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DRAFT Bassett Creek Hydrologic and Hydraulic Analyses

Phase 2 XPSWMM Model Report

Prepared for
Bassett Creek Watershed Management Commission

January 11, 2017

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Certifications

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Minnesota.

	date
Jennifer Koehler, PE	Date
MN PE #: 47500	

Acronyms

Acronym	Description
BCWMC	Bassett Creek Watershed Management Commission
DEM	Digital Elevation Model
FEMA	Federal Emergency Management Agency
FIS	Flood Insurance Study
HEC	Hydrologic Engineering Center
HEC-RAS	Hydrologic Engineering Center River Analysis System
JPA	joint powers agreement
LiDAR	Light Detection and Ranging
MnDOT	Minnesota Department of Transportation
MnDNR	Minnesota Department of Natural Resources
MSL 1912	Mean Sea Level Datum of 1912
NAVD88	North American Vertical Datum of 1988
NCDC	National Climatic Data Center
NEXRAD	Next-Generation Radar
NGIA	National Geospatial Intelligence Agency
NGVD29	National Geodetic Vertical Datum of 1929
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWL	Normal Water Level
NWS	National Weather Service
PCSWMM	Storm Water Management Module (interface by PC Solutions)
SSURGO	Soil Survey Geographic Dataset maintained by the NRCS
TAC	Technical Advisory Committee
TMDL	Total Maximum Daily Load
TP40	Technical Paper 40
USACE	United States Army Corps of Engineers
WOMP	Watershed Outlet Monitoring Program
WMO	Watershed Management Organization
WRMP	Water Resources Management Plan
XPSWMM	Storm Water Management Module (interface by XP Solutions)

Executive Summary

The Bassett Creek Watershed Management Commission (BCWMC) Phase 2 XPSWMM model update incorporated more detailed subwatershed, storage, and storm sewer information for the watershed, including the major ponds and wetlands. The Phase 2 XPSWMM modeling effort included the following items:

- Increasing the number of the subwatersheds for the entire BCWMC watershed from approximately 55 to approximately 1,156 (see Figure 2-1)
- Developing revised watershed hydrology inputs based on more current soils data and impervious coverage information for the Twin Cities area.
- Modeling of storm sewer and outlet structures based on data provided by the member cities and agencies.
- Integrating detailed storage (e.g. ponds and wetlands) within each of the subwatersheds based on recent topographic data.
- Ensuring consistent vertical datum in the model with the entire Phase 2 XPSWMM model updated to be in the NAVD88 vertical datum.
- Developing the model to fully capture and route the Atlas 14 100-year design storm event.
- Performing flow/elevation monitoring at Douglas Drive on the North Branch of Bassett Creek (in 2015).
- Calibrating at several locations including Plymouth Creek, Wisconsin Avenue, the North Branch of Bassett Creek (at Douglas Drive), and at the Watershed Outlet Monitoring Program (WOMP) gage.
- Using the calibrated model to estimate the Atlas 14 100-year flood elevations along the Bassett Creek system and within the contributing watershed.

The Phase 2 XPSWMM model is a tool that can be utilized by the BCWMC, member cities, and other entities to evaluate projects and make informed watershed management decisions. One of the primary applications is evaluating and updating flood management elevations to reflect current and future infrastructure and land use conditions. However, there are a variety of other uses of the BCWMC Phase 2 XPSWMM model, such as assessing the capacity of the existing and proposed storm sewer systems, identifying localized flooding issues in the watershed, verifying and designing outlet and storm sewer modifications, and estimating various flow regimes for stream stabilization and restoration analysis and design projects. Section 1.2.1 further discusses other potential uses of the Phase 2 XPSWMM model, and Section 1.2.2 outlines the model structure and organization. Additionally, the BCWMC may update the XPSWMM model annually to include projects built within the nine member cities.

The BCWMC Phase 2 XPSWMM model was calibrated at flow/elevation monitoring gages at various points within the watershed, including two locations upstream of Medicine Lake (Parkers Lake storm sewer inflow and on Plymouth Creek), two locations on the Main Stem of Bassett Creek (Wisconsin Avenue control structure and the WOMP station), and one location on the North Branch of Bassett Creek (Douglas Drive). Calibration was performed for both a small precipitation event and a large precipitation event. Once calibrated, the model was run for a third validation event that was a precipitation depth

between the small and large event. To evaluate the calibration and validation results, we used several parameters to compare the Phase 2 XPSWMM model performance with the monitoring data. These parameters include the percent error in peak flow and/or peak elevation/flow depth, percent error in volume (if flow monitoring data was available), and the Nash-Sutcliffe efficiency index. The calculated Nash-Sutcliffe efficiency indices and the percent error statistics indicate a good fit for both the small and large calibration events as well as the validation events for the various monitoring stations in the watershed. Also, review of the calibration plots indicate that the XPSWMM model results are closely matching the monitoring data magnitudes and hydrograph shapes for the various storm events. Additional discussion related to the modeling methodology and calibration results can be found in Sections 2.0 and 3.0, respectively, in the report.

The historic 100-year flood elevations reported in the current BCWMC *Watershed Management Plan* were based on the *Technical Paper 40* (TP40) precipitation data which was equivalent to a storm event with 6.0 inches of precipitation falling within a 24-hour period. In 2013, the precipitation depths outlined in the *Atlas 14 Precipitation Frequency Atlas of the United* States (Atlas 14), Volume 8 replaced the TP40 design storm events; the new 100-year (1% chance) storm event is 7.42 inches of precipitation falling within a 24-hour period (~25% increase in the design storm precipitation depth). The final, calibrated XPSWMM model was used to evaluate the Atlas 14 100-year (1% chance) design storm event.

Table 3-7 summarizes the flood elevations and peaks discharges as summarized in the BCWMC Watershed Management Plan, the corresponding flood elevations and peak discharges as estimated by the Phase 2 XPSWMM model, and the difference between the data sources. Figure 3-16 through Figure 3-19 show the expected extents of inundation based on the peak flood elevations from BCWMC Phase 2 XPSWMM model for the Atlas 14 100-year as applied to the 2011 MnDNR LiDAR elevation data. T The inundation mapping was developed using a level pool mapping methodology, based on the modeled peak flood elevation for each subwatershed and the MnDNR LiDAR elevation data. This method is more accurate for lakes, wetlands, and ponds, whereas the inundation extents shown along Plymouth Creek, North Branch Bassett Creek, and Bassett Creek Main Stem are approximate. To more accurately determine the flood inundation along the creeks, the elevations summarized in Table 3-7 should be used.

In general, it would be expected that evaluating the Atlas 14 design storm event across the Bassett Creek watershed would result in increases of the peak flood elevations and discharge rates throughout the watershed due to the larger magnitude of the design storm precipitation depth. However, the Phase 2 XPSWMM model also incorporated significantly more detail, including the refined subwatersheds, the storage available in all of the ponds and wetlands throughout the watershed, and the incorporation of storm sewer systems connecting the ponds and wetlands, compared to the previous modeling efforts for the watershed. As a result, the estimated peak flood elevations and discharge rates for the Atlas 14 design storm event are higher than the values included in the BCWMC Watershed Management Plan in some locations, while in other locations in the watershed, a slight decrease in the peak flood elevations are observed.

