.12
W360	0.7978	0.6	01Jan2000, 17:45	39.28
W460	0.90416	4.1	01Jan2000, 14:30	115.32
J196	26.43551	29.9	01Jan2000, 16:30	57.05
J213	17.48204	18	01Jan2000, 16:00	48.72
J234	4.622	3.5	01Jan2000, 20:30	48

R30	1.54126	2.4	01Jan2000, 15:30	54.4
J237	5.74251	7.1	01Jan2000, 16:00	46.98
J216	2.05356	2.6	01Jan2000, 20:15	81.73
W450	0.66979	1.2	01Jan2000, 15:00	56.75
R180	17.48204	18	01Jan2000, 16:30	48.62
W550	1.4031	2.7	01Jan2000, 15:00	58.98
W430	1.2595	1.8	01Jan2000, 21:00	93.71
W530	0.040626	0.1	01Jan2000, 12:30	34.08
W410	1.1819	0.7	01Jan2000, 16:45	27.47
W510	1.5848	7.7	01Jan2000, 13:45	92
R100	4.622	3.4	01Jan2000, 20:45	47.92
W390	0.62726	1.7	01Jan2000, 14:15	67.03
R120	5.74251	7.1	01Jan2000, 16:30	46.97
W490	0.96854	1.6	01Jan2000, 15:30	59.38
W370	0.74346	2.1	01Jan2000, 14:45	70.58
W470	0.62659	3.2	01Jan2000, 13:45	95.07
W350	3.408	1.2	01Jan2000, 18:00	20.18
R260	26.43551	29.9	01Jan2000, 17:00	56.93
W520	2.6987	7	01Jan2000, 16:15	102.48
J189	3.23757	7.5	01Jan2000, 16:15	96.54
W590	0.53887	0.6	01Jan2000, 18:15	66.74
R280	3.23757	7.2	01Jan2000, 18:30	96.02
W580	2.3309	9.2	01Jan2000, 13:30	72.69
W600	1.9995	4.9	01Jan2000, 16:45	103.43
J186	7.56797	14.2	01Jan2000, 17:30	90.79
R270	7.56797	14.2	01Jan2000, 17:30	90.79
W610	0.43645	1	01Jan2000, 15:00	75.2
W570	2.43	7	01Jan2000, 15:30	100.98
J183	36.86993	50.8	01Jan2000, 17:00	67
W640	0.72932	1	01Jan2000, 16:00	52.75
J176	38.21733	52.8	01Jan2000, 17:15	66.88
W670	0.309904	0.6	01Jan2000, 16:45	79.75
W630	0.308175	0.6	01Jan2000, 16:15	83.82
J180	37.1781	51.3	01Jan2000, 17:15	67.09
R320	38.21733	52.8	01Jan2000, 17:15	66.88

W620	1.1093	2.3	01Jan2000, 18:30	111.71
W650	0.020214	0.3	01Jan2000, 12:15	81.79
J173	39.34684	54.9	01Jan2000, 17:15	68.15
R330	39.34684	54.7	01Jan2000, 17:30	68.03
W660	0.43119	2.1	01Jan2000, 14:15	109.86
Outlet1	39.77803	55.7	01Jan2000, 17:15	68.49
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

100-Year 6-Hour SCS Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	40.1	01Jan2000, 08:15	42.25
R310	37.1781	40.6	01Jan2000, 08:30	42.34
J221	15.88691	11.8	01Jan2000, 07:15	26.93
J224	3.66235	3.7	01Jan2000, 06:45	26.09
J244	1.54126	1.8	01Jan2000, 06:00	29.93
J201	4.81074	4.8	01Jan2000, 10:00	52.3
R80	3.66235	3.6	01Jan2000, 07:30	26.05
J204	23.91821	20.8	01Jan2000, 07:30	35.37
J227	8.4966	3.2	01Jan2000, 09:45	21.42
R190	4.81074	4.8	01Jan2000, 10:00	52.29
W340	3.4401	2	01Jan2000, 11:30	33.11
W560	1.1142	1.5	01Jan2000, 05:45	27.13
W440	0.4666	1.1	01Jan2000, 05:00	31.57
W540	0.97038	0.5	01Jan2000, 11:30	28.71
W420	0.74364	1.2	01Jan2000, 06:00	34.08
W400	1.4529	0.8	01Jan2000, 07:45	18.07
W500	1.7868	2.5	01Jan2000, 09:15	60.2
R110	8.4966	3.2	01Jan2000, 10:15	21.4
R210	23.91821	20.8	01Jan2000, 07:45	35.36
W380	1.4513	1	01Jan2000, 07:15	19.06
R150	15.88691	11.8	01Jan2000, 07:30	26.92
W480	0.79406	0.8	01Jan2000, 08:45	42.81

R170	2.05356	2	01Jan2000, 11:45	56.57
W360	0.7978	0.4	01Jan2000, 08:45	18.9
W460	0.90416	3.9	01Jan2000, 05:30	80.44
J196	26.43551	23.7	01Jan2000, 07:30	34.95
J213	17.48204	14.3	01Jan2000, 07:15	28.62
J234	4.622	2.3	01Jan2000, 11:00	27.97
R30	1.54126	1.8	01Jan2000, 06:45	29.97
J237	5.74251	5.4	01Jan2000, 07:15	25.75
J216	2.05356	2	01Jan2000, 10:45	56.7
W450	0.66979	1	01Jan2000, 06:15	32.36
R180	17.48204	14.3	01Jan2000, 07:45	28.6
W550	1.4031	2.1	01Jan2000, 06:15	34.32
W430	1.2595	1.4	01Jan2000, 11:45	65.45
W530	0.040626	0.1	01Jan2000, 03:45	17
W410	1.1819	0.5	01Jan2000, 07:45	13.02
W510	1.5848	6.5	01Jan2000, 05:00	59.17
R100	4.622	2.3	01Jan2000, 11:15	27.96
W390	0.62726	1.4	01Jan2000, 05:15	41.73
R120	5.74251	5.4	01Jan2000, 07:45	25.75
W490	0.96854	1.3	01Jan2000, 06:45	34.93
W370	0.74346	1.6	01Jan2000, 06:00	41.76
W470	0.62659	2.7	01Jan2000, 05:00	61.85
W350	3.408	0.9	01Jan2000, 08:45	11.15
R260	26.43551	23.6	01Jan2000, 08:15	34.94
W520	2.6987	5.9	01Jan2000, 07:15	68.61
J189	3.23757	6.4	01Jan2000, 07:30	64.34
W590	0.53887	0.5	01Jan2000, 09:15	43
R280	3.23757	6.1	01Jan2000, 09:45	63.94
W580	2.3309	7.3	01Jan2000, 04:45	43.94
W600	1.9995	4.1	01Jan2000, 07:45	69.63
J186	7.56797	10.9	01Jan2000, 08:45	59.29
R270	7.56797	10.9	01Jan2000, 08:45	59.29
W610	0.43645	0.9	01Jan2000, 06:15	49.17
W570	2.43	6.1	01Jan2000, 06:45	67.7
J183	36.86993	40.1	01Jan2000, 08:00	42.26

W640	0.72932	0.9	01Jan2000, 07:00	32.31
J176	38.21733	41.8	01Jan2000, 08:30	42.22
W670	0.309904	0.5	01Jan2000, 07:45	51.23
W630	0.308175	0.5	01Jan2000, 07:15	54.01
J180	37.1781	40.6	01Jan2000, 08:15	42.34
R320	38.21733	41.8	01Jan2000, 08:30	42.22
W620	1.1093	1.9	01Jan2000, 09:30	79
W650	0.020214	0.2	01Jan2000, 03:30	51.34
J173	39.34684	43.6	01Jan2000, 08:30	43.26
R330	39.34684	43.4	01Jan2000, 08:45	43.2
W660	0.43119	1.9	01Jan2000, 05:30	75.49
Outlet1	39.77803	44.1	01Jan2000, 08:15	43.55
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

100-Year 12-Hour SCS Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	49.2	01Jan2000, 11:30	57.02
R310	37.1781	49.7	01Jan2000, 11:30	57.13
J221	15.88691	14.3	01Jan2000, 10:15	38.33
J224	3.66235	4.6	01Jan2000, 09:30	38.62
J244	1.54126	2.2	01Jan2000, 08:45	44.23
J201	4.81074	5.9	01Jan2000, 13:30	68.46
R80	3.66235	4.5	01Jan2000, 10:15	38.57
J204	23.91821	25.3	01Jan2000, 10:30	48.57
J227	8.4966	4.5	01Jan2000, 13:15	30.91
R190	4.81074	5.9	01Jan2000, 13:30	68.46
W340	3.4401	2.7	01Jan2000, 14:30	46.81
W560	1.1142	1.8	01Jan2000, 08:30	39.85
W440	0.4666	1.4	01Jan2000, 07:45	46.74
W540	0.97038	0.7	01Jan2000, 14:30	40.15
W420	0.74364	1.4	01Jan2000, 08:45	49.48
W400	1.4529	1.1	01Jan2000, 10:45	28.6
W500	1.7868	3	01Jan2000, 12:15	79.31

R110	8.4966	4.5	01Jan2000, 13:45	30.87
R210	23.91821	25.3	01Jan2000, 11:00	48.54
W380	1.4513	1.3	01Jan2000, 10:15	28.96
R150	15.88691	14.3	01Jan2000, 10:30	38.31
W480	0.79406	0.9	01Jan2000, 11:45	54.72
R170	2.05356	2.5	01Jan2000, 15:15	72.4
W360	0.7978	0.6	01Jan2000, 12:00	30.74
W460	0.90416	4.2	01Jan2000, 08:30	101.31

J196	26.43551	28.8	01Jan2000, 10:45	48.18
J213	17.48204	17.4	01Jan2000, 10:00	40.47
J234	4.622	3.2	01Jan2000, 14:15	40.23
R30	1.54126	2.2	01Jan2000, 09:30	44.27
J237	5.74251	6.8	01Jan2000, 10:15	38.01
J216	2.05356	2.5	01Jan2000, 14:15	72.67
W450	0.66979	1.2	01Jan2000, 09:00	46.53
R180	17.48204	17.3	01Jan2000, 10:45	40.42
W550	1.4031	2.5	01Jan2000, 09:00	48.66
W430	1.2595	1.7	01Jan2000, 15:00	83.98
W530	0.040626	0.1	01Jan2000, 06:30	26.66
W410	1.1819	0.7	01Jan2000, 10:45	21.1
W510	1.5848	7.5	01Jan2000, 07:45	78.68
R100	4.622	3.2	01Jan2000, 14:30	40.2
W390	0.62726	1.6	01Jan2000, 08:15	56.51
R120	5.74251	6.8	01Jan2000, 10:30	38.01
W490	0.96854	1.5	01Jan2000, 09:30	49.15
W370	0.74346	2	01Jan2000, 08:45	58.7
W470	0.62659	3.1	01Jan2000, 07:45	81.62
W350	3.408	1.1	01Jan2000, 12:00	16.14
R260	26.43551	28.8	01Jan2000, 11:15	48.11
W520	2.6987	6.9	01Jan2000, 10:15	88.85
J189	3.23757	7.4	01Jan2000, 10:15	83.6
W590	0.53887	0.6	01Jan2000, 12:15	57.31
R280	3.23757	7.1	01Jan2000, 12:45	83.19
W580	2.3309	8.8	01Jan2000, 07:30	60.84

W600	1.9995	4.8	01Jan2000, 10:45	89.89
J186	7.56797	14	01Jan2000, 11:45	78.08
R270	7.56797	14	01Jan2000, 11:45	78.08
W610	0.43645	1	01Jan2000, 09:00	64.44
W570	2.43	6.9	01Jan2000, 09:30	87.52
J183	36.86993	49.2	01Jan2000, 11:15	57.05
W640	0.72932	1	01Jan2000, 10:00	44.11
J176	38.21733	51.1	01Jan2000, 11:30	56.97
W670	0.309904	0.6	01Jan2000, 10:45	68.08
W630	0.308175	0.6	01Jan2000, 10:15	71.64
J180	37.1781	49.7	01Jan2000, 11:30	57.14
R320	38.21733	51.1	01Jan2000, 11:30	56.97
W620	1.1093	2.3	01Jan2000, 12:30	99.36
W650	0.020214	0.3	01Jan2000, 06:15	69.33
J173	39.34684	53.3	01Jan2000, 11:30	58.17
R330	39.34684	53.1	01Jan2000, 11:45	58.09
W660	0.43119	2.1	01Jan2000, 08:15	96.02
Outlet1	39.77803	54	01Jan2000, 11:30	58.5
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

100-Year 24-Hour SCS Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	57.7	01Jan2000, 17:00	75.88
R310	37.1781	58.4	01Jan2000, 17:15	75.99
J221	15.88691	17.4	01Jan2000, 16:15	53.63
J224	3.66235	5.7	01Jan2000, 15:30	55.79
J244	1.54126	2.8	01Jan2000, 14:45	63.3
J201	4.81074	6.8	01Jan2000, 19:30	87.59
R80	3.66235	5.6	01Jan2000, 16:15	55.7
J204	23.91821	30	01Jan2000, 16:30	65.59
J227	8.4966	5.7	01Jan2000, 20:00	43.67
R190	4.81074	6.8	01Jan2000, 19:30	87.57
W340	3.4401	3.3	01Jan2000, 20:30	63.52