The following are some general observations regarding the changes in the 100-year flood elevations and flows from the BCWMC Watershed Management Plan to the Phase 2 XPSWMM modeling (organized by location in the watershed):

Bassett Creek Main Stem

- Flood elevations upstream of the New Tunnel inlet increased significantly (approximately 3.7 ft), as well as along the channel to the Cedar Lake Road Bridge (0.5-2.6 ft increase).
- Flood elevations generally increased upstream of the Freun Mill Dam to Noble Lane, with flood elevations between Golden Valley Road and Noble Lane increasing significantly (2.4 to 4.4 feet)
- Flood elevations near Highway 100 and the confluence with the North Branch of Bassett Creek rose significantly (1.5 to 2.7 feet).
- Flood elevations between Duluth Street and the Golden Valley Country Club increased moderately (between 0.4 and 1.5 feet).
- Flood elevations between the Golden Valley Country Club control structure and Wisconsin Avenue increased significantly (2.0 to 2.5 feet). Flood elevations near Hampshire Avenue increased between 0.5 and 1.0 feet.
- Flood elevations upstream of Wisconsin Avenue, including the Brookview Golf Course, to Medicine Lake are similar to, but slightly lower than, the Bassett Plan water surface elevations (-0.2 to -1.2 feet).

North Branch of Bassett Creek

- Flood elevations between Highway 100 through Bassett Creek Park Pond Park increased significantly (1.8 to 2.3 feet).
- Flows between Brunswick Avenue and 32nd Avenue decreased.
- Flood elevations upstream of the Edgewood Embankment and especially upstream of Winnetka Pond East increased significantly (2.0 to 3.4 feet)
- The flood elevation of Northwood Lake increased by 1.7 feet.

Sweeney Branch

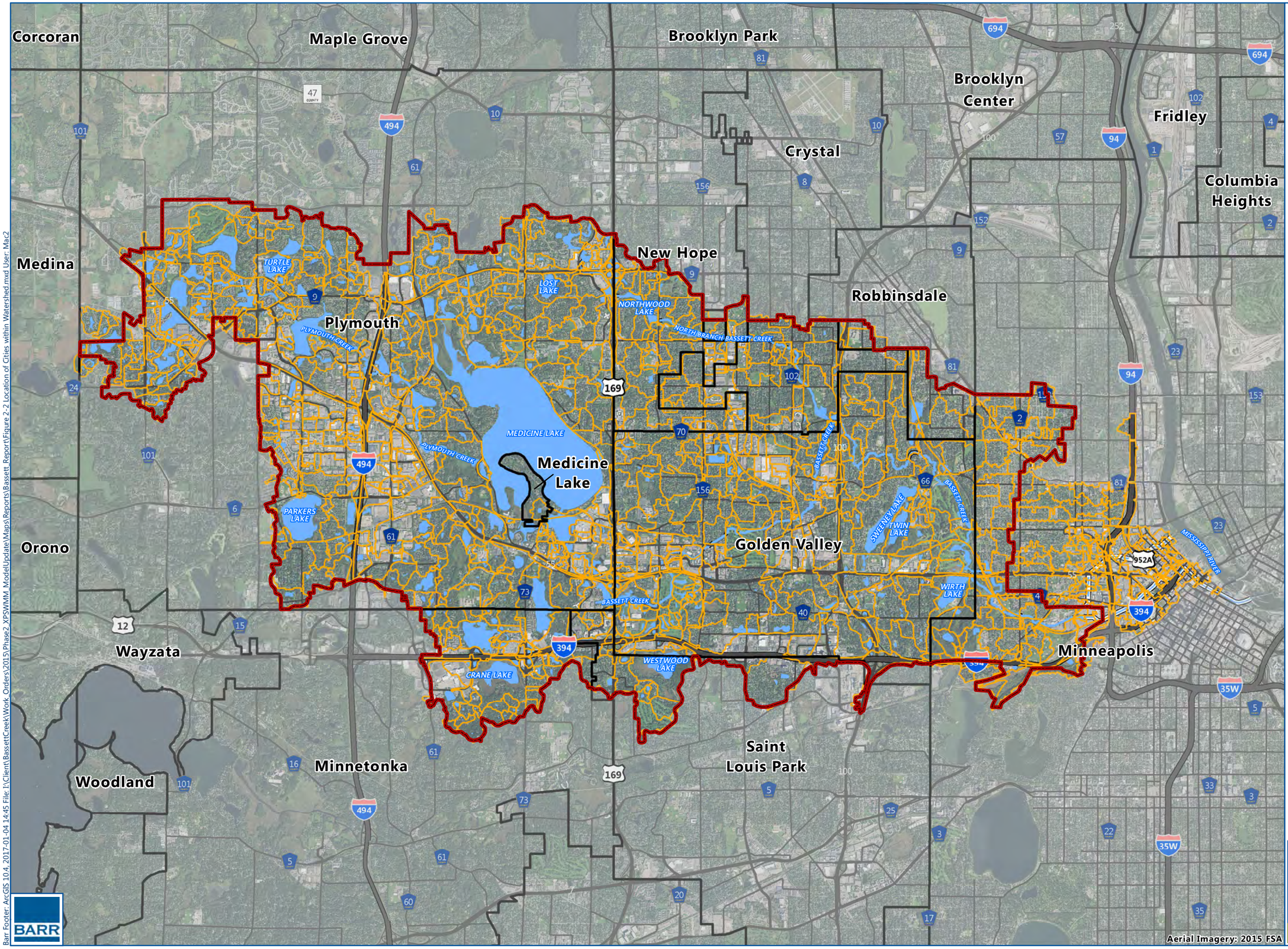
- Flood elevations between the upstream side of Highway 100 to the Ravine Storage Area increased substantially (0.5 to 6.3 feet).
- The flood elevation of Sweeney and Twin Lakes increased by 0.4 feet.

Plymouth Creek/Medicine Lake

- Flood elevations in the Dunkirk flood storage area increased substantially (3.1 to 5.4 feet).
- Flood elevations upstream of County Road 9 (Rockford Road) decreased substantially (-4.1 feet).
- The flood elevation of Medicine Lake decreased slightly (-0.2 feet).
- The Crane Lake flood elevation decreased by 0.5 feet.

Based on a review of the inundation mapping, the LiDAR data, and aerial photos, the new flood elevations and inundation mapping indicate several structures are potentially at-risk of flooding during the Atlas 14

100-year design storm event. Some of the potentially at-risk structures are located along the Bassett Creek Main Stem; however, other potentially at-risk properties are located in upstream portions of the watershed. Topographic surveys of these structures are needed to confirm if these structures are at-risk of flooding.