W560	1.1142	2.3	01Jan2000, 14:30	57.36
W440	0.4666	1.8	01Jan2000, 13:45	66.99
W540	0.97038	0.8	01Jan2000, 20:30	54.52
W420	0.74364	1.8	01Jan2000, 14:45	69.95
W400	1.4529	1.5	01Jan2000, 16:30	43.68
W500	1.7868	3.5	01Jan2000, 18:15	102.31
R110	8.4966	5.7	01Jan2000, 20:15	43.56
R210	23.91821	30	01Jan2000, 17:00	65.49
W380	1.4513	1.6	01Jan2000, 16:15	43.26
R150	15.88691	17.4	01Jan2000, 16:30	53.59
W480	0.79406	1.1	01Jan2000, 17:45	70.09
R170	2.05356	2.9	01Jan2000, 21:15	90.4
W360	0.7978	0.7	01Jan2000, 17:45	47.06
W460	0.90416	4.6	01Jan2000, 14:30	127
J196	26.43551	34.3	01Jan2000, 16:15	65.28
J213	17.48204	20.8	01Jan2000, 16:15	56.3
J234	4.622	4	01Jan2000, 20:15	55.79
R30	1.54126	2.8	01Jan2000, 15:30	63.31
J237	5.74251	8.4	01Jan2000, 16:00	54.89
J216	2.05356	2.9	01Jan2000, 20:15	91.07
W450	0.66979	1.5	01Jan2000, 15:00	65.62

R180	17.48204	20.8	01Jan2000, 16:45	56.19
W550	1.4031	3.1	01Jan2000, 15:00	67.92
W430	1.2595	2	01Jan2000, 21:00	104.29
W530	0.040626	0.2	01Jan2000, 12:30	40.74
W410	1.1819	0.9	01Jan2000, 16:30	33.29
W510	1.5848	8.6	01Jan2000, 13:45	103.19
R100	4.622	4	01Jan2000, 20:30	55.69
W390	0.62726	1.9	01Jan2000, 14:15	76.11
R120	5.74251	8.4	01Jan2000, 16:30	54.87
W490	0.96854	1.9	01Jan2000, 15:30	68.25
W370	0.74346	2.4	01Jan2000, 14:45	80.72
W470	0.62659	3.6	01Jan2000, 13:45	106.35
W350	3.408	1.4	01Jan2000, 18:00	24.17

R260	26.43551	34.3	01Jan2000, 16:45	65.1
W520	2.6987	7.8	01Jan2000, 16:15	113.94
J189	3.23757	8.4	01Jan2000, 16:15	107.54
W590	0.53887	0.7	01Jan2000, 18:15	75.49
R280	3.23757	8.1	01Jan2000, 18:30	107.02
W580	2.3309	10.6	01Jan2000, 13:30	82.8
W600	1.9995	5.4	01Jan2000, 16:45	114.88
J186	7.56797	16	01Jan2000, 17:30	101.64
R270	7.56797	16	01Jan2000, 17:30	101.63
W610	0.43645	1.2	01Jan2000, 15:00	84.43
W570	2.43	7.8	01Jan2000, 15:30	112.27
J183	36.86993	57.7	01Jan2000, 16:45	75.94
W640	0.72932	1.2	01Jan2000, 16:00	60.32
J176	38.21733	60	01Jan2000, 17:15	75.8
W670	0.309904	0.6	01Jan2000, 16:45	89.77
W630	0.308175	0.7	01Jan2000, 16:15	94.2
J180	37.1781	58.4	01Jan2000, 17:00	76.03
R320	38.21733	60	01Jan2000, 17:15	75.79
W620	1.1093	2.5	01Jan2000, 18:30	123.14
W650	0.020214	0.3	01Jan2000, 12:15	92.36
J173	39.34684	62.4	01Jan2000, 17:15	77.14
R330	39.34684	62.1	01Jan2000, 17:30	77.01
W660	0.43119	2.3	01Jan2000, 14:15	121.42
Outlet1	39.77803	63.2	01Jan2000, 17:15	77.49
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

2-Year 4-Hour Chicago Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	10.8	01Jan2000, 07:00	11.54
R310	37.1781	11	01Jan2000, 07:00	11.58
J221	15.88691	2.9	01Jan2000, 05:45	6.44
J224	3.66235	0.7	01Jan2000, 05:30	4.62
J244	1.54126	0.3	01Jan2000, 04:45	3.95

J201	4.81074	1.5	01Jan2000, 08:45	15.93
R80	3.66235	0.7	01Jan2000, 06:45	4.62
J204	23.91821	5.5	01Jan2000, 05:30	9.23
J227	8.4966	0.8	01Jan2000, 07:45	5.14
R190	4.81074	1.5	01Jan2000, 08:45	15.93
W340	3.4401	0.4	01Jan2000, 10:00	6.92
W560	1.1142	0.3	01Jan2000, 04:15	5.3
W440	0.4666	0.1	01Jan2000, 04:30	3.49
W540	0.97038	0.1	01Jan2000, 09:45	8.19
W420	0.74364	0.2	01Jan2000, 05:00	4.99
W400	1.4529	0.1	01Jan2000, 05:45	2.62
W500	1.7868	0.7	01Jan2000, 08:00	16.45
R110	8.4966	0.8	01Jan2000, 08:15	5.14
R210	23.91821	5.5	01Jan2000, 05:45	9.23
W380	1.4513	0.2	01Jan2000, 05:30	4.49
R150	15.88691	2.9	01Jan2000, 06:00	6.44
W480	0.79406	0.3	01Jan2000, 07:15	17.32
R170	2.05356	0.7	01Jan2000, 10:15	19.14
W360	0.7978	0	01Jan2000, 08:15	0.64
W460	0.90416	1.4	01Jan2000, 04:15	29.1
J196	26.43551	6.2	01Jan2000, 05:45	8.98
J213	17.48204	3.6	01Jan2000, 05:15	6.9
J234	4.622	0.5	01Jan2000, 09:30	5.91
R30	1.54126	0.3	01Jan2000, 05:30	3.96
J237	5.74251	1.1	01Jan2000, 06:15	4.97
J216	2.05356	0.7	01Jan2000, 09:00	19.16
W450	0.66979	0.2	01Jan2000, 04:45	6.42
R180	17.48204	3.6	01Jan2000, 05:30	6.9
W550	1.4031	0.5	01Jan2000, 04:45	7.59
W430	1.2595	0.4	01Jan2000, 10:30	20.33
W530	0.040626	0	01Jan2000, 02:00	3.4
W410	1.1819	0.1	01Jan2000, 05:45	2.96
W510	1.5848	1.5	01Jan2000, 03:45	14.81
R100	4.622	0.5	01Jan2000, 09:45	5.91
W390	0.62726	0.4	01Jan2000, 03:45	12.51