Corcoran
Maple Grove
Brooklyn Park
Brooklyn Center
Fridley
Columbia Heights
Crystal
Medina
New Hope
Robbinsdale
Plymouth
TURTLE LAKE
LOST LAKE
NORTHWOOD LAKE
NORTH BRANCH BASSETT CREEK
PLYMOUTH CREEK
MEDICINE LAKE
Medicine Lake
PARKERS LAKE
Orono
Golden Valley
SWEENEY LAKE
TWIN LAKE
WIRTH LAKE
BASSETT CREEK
MISSISSIPPI RIVER
Wayzata
CRANE LAKE
WESTWOOD LAKE
Minneapolis
Woodland
Minnetonka
Saint Louis Park
Aerial Imagery: 2015 FSA
Subwatersheds
City Boundaries
Legal Boundary
Bassett Creek Watershed Management Commission
N
0
0.5
1
Miles
LOCATION OF CITIES WITHIN WATERSHED
XPSWMM Phase 2 Model
BCWMC
FIGURE 2-2
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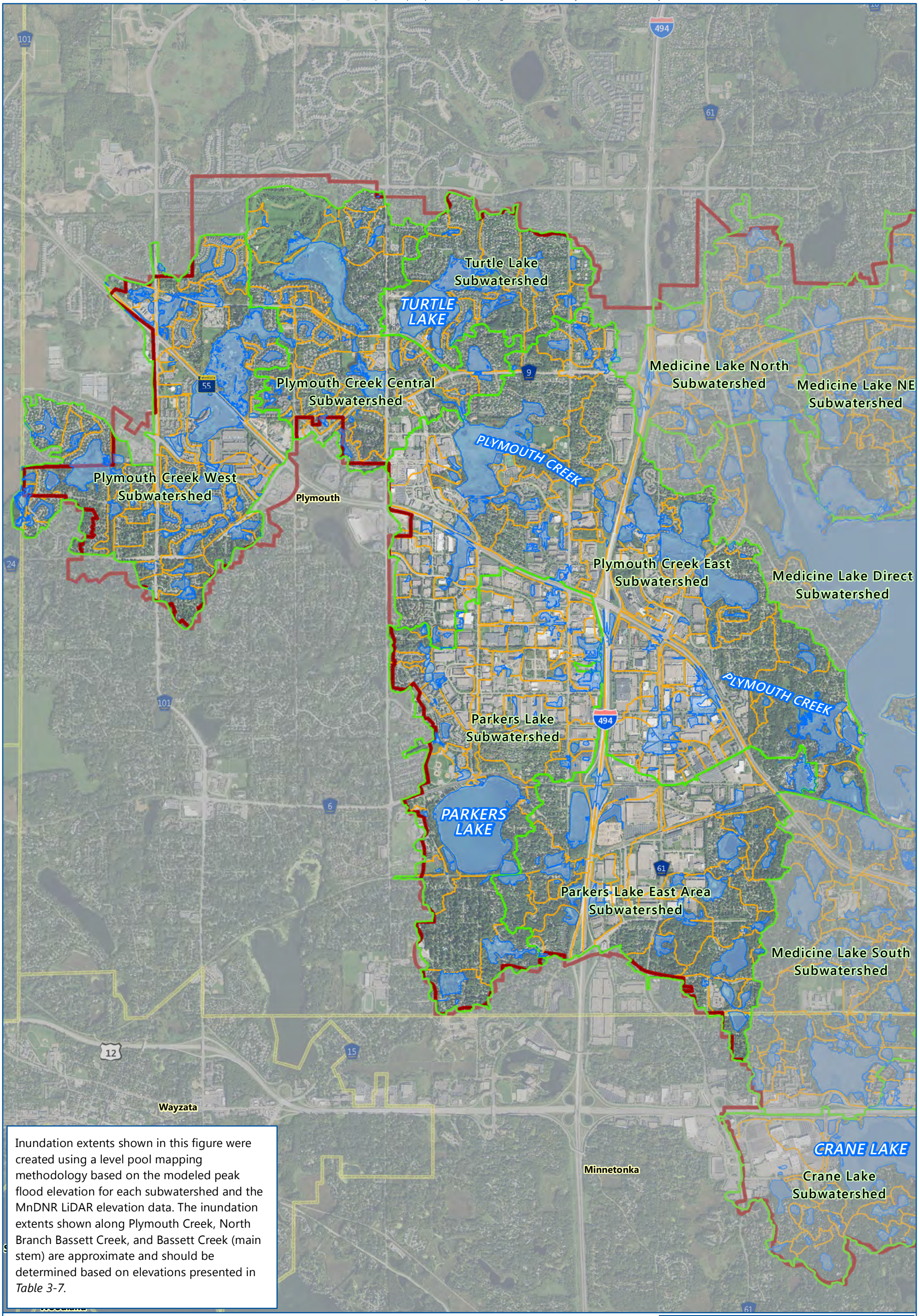
Barr Footer: ArcGIS 10.4, 2017-01-04 14:45 File: I:\Client\BassettCreek\Work_Orders\2015\Phase2_XPSWMM_ModelUpdate\Maps\Reports\Bassett_Report\Figure 2-2 Location of Cities within Watershed.mxd User: Mac2

Barr Footer: ArcGIS 10.4, 2017-01-11 17:07 File: I:\Client\BassettCreek\Work_Orders\2015\Phase2_XPSWMM_ModelUpdate\Maps\Reports\Bassett_Report\Figure 3-16 Atlas 14 100-year Inundation Extents Plymouth creek.mxd User: Mac2



Inundation extents shown in this figure were created using a level pool mapping methodology based on the modeled peak flood elevation for each subwatershed and the MnDNR LiDAR elevation data. The inundation extents shown along Plymouth Creek, North Branch Bassett Creek, and Bassett Creek (main stem) are approximate and should be determined based on elevations presented in *Table 3-7*.

- Atlas 14 100yr Inundation Extents
- Subwatersheds
- Major Subwatersheds
- Legal Boundary
- City Boundaries

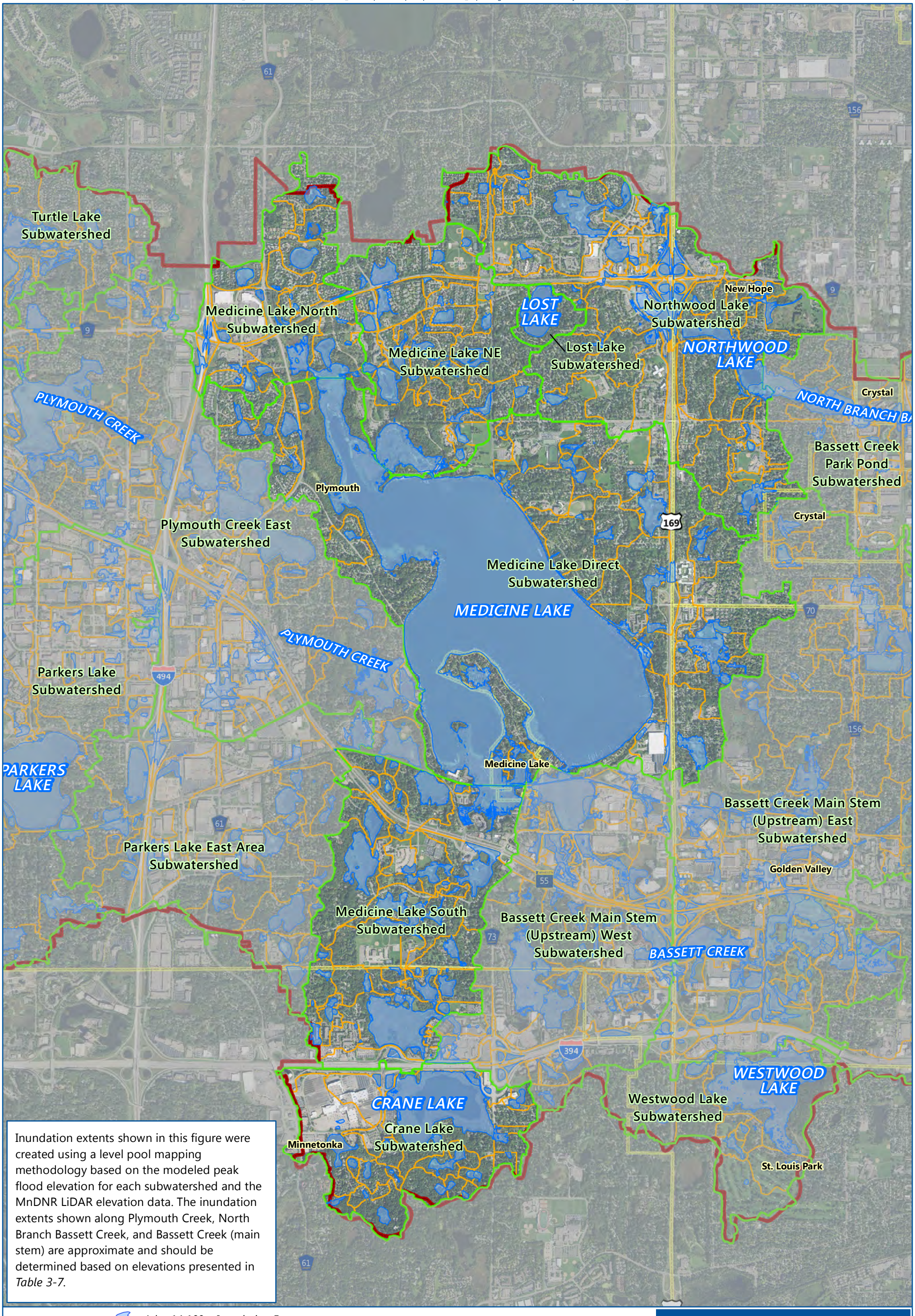
N

0 2,500 5,000

Feet

PLYMOUTH CREEK, TURTLE LAKE AND PARKERS LAKE SUBWATERSHEDS ATLAS 14 100-YEAR INUNDATION EXTENTS
Bassett Creek Water Management Commission

FIGURE 3-16



Inundation extents shown in this figure were created using a level pool mapping methodology based on the modeled peak flood elevation for each subwatershed and the MnDNR LiDAR elevation data. The inundation extents shown along Plymouth Creek, North Branch Bassett Creek, and Bassett Creek (main stem) are approximate and should be determined based on elevations presented in *Table 3-7*.

- Atlas 14 100yr Inundation Extents
- Subwatersheds
- Major Subwatersheds
- Legal Boundary
- City Boundaries

N

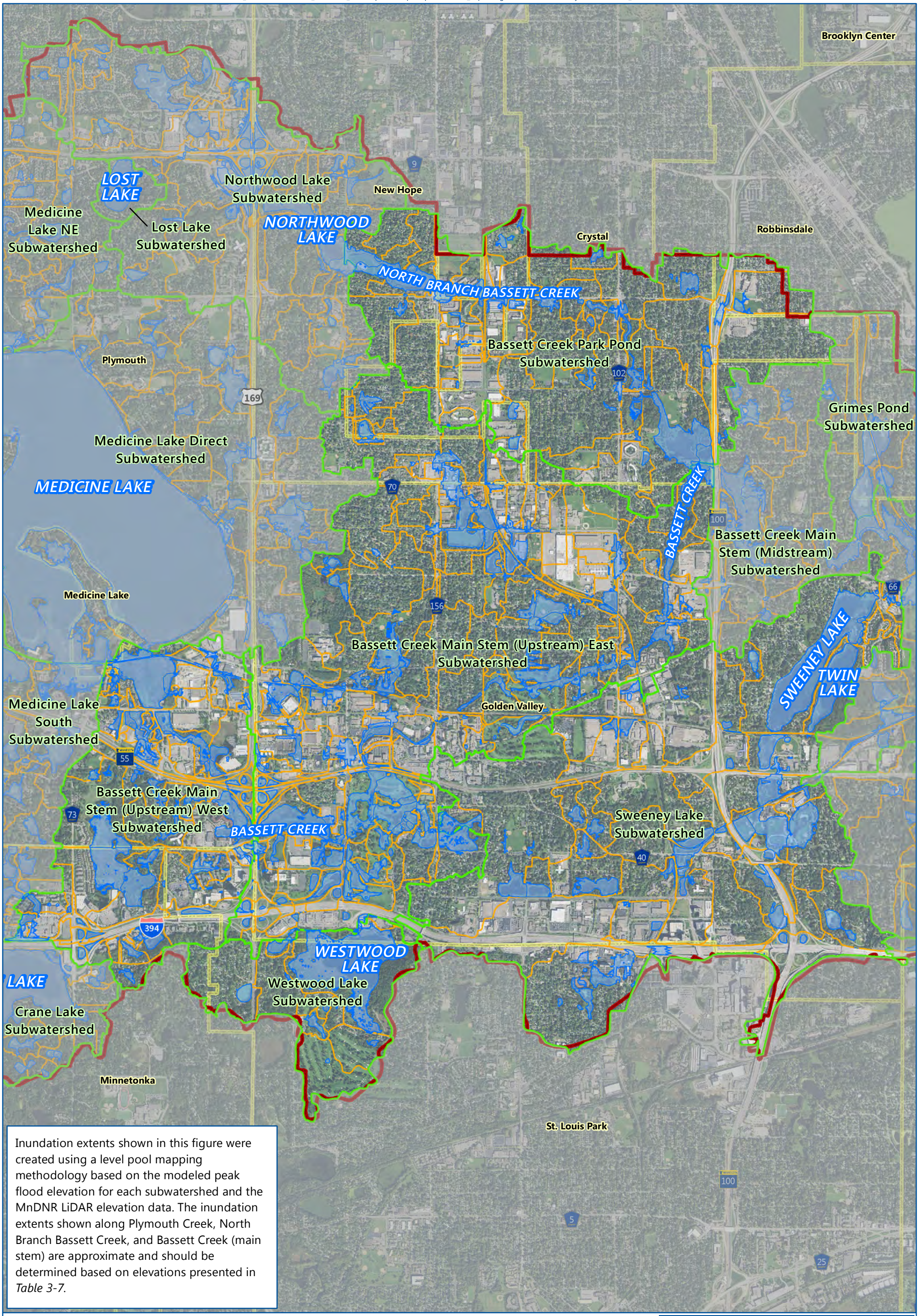
0 2,500 5,000

Feet

LOST LAKE, NORTHWOOD LAKE, CRANE LAKE, AND MEDICINE LAKE SUBWATERSHEDS
ATLAS 14 100-YEAR INUNDATION EXTENTS
Bassett Creek Water Management Commission