R120	5.74251	1.1	01Jan2000, 06:45	4.98
W490	0.96854	0.3	01Jan2000, 05:15	8.32
W370	0.74346	0.3	01Jan2000, 04:45	7.51
W470	0.62659	0.7	01Jan2000, 03:45	16.32
W350	3.408	0.4	01Jan2000, 07:15	4.33
R260	26.43551	6.2	01Jan2000, 06:30	8.98
W520	2.6987	1.8	01Jan2000, 06:00	20.68
J189	3.23757	1.9	01Jan2000, 06:00	19.58
W590	0.53887	0.2	01Jan2000, 07:45	14.08
R280	3.23757	1.9	01Jan2000, 09:15	19.49
W580	2.3309	1.4	01Jan2000, 03:30	9.46
W600	1.9995	1.3	01Jan2000, 06:30	21.64
J186	7.56797	3.1	01Jan2000, 08:00	16.97
R270	7.56797	3.1	01Jan2000, 08:00	16.97
W610	0.43645	0.3	01Jan2000, 04:45	17.3
W570	2.43	2	01Jan2000, 05:15	21.56
J183	36.86993	10.8	01Jan2000, 06:30	11.55
W640	0.72932	0.3	01Jan2000, 05:30	10.95
J176	38.21733	11.4	01Jan2000, 07:00	11.6
W670	0.309904	0.1	01Jan2000, 06:15	15.63
W630	0.308175	0.2	01Jan2000, 05:45	16.04
J180	37.1781	11	01Jan2000, 07:00	11.58
R320	38.21733	11.4	01Jan2000, 07:00	11.6
W620	1.1093	0.7	01Jan2000, 08:00	28.47
W650	0.020214	0	01Jan2000, 02:00	12.8
J173	39.34684	12	01Jan2000, 07:15	12.08
R330	39.34684	12	01Jan2000, 07:30	12.06
W660	0.43119	0.7	01Jan2000, 04:00	25.99
Outlet1	39.77803	12.2	01Jan2000, 07:15	12.21
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	16.2	01Jan2000, 06:45	17.09
R310	37.1781	16.4	01Jan2000, 06:45	17.14
J221	15.88691	4.3	01Jan2000, 06:00	9.67

J224	3.66235	1.2	01Jan2000, 05:30	7.61

5-Year 4-Hour Chicago Storm

J244	1.54126	0.5	01Jan2000, 04:45	7.83
J201	4.81074	2.1	01Jan2000, 08:45	22.92
R80	3.66235	1.1	01Jan2000, 06:30	7.61
J204	23.91821	8.2	01Jan2000, 05:30	13.76
J227	8.4966	1.2	01Jan2000, 08:00	7.69
R190	4.81074	2.1	01Jan2000, 08:45	22.92
W340	3.4401	0.7	01Jan2000, 10:00	11.02
W560	1.1142	0.4	01Jan2000, 04:30	8.36
W440	0.4666	0.2	01Jan2000, 04:15	7.76
W540	0.97038	0.2	01Jan2000, 09:45	11.21
W420	0.74364	0.3	01Jan2000, 05:00	9.55
W400	1.4529	0.2	01Jan2000, 06:00	4.21
W500	1.7868	1	01Jan2000, 08:00	24.92
R110	8.4966	1.2	01Jan2000, 08:30	7.68
R210	23.91821	8.2	01Jan2000, 05:45	13.75
W380	1.4513	0.3	01Jan2000, 05:45	6.09
R150	15.88691	4.3	01Jan2000, 06:15	9.67
W480	0.79406	0.4	01Jan2000, 07:15	22.58
R170	2.05356	1	01Jan2000, 10:15	26.72
W360	0.7978	0.1	01Jan2000, 08:00	2.68
W460	0.90416	1.9	01Jan2000, 04:15	39.96
J196	26.43551	9.2	01Jan2000, 05:30	13.42
J213	17.48204	5.3	01Jan2000, 05:30	10.38
J234	4.622	0.8	01Jan2000, 09:30	9.19
R30	1.54126	0.5	01Jan2000, 05:30	7.84
J237	5.74251	1.7	01Jan2000, 06:00	7.84
J216	2.05356	1	01Jan2000, 09:15	26.76
W450	0.66979	0.3	01Jan2000, 05:00	10.39
R180	17.48204	5.3	01Jan2000, 06:00	10.38
W550	1.4031	0.7	01Jan2000, 04:45	11.79
W430	1.2595	0.6	01Jan2000, 10:30	29.39
W530	0.040626	0	01Jan2000, 02:00	4.72

W410	1.1819	0.2	01Jan2000, 05:45	3.87
W510	1.5848	2.4	01Jan2000, 03:45	23.41
R100	4.622	0.8	01Jan2000, 10:00	9.19
W390	0.62726	0.6	01Jan2000, 04:00	17.52
R120	5.74251	1.7	01Jan2000, 06:30	7.84
W490	0.96854	0.5	01Jan2000, 05:15	12.54
W370	0.74346	0.5	01Jan2000, 04:45	13.35
W470	0.62659	1.1	01Jan2000, 03:30	25.27
W350	3.408	0.5	01Jan2000, 07:15	5.65
R260	26.43551	9.2	01Jan2000, 06:15	13.42
W520	2.6987	2.7	01Jan2000, 06:00	30.39
J189	3.23757	2.9	01Jan2000, 06:00	28.52
W590	0.53887	0.2	01Jan2000, 07:45	19.13
R280	3.23757	2.7	01Jan2000, 09:00	28.38
W580	2.3309	2.4	01Jan2000, 03:30	15.44
W600	1.9995	1.9	01Jan2000, 06:30	31.39
J186	7.56797	4.5	01Jan2000, 08:15	25.19
R270	7.56797	4.5	01Jan2000, 08:15	25.19
W610	0.43645	0.4	01Jan2000, 04:45	23.15
W570	2.43	2.8	01Jan2000, 05:15	30.78
J183	36.86993	16.2	01Jan2000, 06:30	17.1
W640	0.72932	0.4	01Jan2000, 05:30	14.37
J176	38.21733	17	01Jan2000, 06:45	17.13
W670	0.309904	0.2	01Jan2000, 06:15	22.15
W630	0.308175	0.2	01Jan2000, 05:45	23.1
J180	37.1781	16.4	01Jan2000, 06:45	17.14
R320	38.21733	17	01Jan2000, 06:45	17.13
W620	1.1093	1	01Jan2000, 08:00	39.1
W650	0.020214	0.1	01Jan2000, 02:00	19.85
J173	39.34684	17.8	01Jan2000, 07:00	17.75
R330	39.34684	17.7	01Jan2000, 07:15	17.72
W660	0.43119	0.9	01Jan2000, 04:00	36.24
Outlet1	39.77803	18.1	01Jan2000, 06:45	17.92
Reservoir-	0	0	01Jan2000, 00:00	n/a