FIGURE 3-17

Barr Footer: ArcGIS 10.4, 2017-01-11 17:09 File: I:\Client\BassettCreek\Work_Orders\2015\Phase2_XPSWMM_ModelUpdate\Maps\Reports\Bassett_Report\Figure 3-18 Atlas 14 100-year Inundations_BassettCreek.mxd User: Mac2



BASSETT CREEK MAIN STEM (UPSTREAM), WESTWOOD LAKE, BASSETT CREEK PARK POND, AND SWEENEY LAKE ATLAS 14 100-YEAR INUNDATION EXTENTS
Bassett Creek Water Management Commission

FIGURE 3-18

Barr Footer: ArcGIS 10.4, 2017-01-11 17:11 File: I:\Client\BassettCreek\Work_Orders\2015\Phase2_XPSWMM_ModelUpdate\Maps\Reports\Bassett_Report\Figure 3-19 Atlas 14 100-year Inundations_Grimes.mxd User: Mac2

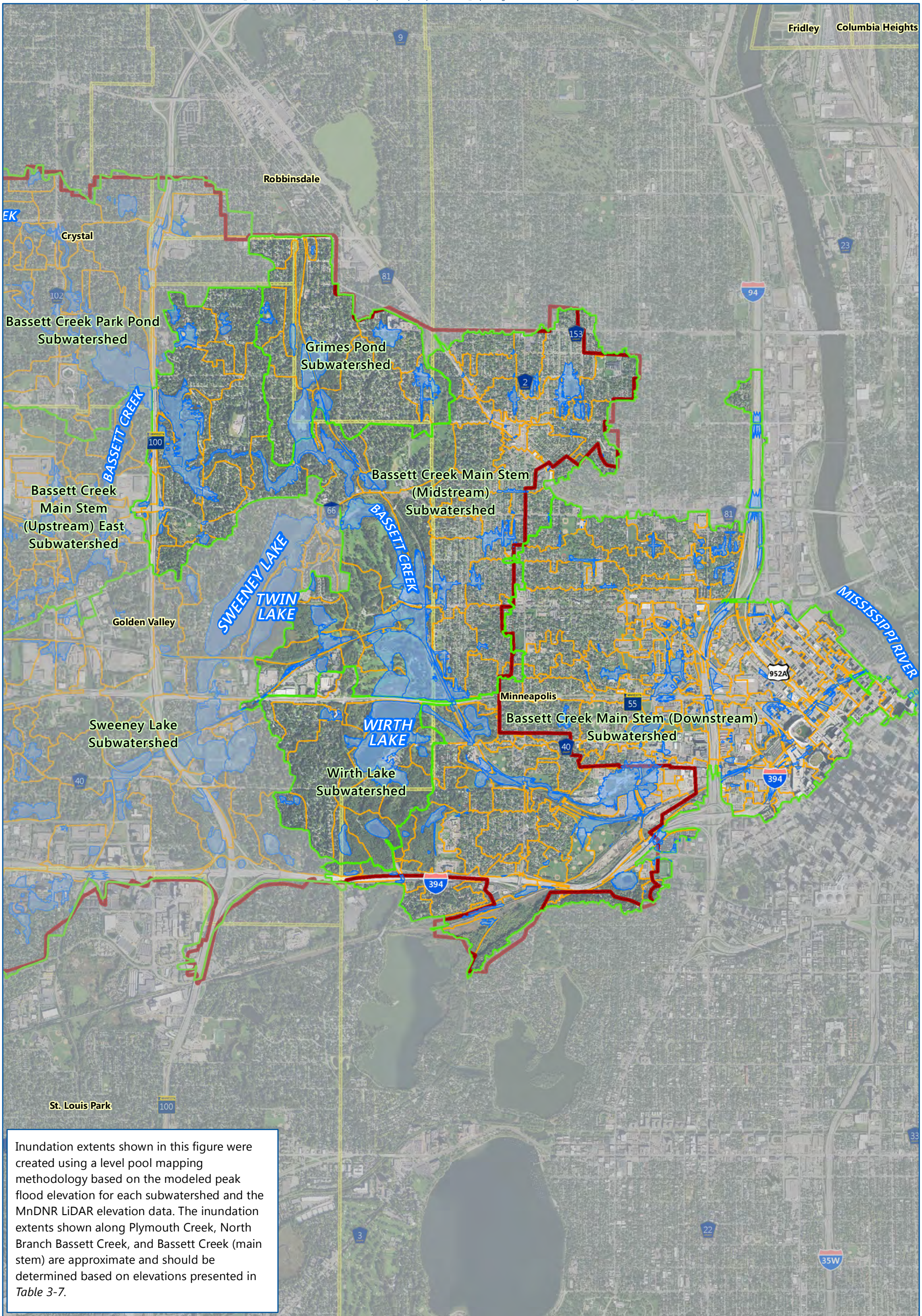


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Table 3-7 Comparison of BCWMC Watershed Management Plan to the Phase 2 XPSWMM Model - Flood Elevations and Peak Discharges

Location	Creek Distance above the Mississippi River (feet)	Normal Water Level (NAVD88)	BCWMC Watershed Management Plan[1]		BCWMC Phase 2 XP-SWMM Model - Atlas 14		Change in Flood Elevations and Flow Rates	
			100-yr		100-yr		XPSWMM - Plan	
			Flood Elevation (NAVD88 feet)	Flow Rate (cfs)	Flood Elevation (NAVD88 feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)
BASSETT CREEK MAIN STEM								
Tunnel Inlet	8,000		807.3	1,220	811.0	1,370	3.7	150
Irving Avenue Bridge (DS)	9,800		808.6	1,135	811.2	1,370	2.6	235
Irving Avenue Bridge (US)	---		809.3	1,135	811.3	1,400	2.0	265
Cedar Lake Rd (Bridge)	10,900		812.9	945	813.4	1,400	0.5	455
MN&S RR Bridge	11,600		814.8	945	813.8	1,400	-1.0	455
Old Penn Ave Bridge (DS)	12,410		814.9	705	814.5	1,400	-0.4	695
Old Penn Ave Bridge (US)	---		815.2	705	814.6	1,400	-0.6	695
BN RR Bridge	12,670		815.3	705	814.5	1,400	-0.8	695
MN&S RR Bridge (DS)	13,930		816.2	465	815.7	1,400	-0.5	935
MN&S RR Bridge (US)	---		816.4	465	815.8	1,400	-0.6	935
Fruen Mill Dam (DS)	14,150		816.5	510	817.2	1,400	0.7	890
Fruen Mill Dam (US)	---		818.2	510	819.8	1,400	1.7	890
Glenwood Ave	14,855		820.3	680	822.2	1,310	1.9	630
Hwy 55 (DS)	16,500		821.7	680	823.4	1,160	1.7	480
Hwy 55 (US)	---		826.2	680	826.9	1,530	0.7	850
Golf Cart Bridge	---		826.2	680	826.9	1,560	0.7	880
MN&S RR Bridge	18,700		826.2	945	826.9	1,560	0.7	615
Plymouth Ave Bridge	19,500		826.2	680	827.0	1,590	0.8	910
Wirth Parkway (DS)	20,480		826.2	1,570	827.0	1,490	0.8	-80
Wirth Parkway (US) Bridge	---		826.5	1,570	827.0	1,490	0.5	-80
Confluence w/ Sweeney Lake Branch	22,000		827.2	----	827.4	1,510	0.3	---
Golden Valley Road (DS)	23,800		827.4	790	828.3	1,400	0.9	610
Golden Valley Road (US)	23,800		830.2	680	834.0	1,400	3.9	720
Dresden Lane (DS)	25,900		830.5	680	834.3	1,400	3.8	720
Dresden Lane (US)	---		831.6	680	834.3	1,400	2.7	720
Bassett Creek Drive (DS)	---		832.2	665	834.6	1,350	2.4	685
Bassett Creek Drive (US)	---		832.9	665	837.3	1,350	4.4	685
Noble Lane (DS)	29,200		839.7	660	838.8	1,380	-0.8	720
Noble Lane (US)	---		839.7	660	839.9	1,360	0.2	700
Regent Avenue (DS)	30,800		---	660	---	1,360	---	700
Regent Avenue (US)	---		842.1	660	843.9	1,330	1.8	670
Minnaqua Avenue	31,650		842.7	---	844.2	1,320	1.5	---
Highway 100 (DS)	34,020		843.4	770	845.0	1,340	1.6	570
Highway 100 (US)	34,020		849.2	610	851.5	1,100 [2]	2.3	490
DS Confluence N. Branch	34,400		849.2	495	851.5	1,100	2.3	605
Westbrook Road (DS)	37,000		857.3	940	859.1	890	1.8	-50
Westbrook Road (US)	---		858.3	940	861.0	890	2.7	-50

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Table 3-7 Comparison of BCWMC Watershed Management Plan to the Phase 2 XPSWMM Model - Flood Elevations and Peak Discharges

Location	Creek Distance above the Mississippi River (feet)	Normal Water Level (NAVD88)	BCWMC Watershed Management Plan[1]		BCWMC Phase 2 XP-SWMM Model - Atlas 14		Change in Flood Elevations and Flow Rates	
			100-yr		100-yr		XPSWMM - Plan	
			Flood Elevation (NAVD88 feet)	Flow Rate (cfs)	Flood Elevation (NAVD88 feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)
Duluth Street (DS)	38,400		861.5	850	862.0	870	0.5	20
Duluth Street (US)	---		862.0	850	862.7	850	0.7	0
St. Croix Avenue (DS)	39,800		863.2	850	864.6	850	1.4	0
St. Croix Avenue (US)	---		864.3	850	864.7	820	0.4	-30
MN&S RR (DS)	41,660		869.7	760	870.4	720	0.7	-40
MN&S RR (US)	---		869.7	760	870.6	710	0.9	-50
Douglas Drive (DS)	42,130		870.4	670	871.0	710	0.7	40
Douglas Drive (US)	---		871.2	670	871.9	710	0.7	40
Florida Avenue (DS)	42,820		871.8	670	872.7	710	0.9	40
Florida Avenue (US)	---		872.5	670	873.1	710	0.6	40
Hampshire Ave (DS)	43,410		872.7	630	873.4	710	0.7	80
Hampshire Ave (US)	---		873.2	630	874.0	680	0.9	50
GV Country Club (DS)	44,320		874.6	365	876.1	670	1.5	305
GV Country Club (US)	---		878.6	405	880.7	670	2.1	265
Pennsylvania Avenue (DS)	46,500		879.5	380	881.7	670	2.2	290
Pennsylvania Avenue(US)	---		880.7	375	883.1	570	2.4	195
C&NW RR (DS)	47,200		881.9	375	884.4	590	2.5	215
C&NW RR (US)	---		883.1	375	884.9	470	1.8	95
Winnetka Ave (DS)	48,000		883.5	360	885.0	450	1.5	90
Winnetka Ave (US)	---		883.7	360	885.3	440	1.6	80
Wisconsin Ave (DS)	49,750		884.9	360	886.0	440	1.1	80
Wisconsin Ave (US)	50,100		888.2	340	887.7	360	-0.5	20
Golden Valley Road (DS)	---		888.2	290	887.8	330	-0.4	40
Golden Valley Road (US)	---		888.2	290	887.8	330	-0.4	40
Westbound Hwy 55 (DS)	51,250		888.2	290	887.8	330	-0.4	40
Eastbound Hwy 55 (US)	---		888.3	290	887.8	400	-0.4	110
Boone Ave (DS)	---		888.4	280	887.9	320	-0.5	40
Boone Ave (US)	---		888.5	280	888.0	220	-0.5	-60
Hwy 169 (DS)	56,500		888.6	255	888.3	300	-0.2	45
Hwy 169 (US)	---		888.7	250	888.4	240	-0.3	-10
Hwy 55 Ramp (DS)	58,300		888.7	235	888.4	210	-0.3	-25
Hwy 55 Ramp (US)	---		888.7	235	888.4	210	-0.2	-25
Hwy 55 Eastbound (DS)	58,500		888.7	235	888.4	210	-0.2	-25
Hwy 55 Eastbound (US)	---		888.7	235	888.5	210	-0.2	-25
Hwy 55 Westbound (DS)	---		888.7	235	888.5	210	-0.2	-25
Hwy 55 Westbound (US)	---		889.0	235	888.5	210	-0.5	-25
Hwy 169 ramp to W 55 (DS)	58,750		889.0	235	888.5	210	-0.5	-25
Hwy 169 ramp to W 55 (US)	---		889.0	235	888.5	210	-0.5	-25
Hwy 55 N Frontage Rd (DS)	58,850		889.2	235	888.5	210	-0.7	-25

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Table 3-7 Comparison of BCWMC Watershed Management Plan to the Phase 2 XPSWMM Model - Flood Elevations and Peak Discharges