Independent Groce				

10-Year 4-Hour Chicago Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	20	01Jan2000, 06:45	21.18
R310	37.1781	20.3	01Jan2000, 06:45	21.23
J221	15.88691	5.4	01Jan2000, 06:00	12.22
J224	3.66235	1.5	01Jan2000, 05:30	10.19
J244	1.54126	0.7	01Jan2000, 04:45	11.05
J201	4.81074	2.6	01Jan2000, 08:45	27.9
R80	3.66235	1.5	01Jan2000, 06:15	10.19
J204	23.91821	10.1	01Jan2000, 05:45	17.17
J227	8.4966	1.5	01Jan2000, 08:15	9.69
R190	4.81074	2.6	01Jan2000, 08:45	27.9
W340	3.4401	0.9	01Jan2000, 10:00	14.33
W560	1.1142	0.6	01Jan2000, 04:30	10.99
W440	0.4666	0.4	01Jan2000, 04:00	11.28
W540	0.97038	0.2	01Jan2000, 09:45	13.72
W420	0.74364	0.4	01Jan2000, 05:00	13.24
W400	1.4529	0.3	01Jan2000, 06:15	5.89
W500	1.7868	1.3	01Jan2000, 07:45	30.96
R110	8.4966	1.5	01Jan2000, 08:30	9.69
R210	23.91821	10.1	01Jan2000, 06:00	17.16
W380	1.4513	0.4	01Jan2000, 05:45	7.67
R150	15.88691	5.4	01Jan2000, 06:15	12.22
W480	0.79406	0.5	01Jan2000, 07:15	26.09
R170	2.05356	1.2	01Jan2000, 10:15	31.95
W360	0.7978	0.1	01Jan2000, 07:45	4.73
W460	0.90416	2.3	01Jan2000, 04:15	47.28
J196	26.43551	11.5	01Jan2000, 05:45	16.8
J213	17.48204	6.7	01Jan2000, 05:45	13.12
J234	4.622	1	01Jan2000, 09:45	11.87
R30	1.54126	0.7	01Jan2000, 05:30	11.07

J237	5.74251	2.2	01Jan2000, 06:00	10.32
J216	2.05356	1.2	01Jan2000, 09:15	32
W450	0.66979	0.4	01Jan2000, 05:00	13.63
R180	17.48204	6.7	01Jan2000, 06:15	13.12
W550	1.4031	0.9	01Jan2000, 04:45	15.16
W430	1.2595	0.8	01Jan2000, 10:30	35.72
W530	0.040626	0	01Jan2000, 02:00	6.14
W410	1.1819	0.2	01Jan2000, 06:00	4.74
W510	1.5848	3.1	01Jan2000, 03:45	29.54
R100	4.622	1	01Jan2000, 10:00	11.87
W390	0.62726	0.7	01Jan2000, 04:00	21.32
R120	5.74251	2.2	01Jan2000, 06:30	10.32
W490	0.96854	0.6	01Jan2000, 05:15	15.91
W370	0.74346	0.7	01Jan2000, 04:45	17.84
W470	0.62659	1.3	01Jan2000, 03:30	31.6
W350	3.408	0.5	01Jan2000, 07:15	6.52
R260	26.43551	11.5	01Jan2000, 06:30	16.79
W520	2.6987	3.2	01Jan2000, 06:00	37.12
J189	3.23757	3.5	01Jan2000, 06:00	34.76
W590	0.53887	0.3	01Jan2000, 07:45	22.92
R280	3.23757	3.3	01Jan2000, 08:45	34.57
W580	2.3309	3.1	01Jan2000, 03:30	19.98
W600	1.9995	2.3	01Jan2000, 06:15	38.13
J186	7.56797	5.6	01Jan2000, 08:00	31.01
R270	7.56797	5.6	01Jan2000, 08:00	31.02
W610	0.43645	0.5	01Jan2000, 04:45	27.41
W570	2.43	3.4	01Jan2000, 05:15	37.22
J183	36.86993	20	01Jan2000, 06:15	21.18
W640	0.72932	0.5	01Jan2000, 05:30	17.01
J176	38.21733	20.9	01Jan2000, 06:45	21.2
W670	0.309904	0.3	01Jan2000, 06:15	26.92
W630	0.308175	0.3	01Jan2000, 06:00	28.23
J180	37.1781	20.3	01Jan2000, 06:45	21.24
R320	38.21733	20.9	01Jan2000, 06:45	21.2
W620	1.1093	1.1	01Jan2000, 08:00	46.29

W650	0.020214	0.1	01Jan2000, 02:00	25.04
J173	39.34684	22	01Jan2000, 07:00	21.91
R330	39.34684	21.8	01Jan2000, 07:15	21.88
W660	0.43119	1.1	01Jan2000, 04:00	43.25
Outlet1	39.77803	22.3	01Jan2000, 06:45	22.11
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

25-Year 4-Hour Chicago Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	24.9	01Jan2000, 06:45	26.65
R310	37.1781	25.2	01Jan2000, 07:00	26.72
J221	15.88691	7.1	01Jan2000, 05:45	15.83
J224	3.66235	2.1	01Jan2000, 05:30	13.98
J244	1.54126	1	01Jan2000, 04:45	15.68
J201	4.81074	3.2	01Jan2000, 08:45	34.41
R80	3.66235	2	01Jan2000, 06:15	13.97
J204	23.91821	12.8	01Jan2000, 06:30	21.8
J227	8.4966	1.9	01Jan2000, 08:15	12.53
R190	4.81074	3.2	01Jan2000, 08:45	34.41
W340	3.4401	1.2	01Jan2000, 10:00	19
W560	1.1142	0.8	01Jan2000, 04:30	14.84
W440	0.4666	0.5	01Jan2000, 03:45	16.29
W540	0.97038	0.3	01Jan2000, 10:00	17.35
W420	0.74364	0.6	01Jan2000, 04:45	18.43
W400	1.4529	0.4	01Jan2000, 06:15	8.59
W500	1.7868	1.6	01Jan2000, 07:45	38.83
R110	8.4966	1.9	01Jan2000, 08:45	12.52
R210	23.91821	12.8	01Jan2000, 06:45	21.8
W380	1.4513	0.5	01Jan2000, 05:45	10.19
R150	15.88691	7.1	01Jan2000, 06:00	15.83
W480	0.79406	0.6	01Jan2000, 07:15	30.48
R170	2.05356	1.4	01Jan2000, 10:30	38.63

W360	0.7978	0.2	01Jan2000, 07:30	7.94
W460	0.90416	2.7	01Jan2000, 04:15	56.49
J196	26.43551	14.4	01Jan2000, 06:00	21.41
J213	17.48204	8.7	01Jan2000, 05:45	16.95
J234	4.622	1.3	01Jan2000, 09:45	15.77
R30	1.54126	1	01Jan2000, 05:30	15.71
J237	5.74251	3	01Jan2000, 06:00	13.98
J216	2.05356	1.4	01Jan2000, 09:15	38.69
W450	0.66979	0.5	01Jan2000, 05:00	18.24
R180	17.48204	8.7	01Jan2000, 06:45	16.94
W550	1.4031	1.2	01Jan2000, 04:45	19.91
W430	1.2595	0.9	01Jan2000, 10:30	43.87
W530	0.040626	0	01Jan2000, 02:00	8.49
W410	1.1819	0.3	01Jan2000, 06:00	6.38
W510	1.5848	4	01Jan2000, 03:45	37.51
R100	4.622	1.3	01Jan2000, 10:00	15.76
W390	0.62726	0.9	01Jan2000, 04:00	26.52
R120	5.74251	3	01Jan2000, 06:30	13.99
W490	0.96854	0.8	01Jan2000, 05:15	20.63
W370	0.74346	0.9	01Jan2000, 04:45	23.98
W470	0.62659	1.7	01Jan2000, 03:30	39.79
W350	3.408	0.6	01Jan2000, 07:15	7.62
R260	26.43551	14.4	01Jan2000, 06:45	21.4
W520	2.6987	4	01Jan2000, 06:00	45.74
J189	3.23757	4.3	01Jan2000, 06:00	42.8
W590	0.53887	0.3	01Jan2000, 07:45	28.06
R280	3.23757	4.1	01Jan2000, 08:45	42.56
W580	2.3309	4.1	01Jan2000, 03:30	26.15
W600	1.9995	2.8	01Jan2000, 06:15	46.76
J186	7.56797	7	01Jan2000, 07:45	38.62
R270	7.56797	7	01Jan2000, 08:00	38.62
W610	0.43645	0.6	01Jan2000, 04:45	33.08
W570	2.43	4.1	01Jan2000, 05:15	45.51
J183	36.86993	24.9	01Jan2000, 06:30	26.66
W640	0.72932	0.6	01Jan2000, 05:30	20.76