Location	Creek Distance above the Mississippi River (feet)	Normal Water Level (NAVD88)	BCWMC Watershed Management Plan[1]		BCWMC Phase 2 XP-SWMM Model - Atlas 14		Change in Flood Elevations and Flow Rates	
			100-yr		100-yr		XPSWMM - Plan	
			Flood Elevation (NAVD88 feet)	Flow Rate (cfs)	Flood Elevation (NAVD88 feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)
Hwy 55 N Frontage Rd (US)	---		889.2	235	888.5	210	-0.7	-25
10th Ave (DS)	---		889.2	---	889.0	210	-0.2	---
10th Ave (US)	---		889.2	---	889.1	210 [2]	-0.1	---
C&NW RR Bridge (DS)	63,450		889.2	200	889.1	210 [2]	-0.1	10
C&NW RR Bridge (US)	---		889.6	200	889.1	210	-0.5	10
South Shore Drive (DS)	63,800		889.6	190	889.3	210	-0.3	20
South Shore Drive (US)	---		890.5	190	889.3	210 [2]	-1.2	20
Medicine Lake Weir (DS)	63,960		890.5	190	889.3	210	-1.2	20
Inundation Areas								
Theodore Wirth Park (Area upstream of Highway 55 Control Structure)	---	815.7	826.2	---	826.9	---	0.7	---
South Rice Pond	---		831.7	---	834.5	---	2.8	---
North Rice Pond	---	832.5	838.2	---	836.4	---	-1.7	---
Grimes Avenue Pond	---	832.5	838.2	---	836.5	---	-1.7	---
Golden Valley Country Club	---		878.6	---	880.7	---	2.1	---
Brookview Golf Course	---		888.3	---	887.8	---	-0.4	---
Westwood Lake	---	887.6 [3]	889.2	---	890.0	---	0.8	---
Medicine Lake	---	887.9	890.5	---	890.3	---	-0.2	---
NORTH BRANCH								
Hwy 100 Control (US)	---		849.2	610	851.5	1,100	2.3	490
Confluence w/Main Stem	---		849.2	---	851.5	1,800 [2]	2.3	---
29th Avenue (DS)	200		849.2	1,515	851.5	1,800 [2]	2.3	285
29th Avenue (US)	---		849.7	1,515	851.5	1,460 [2]	1.8	-55
32nd Avenue (DS)	2,600		849.8	1,175	852.2	1,460 [2]	2.4	285
32nd Avenue (US)	---		854.2	1,175	852.7	560 [2]	-1.5	-615
Brunswick Avenue (DS)	3,000		854.9	1,175	852.7	560 [2]	-2.2	-615
Brunswick Avenue (US)	---		856.1	1,175	856.7	510	0.6	-665
34th Culvert (DS)	4,200		863.0	700	865.4	520	2.4	-180
34th Culvert (US)	---		866.3	430	867.1	500	0.8	70
Douglas Drive (DS)	5,250		870.2	670	869.3	560 [2]	-0.8	-110
Douglas Drive (US)	---		870.3	670	870.4	350 [2]	0.1	-320
Edgewood Emb (DS)	5,600		870.9	430	871.0	350 [2]	0.1	-80
Edgewood Emb (US)	---		878.4	340	880.4	330	2.0	-10

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Table 3-7 Comparison of BCWMC Watershed Management Plan to the Phase 2 XPSWMM Model - Flood Elevations and Peak Discharges

Location	Creek Distance above the Mississippi River (feet)	Normal Water Level (NAVD88)	BCWMC Watershed Management Plan[1]		BCWMC Phase 2 XP-SWMM Model - Atlas 14		Change in Flood Elevations and Flow Rates	
			100-yr		100-yr		XPSWMM - Plan	
			Flood Elevation (NAVD88 feet)	Flow Rate (cfs)	Flood Elevation (NAVD88 feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)
Georgia Avenue (DS)	6,250		878.4	305	880.4	450	2.0	145
Georgia Avenue (US)	---		878.6	305	880.7	500 [2]	2.1	195
36th & Hampshire (DS)	6,800		878.6	260	880.7	460 [2]	2.1	200
36th & Hampshire (US)	6,980		879.2	260	881.2	290 [2]	2.0	30
Louisiana Ave. (DS) (Street Elevation Approx. 882.4)	8,000		881.2	---	883.3	500 [2]	2.1	---
Maryland Ave. (Street Elevation Approx. 885.7)	8,500		---	---	886.0	270 [2]	---	---
Oregon Ave. (Street Elevation Approx. 885.4)	9,000		---	---	888.9	90 [2]	---	---
MN & S RR (Street Elevation Approx. 889.1)	9,300		---	---	889.8	90 [2]	---	---
Inlet of 42" CMP (East Winnetka Pond)	9,500		888.2	---	891.0	100 [2]	2.8	---
Service Road (West Winnetka Pond)	10,000		888.2	---	891.2	190 [2]	3.1	---
Winnetka Ave. (DS)	10,600		888.2	---	891.3	240 [2]	3.1	---
Winnetka Ave. (US)	---		889.2	---	891.4	280	2.2	---
Boone Ave. (DS)	13,500		889.5	---	891.4	680 [2]	1.9	---
Boone Ave. (US)	---		889.7	---	891.4	270 [2]	1.7	---
Northwood Lake	---		889.7	---	891.4	270 [2]	1.7	---
TH 169 (DS)	16,850		889.7	---	893.0	270 [2]	3.4	---
TH 169(US)	---		890.7	---	893.1	760 [2]	2.4	---
Rockford Road (DS)	18,350		890.7	---	893.1	760 [2]	2.4	---
Rockford Road (US)	---		898.7	---	901.4	20 [2]	2.8	---
Inundation Areas								
Bassett Creek Park	---	840.6	849.7	---	851.5	---	1.8	---
Edgewood Avenue Pond	---		878.4	---	880.4	---	2.0	---
Winnetka Pond (DS of Winnetka Avenue)	---	879.8	888.2	---	891.0	---	2.8	---
Northwood Park	---		889.5	---	891.4	---	1.9	---
Northwood Lake	---	884.6	889.7	---	891.4	---	1.7	---
SWEENEY LAKE BRANCH								
Confluence w/Main Stem	---		827.2	---	827.4	1,510	0.3	---
France Ave extension (DS)	700		827.2	---	827.8	170 [2]	0.7	---
France Ave (US)	---		829.2	---	828.1	170 [2]	-1.0	---
Courage Center & Hidden Lakes Parkway (DS)	900		829.2	---	830.7	170	1.5	---
Courage Center & Hidden Lakes Parkway (US)	---		831.2	---	832.0	170	0.9	---

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Table 3-7 Comparison of BCWMC Watershed Management Plan to the Phase 2 XPSWMM Model - Flood Elevations and Peak Discharges