J176	38.21733	26	01Jan2000, 06:45	26.66
W670	0.309904	0.3	01Jan2000, 06:15	33.28
W630	0.308175	0.4	01Jan2000, 06:00	35.02
J180	37.1781	25.3	01Jan2000, 06:45	26.72
R320	38.21733	26	01Jan2000, 07:00	26.66
W620	1.1093	1.4	01Jan2000, 08:00	55.37
W650	0.020214	0.1	01Jan2000, 02:00	31.95
J173	39.34684	27.3	01Jan2000, 07:00	27.47
R330	39.34684	27.2	01Jan2000, 07:30	27.43
W660	0.43119	1.3	01Jan2000, 04:00	52.13
Outlet1	39.77803	27.7	01Jan2000, 07:00	27.69
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

50-Year 4-Hour Chicago Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	29.1	01Jan2000, 07:00	30.9
R310	37.1781	29.5	01Jan2000, 07:15	30.97
J221	15.88691	8.4	01Jan2000, 05:45	18.73
J224	3.66235	2.5	01Jan2000, 05:30	17.12
J244	1.54126	1.2	01Jan2000, 04:45	19.43
J201	4.81074	3.6	01Jan2000, 08:45	39.37
R80	3.66235	2.5	01Jan2000, 06:15	17.1
J204	23.91821	15.1	01Jan2000, 06:15	25.45
J227	8.4966	2.2	01Jan2000, 08:15	14.81
R190	4.81074	3.6	01Jan2000, 08:45	39.37
W340	3.4401	1.4	01Jan2000, 10:00	22.76
W560	1.1142	1	01Jan2000, 04:30	18.03
W440	0.4666	0.7	01Jan2000, 03:45	20.34
W540	0.97038	0.4	01Jan2000, 10:00	20.33
W420	0.74364	0.8	01Jan2000, 04:45	22.6
W400	1.4529	0.5	01Jan2000, 06:15	10.95
W500	1.7868	1.9	01Jan2000, 07:45	44.79
R110	8.4966	2.2	01Jan2000, 08:45	14.8

R210	23.91821	15.1	01Jan2000, 06:30	25.44
W380	1.4513	0.7	01Jan2000, 05:45	12.39
R150	15.88691	8.4	01Jan2000, 06:00	18.73
W480	0.79406	0.7	01Jan2000, 07:15	33.81
R170	2.05356	1.6	01Jan2000, 10:30	43.66
W360	0.7978	0.2	01Jan2000, 07:30	10.7

W460	0.90416	3.1	01Jan2000, 04:15	63.3
J196	26.43551	17	01Jan2000, 06:00	25.04
J213	17.48204	10.3	01Jan2000, 05:45	20.02
J234	4.622	1.6	01Jan2000, 09:45	18.97
R30	1.54126	1.2	01Jan2000, 05:30	19.47
J237	5.74251	3.7	01Jan2000, 06:00	17.02
J216	2.05356	1.6	01Jan2000, 09:15	43.73
W450	0.66979	0.7	01Jan2000, 05:00	21.97
R180	17.48204	10.2	01Jan2000, 06:30	20.01
W550	1.4031	1.5	01Jan2000, 04:45	23.73
W430	1.2595	1.1	01Jan2000, 10:30	49.99
W530	0.040626	0	01Jan2000, 02:15	10.58
W410	1.1819	0.3	01Jan2000, 06:15	7.94
W510	1.5848	4.6	01Jan2000, 03:45	43.55
R100	4.622	1.6	01Jan2000, 10:00	18.96
W390	0.62726	1	01Jan2000, 04:00	30.61
R120	5.74251	3.7	01Jan2000, 06:15	17.03
W490	0.96854	0.9	01Jan2000, 05:15	24.42
W370	0.74346	1.1	01Jan2000, 04:30	28.8
W470	0.62659	2	01Jan2000, 03:30	45.96
W350	3.408	0.7	01Jan2000, 07:15	8.43
R260	26.43551	17	01Jan2000, 06:45	25.03
W520	2.6987	4.6	01Jan2000, 06:00	52.18
J189	3.23757	4.9	01Jan2000, 06:00	48.84
W590	0.53887	0.4	01Jan2000, 07:45	32.1
R280	3.23757	4.6	01Jan2000, 08:30	48.56
W580	2.3309	4.9	01Jan2000, 03:30	30.98
W600	1.9995	3.2	01Jan2000, 06:15	53.2

J186	7.56797	8.1	01Jan2000, 07:45	44.37
R270	7.56797	8.1	01Jan2000, 07:45	44.37
W610	0.43645	0.7	01Jan2000, 04:45	37.46
W570	2.43	4.7	01Jan2000, 05:15	51.73
J183	36.86993	29.2	01Jan2000, 06:45	30.91
W640	0.72932	0.6	01Jan2000, 05:30	23.79
J176	38.21733	30.4	01Jan2000, 07:15	30.89
W670	0.309904	0.4	01Jan2000, 06:15	38.2
W630	0.308175	0.4	01Jan2000, 06:00	40.24
J180	37.1781	29.5	01Jan2000, 07:00	30.98
R320	38.21733	30.4	01Jan2000, 07:15	30.89
W620	1.1093	1.5	01Jan2000, 08:00	62.1
W650	0.020214	0.1	01Jan2000, 02:00	37.28
J173	39.34684	31.8	01Jan2000, 07:15	31.77
R330	39.34684	31.7	01Jan2000, 07:30	31.72
W660	0.43119	1.5	01Jan2000, 04:00	58.74
Outlet1	39.77803	32.2	01Jan2000, 07:15	32.02
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

100-Year 4-Hour Chicago Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	33.5	01Jan2000, 07:00	35.26
R310	37.1781	33.9	01Jan2000, 07:15	35.34
J221	15.88691	9.7	01Jan2000, 05:45	21.82
J224	3.66235	3	01Jan2000, 05:30	20.49
J244	1.54126	1.5	01Jan2000, 04:45	23.41
J201	4.81074	4.1	01Jan2000, 08:45	44.42
R80	3.66235	2.9	01Jan2000, 06:15	20.46
J204	23.91821	17.4	01Jan2000, 06:15	29.24
J227	8.4966	2.6	01Jan2000, 08:30	17.27
R190	4.81074	4.1	01Jan2000, 08:45	44.42
W340	3.4401	1.6	01Jan2000, 10:00	26.73
W560	1.1142	1.2	01Jan2000, 04:30	21.45

W440	0.4666	0.8	01Jan2000, 03:45	24.61
W540	0.97038	0.4	01Jan2000, 10:00	23.51
W420	0.74364	0.9	01Jan2000, 04:45	26.97
W400	1.4529	0.6	01Jan2000, 06:15	13.57
W500	1.7868	2.1	01Jan2000, 07:45	50.81
R110	8.4966	2.6	01Jan2000, 08:45	17.26
R210	23.91821	17.4	01Jan2000, 06:30	29.23
W380	1.4513	0.8	01Jan2000, 06:00	14.84
R150	15.88691	9.7	01Jan2000, 06:00	21.81
W480	0.79406	0.7	01Jan2000, 07:15	37.26
R170	2.05356	1.8	01Jan2000, 10:30	48.75
W360	0.7978	0.3	01Jan2000, 07:30	13.74
W460	0.90416	3.4	01Jan2000, 04:15	70.05
J196	26.43551	19.7	01Jan2000, 06:15	28.83
J213	17.48204	11.9	01Jan2000, 05:45	23.27
J234	4.622	1.9	01Jan2000, 09:30	22.39
R30	1.54126	1.5	01Jan2000, 05:30	23.45
J237	5.74251	4.4	01Jan2000, 06:00	20.29
J216	2.05356	1.8	01Jan2000, 09:15	48.84

W450	0.66979	0.8	01Jan2000, 05:00	25.91
R180	17.48204	11.9	01Jan2000, 06:30	23.25
W550	1.4031	1.7	01Jan2000, 04:45	27.75
W430	1.2595	1.2	01Jan2000, 10:30	56.13
W530	0.040626	0.1	01Jan2000, 02:15	12.93
W410	1.1819	0.4	01Jan2000, 06:15	9.75
W510	1.5848	5.3	01Jan2000, 03:45	49.65
R100	4.622	1.9	01Jan2000, 10:00	22.38
W390	0.62726	1.2	01Jan2000, 04:00	34.86
R120	5.74251	4.4	01Jan2000, 06:15	20.3
W490	0.96854	1	01Jan2000, 05:15	28.41
W370	0.74346	1.3	01Jan2000, 04:30	33.78
W470	0.62659	2.2	01Jan2000, 03:30	52.17
W350	3.408	0.8	01Jan2000, 07:15	9.34
R260	26.43551	19.6	01Jan2000, 06:45	28.8

W520	2.6987	5.1	01Jan2000, 06:00	58.62
J189	3.23757	5.5	01Jan2000, 06:00	54.91
W590	0.53887	0.4	01Jan2000, 07:45	36.28
R280	3.23757	5.2	01Jan2000, 08:30	54.58
W580	2.3309	5.7	01Jan2000, 03:30	35.97
W600	1.9995	3.6	01Jan2000, 06:15	59.65
J186	7.56797	9.2	01Jan2000, 07:30	50.19
R270	7.56797	9.2	01Jan2000, 07:45	50.19
W610	0.43645	0.8	01Jan2000, 04:45	41.97
W570	2.43	5.3	01Jan2000, 05:15	57.99
J183	36.86993	33.6	01Jan2000, 06:45	35.27
W640	0.72932	0.7	01Jan2000, 05:30	27.01
J176	38.21733	34.9	01Jan2000, 07:00	35.25
W670	0.309904	0.4	01Jan2000, 06:15	43.23
W630	0.308175	0.5	01Jan2000, 05:45	45.58
J180	37.1781	33.9	01Jan2000, 07:00	35.34
R320	38.21733	34.9	01Jan2000, 07:15	35.25
W620	1.1093	1.7	01Jan2000, 08:00	68.78
W650	0.020214	0.2	01Jan2000, 02:00	42.72
J173	39.34684	36.5	01Jan2000, 07:15	36.19
R330	39.34684	36.4	01Jan2000, 07:30	36.14
W660	0.43119	1.7	01Jan2000, 04:00	65.33
Outlet1	39.77803	37	01Jan2000, 07:00	36.45
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

100-Year 2-Hour Chicago Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	24.7	01Jan2000, 05:30	25.75
R310	37.1781	25	01Jan2000, 05:45	25.82
J221	15.88691	7	01Jan2000, 04:45	15.22
J224	3.66235	2.2	01Jan2000, 04:15	13.33
J244	1.54126	1.1	01Jan2000, 03:45	14.89
J201	4.81074	3.1	01Jan2000, 07:45	33.37

R80	3.66235	2.1	01Jan2000, 05:15	13.31
J204	23.91821	12.7	01Jan2000, 04:45	21.04
J227	8.4966	1.9	01Jan2000, 07:15	12.06
R190	4.81074	3.1	01Jan2000, 07:45	33.37
W340	3.4401	1.1	01Jan2000, 09:15	18.24
W560	1.1142	0.9	01Jan2000, 03:30	14.18
W440	0.4666	0.6	01Jan2000, 02:45	15.44
W540	0.97038	0.3	01Jan2000, 09:00	16.75
W420	0.74364	0.7	01Jan2000, 03:45	17.56
W400	1.4529	0.4	01Jan2000, 05:15	8.11
W500	1.7868	1.6	01Jan2000, 07:00	37.54
R110	8.4966	1.9	01Jan2000, 07:30	12.05
R210	23.91821	12.7	01Jan2000, 05:15	21.04
W380	1.4513	0.6	01Jan2000, 05:00	9.74
R150	15.88691	7	01Jan2000, 05:00	15.22
W480	0.79406	0.6	01Jan2000, 06:30	29.77
R170	2.05356	1.4	01Jan2000, 09:15	37.6
W360	0.7978	0.2	01Jan2000, 06:30	7.37
W460	0.90416	3	01Jan2000, 03:30	55
J196	26.43551	14.4	01Jan2000, 04:45	20.65
J213	17.48204	8.7	01Jan2000, 04:30	16.31
J234	4.622	1.3	01Jan2000, 08:45	15.13
R30	1.54126	1.1	01Jan2000, 04:15	14.93
J237	5.74251	3.1	01Jan2000, 05:00	13.34
J216	2.05356	1.4	01Jan2000, 08:15	37.66
W450	0.66979	0.6	01Jan2000, 04:00	17.46
R180	17.48204	8.7	01Jan2000, 05:30	16.3
W550	1.4031	1.3	01Jan2000, 04:00	19.11
W430	1.2595	0.9	01Jan2000, 09:45	42.63
W530	0.040626	0	01Jan2000, 01:30	8.07
W410	1.1819	0.3	01Jan2000, 05:15	6.07
W510	1.5848	4.5	01Jan2000, 03:00	36.21
R100	4.622	1.3	01Jan2000, 09:00	15.12
W390	0.62726	1	01Jan2000, 03:15	25.65
R120	5.74251	3.1	01Jan2000, 05:30	13.35