Location	Creek Distance above the Mississippi River (feet)	Normal Water Level (NAVD88)	BCWMC Watershed Management Plan[1]		BCWMC Phase 2 XP-SWMM Model - Atlas 14		Change in Flood Elevations and Flow Rates	
			100-yr		100-yr		XPSWMM - Plan	
			Flood Elevation (NAVD88 feet)	Flow Rate (cfs)	Flood Elevation (NAVD88 feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)
Precast Concrete Dam (DS)	1,700		831.7	---	832.0	170	0.4	---
Sweeney Lake	---		831.7	---	832.0	170	0.4	---
Union Pacific RR (DS)	6,800		831.7	---	832.0	410	0.4	---
Union Pacific RR (US)	---		835.8	311	836.4	480 [2]	0.6	169
Hwy 55 (DS)	8,150		835.8	680	836.9	870 [2]	1.1	190
Hwy 55 (US)	---		836.9	680	838.5	320 [2]	1.7	-360
MN & S RR (DS)	9,000		836.9	233	838.5	270	1.7	37
MN & S RR (US)	---		839.5	233	842.0	270	2.5	37
Breck Pond & Control Structure (US)	9,580		839.9	296	842.6	280 [2]	2.7	-16
TH 100 (DS) (Breck Pond)	10,400		839.9	298	842.6	450 [2]	2.7	152
TH 100 (US)	---		845.4	298	851.7	520 [2]	6.3	222
Turners Crossroad (US)	10,950		854.9	241	857.2	450 [2]	2.4	209
Glenwood Pond A	---		854.9	---	857.2	---	2.4	---
MN & S RR (DS)	11,550		854.9	233	857.2	450 [2]	2.4	217
MN & S RR (US)	---		855.0	233	857.3	450 [2]	2.3	217
Glenwood Pond B	---		855.0	---	857.3	---	2.3	---
Glenwood Ave (DS)	---		855.0	84	857.3	100 [2]	2.3	16
Glenwood Ave (US)	---		855.0	84	857.3	100	2.3	16
Duck Pond	---		855.0	---	857.3	---	2.3	---
MN & S RR (DS)	---		855.0	233	857.3	570 [2]	2.3	337
MN & S RR (US)	---		858.9	233	859.6	310 [2]	0.7	77
Ravine Storage Area	---		858.9	---	859.6	90 [2]	0.7	---
Courtlawn Pond	---		873.1	---	873.6	120 [2]	0.5	---
East Ring Pond	---		879.0	---	879.4	190 [2]	0.5	---
78" RCP Equalizer	18,800		---	---	---	480 [2]	---	---
West Ring Pond	---		879.0	---	879.4	---	0.5	---
Ravine Storage Area Overflow								
Glenwood Pond B	---		855.0	---	857.3	---	2.3	---
MN & S RR (DS)	---		855.0	---	857.3	---	2.3	---
MN & S RR (US)	---		857.3	---	859.6	---	2.3	---
Glenwood Ave (DS)	---		855.0	---	857.3	---	2.3	---
Glenwood Ave (US)	---		855.0	---	857.3	---	2.3	---
Inundation Areas								
Sweeney Lake	---	827.2 [4]	831.7	---	832.0	---	0.4	---
Twin Lake	---	827.2 [4]	831.7	---	832.0	---	0.4	---

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Table 3-7 Comparison of BCWMC Watershed Management Plan to the Phase 2 XPSWMM Model - Flood Elevations and Peak Discharges

Location	Creek Distance above the Mississippi River (feet)	Normal Water Level (NAVD88)	BCWMC Watershed Management Plan[1]		BCWMC Phase 2 XP-SWMM Model - Atlas 14		Change in Flood Elevations and Flow Rates	
			100-yr		100-yr		XPSWMM - Plan	
			Flood Elevation (NAVD88 feet)	Flow Rate (cfs)	Flood Elevation (NAVD88 feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)
Breck Pond	---	831.6	839.9	---	842.6	---	2.7	---
Courtlawn Pond	---	870.1	873.1	---	873.6	---	0.5	---
East Ring Pond	---	874.1	879.0	---	879.4	---	0.5	---
West Ring Pond	---	874.1	879.0	---	879.4	---	0.5	---
MEDICINE LAKE BRANCH (PLYMOUTH CREEK)								
West Medicine Lake Drive (DS)	10,450		890.5	---	890.7	300	0.2	---
West Medicine Lake Drive (US)	---		891.7	---	893.6	700 [2]	1.9	---
26th Avenue N. (DS)	16,500		925.2	---	924.4	230	-0.8	---
26th Avenue N. (US)	---		925.7	---	925.0	230	-0.7	---
28th Avenue N. Dike (DS)	---		928.2	---	929.9	230	1.7	---
28th Avenue N. Dike (US)	---		931.0	---	932.3	270 [2]	1.3	---
County Road 61 (DS)	---		931.0	---	932.3	270	1.3	---
County Road 61 (US)	---		931.4	---	933.9	230	2.5	---
Xenium Lane (DS)	20,850		931.4	---	933.9	440	2.6	---
Xenium Lane (US)	---		931.7	---	934.3	470 [2]	2.6	---
I-494 (DS)	22,500		935.2	---	938.1	440	2.9	---
I-494 (US)	---		938.7	---	939.0	410	0.3	---
Fernbrook Lane (DS)	25,000		947.2	---	946.6	260	-0.6	---
Fernbrook Lane (US)	---		948.2	---	946.7	260	-1.5	---
Central Park Pond Outlet Structure (DS)	---		949.2	---	949.7	260	0.5	---
Central Park Pond Outlet Structure (US)	---		953.2	---	954.8	690 [2]	1.6	---
37th Avenue	28,900		956.2	---	954.9	690 [2]	-1.3	---
County Road 9	30,450		959.2	---	955.0	400	-4.1	---
Vicksburg Lane (DS)	31,300		961.2	---	963.1	390	1.9	---
Vicksburg Lane (US)	---		962.2	---	963.8	290	1.6	---
Dunkirk Lane (DS)	---		979.2	---	979.4	80	0.2	---
Dunkirk Lane (US)	34,450		982.2	---	985.3	90	3.1	---
T.H. 55 (DS)	38,300		982.2	---	987.6	40	5.4	---
T.H. 55 (US)	---		982.7	---	987.6	---	4.9	---
Inundation Areas								
Xenium Lane	---		931.7	---	934.3	---	2.6	---
Central Park Pond	---	948.2	952.2	---	954.8	---	2.6	---
Turtle Lake	---	962.9 [5]	964.2	---	967.0	---	2.8	---
Rockford Road	---		968.2	---	968.5	---	0.3	---
Dunkirk Lane	---		982.2	---	982.2	---	0.1	---

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Table 3-7 Comparison of BCWMC Watershed Management Plan to the Phase 2 XPSWMM Model - Flood Elevations and Peak Discharges

Location	Creek Distance above the Mississippi River (feet)	Normal Water Level (NAVD88)	BCWMC Watershed Management Plan[1]		BCWMC Phase 2 XP-SWMM Model - Atlas 14		Change in Flood Elevations and Flow Rates	
			100-yr		100-yr		XPSWMM - Plan	
			Flood Elevation (NAVD88 feet)	Flow Rate (cfs)	Flood Elevation (NAVD88 feet)	Flow Rate (cfs)	Flood Elevation (feet)	Flow Rate (cfs)
Oak Knoll Pond	---	914.4	917.3	---	918.5	---	1.2	---
Crane Lake	---	917.3	920.7	---	920.2	---	-0.5	---

Notes

[1]Historical reporting for the Bassett Plan were presented in NGVD29 (NAVD88=NGVD29+0.18ft)

[2]Multiple inflows to node. The reported peak inflow reflects the sum all inflow peaks.

[3]Barr study surveyed outlet of Westwood Lake and found the outlet ditch has filled with sediment to evelevation 887.6ft. The outlet pipe invert elevation (historical normal water level) is at 886.18ft