W490	0.96854	0.8	01Jan2000, 04:30	19.83
W370	0.74346	1	01Jan2000, 03:45	22.95
W470	0.62659	1.9	01Jan2000, 02:45	38.45
W350	3.408	0.6	01Jan2000, 06:30	7.44
R260	26.43551	14.4	01Jan2000, 05:30	20.65
W520	2.6987	4.1	01Jan2000, 05:15	44.34
J189	3.23757	4.4	01Jan2000, 05:15	41.49
W590	0.53887	0.3	01Jan2000, 07:00	27.21
R280	3.23757	4.1	01Jan2000, 07:45	41.23
W580	2.3309	4.9	01Jan2000, 02:45	25.12
W600	1.9995	2.8	01Jan2000, 05:30	45.35
J186	7.56797	6.9	01Jan2000, 07:00	37.36
R270	7.56797	6.9	01Jan2000, 07:00	37.36
W610	0.43645	0.7	01Jan2000, 04:00	32.14
W570	2.43	4.3	01Jan2000, 04:30	44.16
J183	36.86993	24.7	01Jan2000, 05:15	25.76
W640	0.72932	0.6	01Jan2000, 04:45	20.12
J176	38.21733	25.9	01Jan2000, 05:30	25.76
W670	0.309904	0.3	01Jan2000, 05:30	32.23
W630	0.308175	0.4	01Jan2000, 05:00	33.9
J180	37.1781	25	01Jan2000, 05:30	25.82
R320	38.21733	25.8	01Jan2000, 05:45	25.76
W620	1.1093	1.4	01Jan2000, 07:15	53.93
W650	0.020214	0.1	01Jan2000, 01:15	30.81
J173	39.34684	27.1	01Jan2000, 05:45	26.56
R330	39.34684	26.9	01Jan2000, 06:15	26.51
W660	0.43119	1.5	01Jan2000, 03:15	50.69
Outlet1	39.77803	27.5	01Jan2000, 05:45	26.78
Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a

Timmins Storm

Hydrologic Element	Drainage Area (km2)	Peak Discharge (cms)	Time of Peak	Volume (mm)
R290	36.86993	114.4	01Jan2000, 12:45	146.65

R310	37.1781	115.6	01Jan2000, 13:00	146.75
J221	15.88691	43.5	01Jan2000, 12:45	127.61
J224	3.66235	13	01Jan2000, 11:45	134.08

J244	1.54126	5.5	01Jan2000, 11:30	142.84
J201	4.81074	12.5	01Jan2000, 15:00	155.07
R80	3.66235	13	01Jan2000, 12:15	133.95
J204	23.91821	66.6	01Jan2000, 12:45	137.72
J227	8.4966	17.6	01Jan2000, 13:45	116.42
R190	4.81074	12.5	01Jan2000, 15:00	155.06
W340	3.4401	7.7	01Jan2000, 15:45	140.53
W560	1.1142	4.8	01Jan2000, 10:30	135.81
W440	0.4666	2.6	01Jan2000, 08:45	147.02
W540	0.97038	2	01Jan2000, 15:45	128.95
W420	0.74364	3.3	01Jan2000, 10:30	148.7
W400	1.4529	4.5	01Jan2000, 12:30	123.63
W500	1.7868	5.7	01Jan2000, 13:45	170.22
R110	8.4966	17.6	01Jan2000, 14:15	116.29
R210	23.91821	66.6	01Jan2000, 13:00	137.62
W380	1.4513	4.8	01Jan2000, 12:15	120.49
R150	15.88691	43.5	01Jan2000, 13:00	127.57
W480	0.79406	2.1	01Jan2000, 13:45	132.61
R170	2.05356	5.1	01Jan2000, 16:00	154.24
W360	0.7978	2.2	01Jan2000, 13:30	130.01
W460	0.90416	4.9	01Jan2000, 09:45	183.03
J196	26.43551	75.8	01Jan2000, 12:45	137.92
J213	17.48204	49.4	01Jan2000, 12:30	130.11
J234	4.622	10.5	01Jan2000, 14:45	132.69
R30	1.54126	5.5	01Jan2000, 12:00	142.85
J237	5.74251	20	01Jan2000, 12:00	132.92
J216	2.05356	5.1	01Jan2000, 15:00	154.82
W450	0.66979	2.9	01Jan2000, 10:45	143.38
R180	17.48204	49.4	01Jan2000, 13:00	129.98
W550	1.4031	5.9	01Jan2000, 10:45	144.65
W430	1.2595	3.2	01Jan2000, 16:00	168.82

W530	0.040626	0.3	01Jan2000, 07:15	118.99
W410	1.1819	3.4	01Jan2000, 12:30	109.86
W510	1.5848	9.5	01Jan2000, 09:00	170.88
R100	4.622	10.5	01Jan2000, 14:45	132.58
W390	0.62726	3	01Jan2000, 10:00	148.38
R120	5.74251	20	01Jan2000, 12:30	132.91
W490	0.96854	3.7	01Jan2000, 11:30	144.29
W370	0.74346	3.7	01Jan2000, 10:00	156.61
W470	0.62659	3.8	01Jan2000, 08:45	172.62
W350	3.408	6.4	01Jan2000, 14:00	90.31

R260	26.43551	75.8	01Jan2000, 13:15	137.76
W520	2.6987	10.9	01Jan2000, 12:00	176.61
J189	3.23757	12.3	01Jan2000, 12:15	171.62
W590	0.53887	1.5	01Jan2000, 14:00	146.66
R280	3.23757	12.1	01Jan2000, 14:00	171.23
W580	2.3309	13.4	01Jan2000, 08:30	157.28
W600	1.9995	7.7	01Jan2000, 12:15	177.05
J186	7.56797	27.9	01Jan2000, 12:00	168.47
R270	7.56797	27.9	01Jan2000, 12:00	168.47
W610	0.43645	1.9	01Jan2000, 11:00	152.17
W570	2.43	10.6	01Jan2000, 11:15	175.17
J183	36.86993	114.5	01Jan2000, 12:45	146.7
W640	0.72932	2.6	01Jan2000, 12:00	131.94
J176	38.21733	119.1	01Jan2000, 13:00	146.57
W670	0.309904	1.1	01Jan2000, 12:30	159.52
W630	0.308175	1.2	01Jan2000, 12:00	163.29
J180	37.1781	115.6	01Jan2000, 12:45	146.79
R320	38.21733	119.1	01Jan2000, 13:00	146.56
W620	1.1093	3.6	01Jan2000, 13:45	181.14
W650	0.020214	0.2	01Jan2000, 07:00	163.5
J173	39.34684	122.7	01Jan2000, 13:00	147.55
R330	39.34684	122.3	01Jan2000, 13:00	147.41
W660	0.43119	2.5	01Jan2000, 09:30	180.18
Outlet1	39.77803	124	01Jan2000, 12:45	147.77

Reservoir-Independent Groce	0	0	01Jan2000, 00:00	n/a