13.0 Southeast Minnehaha Creek

13.1 General Description of Drainage Area

Figure 13.1 depicts the Southeast Minnehaha Creek drainage area and the individual subwatersheds within this area. The Southeast Minnehaha Creek drainage basin is located in east-central Edina and contains several ponds, Lake Harvey, Lake Pamela, and Melody Lake.

13.1.1 Drainage Patterns

The stormwater system within this drainage area is comprised of storm sewers, ponding basins, wetlands, drainage ditches, and overland flow paths. The Southeast Minnehaha Creek basin has been divided into several major watersheds based on the drainage patterns. These major watersheds are depicted in Figure 13.2. Each major watershed has been further delineated into numerous subwatersheds. The naming convention for each subwatershed is based on the major watershed it is located within. Table 13.1 lists each major watershed and the associated subwatershed naming convention.

Table 13.1 Major Watersheds within the Southeast Minnehaha Creek Drainage Basin

Major Watershed	Subwatershed Naming Convention	# of Subwatersheds	Drainage Area (acres)
Lake Pamela	LP_##	28	274
Minnehaha Creek South	MHS_##	86	508
Melody Lake	ML_##	15	178

13.1.1.1 Lake Pamela

The Lake Pamela watershed is located in the east central portion of Edina. The entire 272-acre watershed drains to Lake Pamela and then north to Minnehaha Creek. The land use of this watershed is primarily low density residential with Pamela Park surrounding Lake Pamela. Four stormwater management basins in this watershed, two on the south end of Lake Pamela and two on the north end of the lake recently have been constructed for water quality treatment of stormwater. The two ponds on the north end of the lake also receive runoff from about half of the Southeast Minnehaha Creek watershed (described below). This runoff is routed through the ponds, over a weir and then to the north bay of Lake Pamela, and finally, to Minnehaha Creek. These ponds were designed to treat runoff from the Minnehaha Creek South watershed before discharge to Minnehaha Creek. Lake Pamela has been excavated to increase the dead storage volume within the lake for water quality treatment.

13.1.1.2 Minnehaha Creek South

The Minnehaha Creek South watershed extends from areas just south of the Edina Country Club at Lake Harvey, west to T.H. 100 and south to West 54th Street. The land use is predominantly low density residential with some scattered areas of institutional land use. There are no ponds east of Minnehaha Creek and only a few wet and dry detention ponds on the western half of this watershed. However, most of the western half of the watershed is routed through ponds and through the northern bay of Lake Pamela before discharge to Minnehaha Creek. Areas directly east and west of Minnehaha Creek are drained by short storm sewer systems or directly by overland flow.

There is a stormwater control weir in a manhole that is located just east of the intersection of West 58th Street and Concord Avenue. This weir is designed to prevent flooding of the backyard area of the house at 5801 Concord Avenue. Also part of this system is a flap gate on a pipe leading from the backyard area of 5801 Concord Avenue. This pipe connects into the downstream end of the weir-manhole and the flap gate stops water from backing into this pipe. The weir, located at node 1849, forces water to back into a pipe that discharges into a ball field located along Concord Avenue. This entire system is designed to store water in the ball park and slowly release it back into the storm sewer system over time so that the house at 5801 Concord Avenue is not flooded during the 100-year frequency storm event.

13.1.1.3 Melody Lake

This 178-acre watershed contains low density residential, institutional, and T.H. 100. The outlet from Melody Lake is a pumped outlet to the T.H.100 drainage system. This system flows north and ultimately discharges to Minnehaha Creek. The T.H. 100 storm sewer system was not modeled as part of this study.

13.2 Stormwater System Analysis and Results

13.2.1 Hydrologic/Hydraulic Modeling Results

The 10-year and 100-year frequency flood analyses were performed for the Southeast Minnehaha Creek drainage basin. The 10-year analysis was based on a ½-hour storm of 1.65 inches of rain and the 100-year analysis was based on a 24-hour storm event of 6 inches of rain. Table 13.2 presents the watershed information and the results for the 10-year and 100-year hydrologic analyses for the Southeast Minnehaha Creek basin.

The results of the 10-year and the 100-year hydraulic analysis for the Southeast Minnehaha Creek drainage basin are summarized in Table 13.3 and Table 13.4. The column headings in Table 13.3 are defined as follows:

Node/Subwatershed ID—XP-SWMM node identification label. Each XP-SWMM node represents a manhole, catchbasin, pond, or other junction within the stormwater system.

Downstream Conduit—References the pipe downstream of the node in the storm sewer system.

Flood Elevation—The maximum water elevation reached in the given pond/manhole for each referenced storm event (mean sea level). In some cases, an additional flood elevation has been given in parenthesis. This flood elevation reflects the 100-year flood elevation of Minnehaha Creek, as shown in the *National Flood Insurance Program Flood Insurance Study for the City of Edina*, May 1980.

Peak Outflow Rate—The peak discharge rate (cfs) from a given ponding basin for each referenced storm event. The peak outflow rates reflect the combined discharge from the pond through the outlet structure and any overflow.

NWL—The normal water level in the ponding basin (mean sea level). The normal water levels for the ponding basins were assumed to be at the outlet pipe invert or at the downstream control elevation.

Flood Bounce—The fluctuation of the water level within a given pond for each referenced storm event.

Volume Stored—The maximum volume (acre-ft) of water that was stored in the ponding basin during the storm event. The volume represents the live storage volume only.

Table 13.4 summarizes the conveyance system data used in the model and the model results for the storm sewer system within the Southeast Minnehaha Creek drainage basin. The peak flow through each conveyance system for the 10-year and the 100-year frequency storm event is listed in the table. The values presented represent the peak flow rate through each pipe system only and does not reflect the combined total flow from an upstream node to the downstream node when overflow from a manhole/pond occurs.

Figure 13.3 graphically represents the results of the 10-year and the 100-year frequency hydraulic analyses. The figure depicts the Southeast Minnehaha Creek drainage basin boundary, subwatershed boundaries, the modeled storm sewer network, surcharge conditions for the XP-SWMM nodes (typically manholes), and the flood prone areas identified in the modeling analyses.

One of the objectives of the hydraulic analyses was to evaluate the level of service provided by the current storm sewer system. The level of service of the system was examined by determining the surcharge conditions of the manholes and catch basins within the storm sewer system during the 10-year and 100-year frequency storm events. An XP-SWMM node was considered surcharged if the hydraulic grade line at that node breached the ground surface (rim elevation). Surcharging is typically the result of limited downstream capacity and tailwater impacts. The XP-SWMM nodes depicted on Figure 13.3 were color coded based on the resulting surcharge conditions. The green nodes signify no surcharging occurred during the 100-year or 10-year storm event, the yellow nodes indicate surcharging during the 100-year frequency event, the red nodes identify that surcharging is likely to occur during both a 100-year and 10-year frequency storm event. Figure 13.3 illustrates that several XP-SWMM nodes within the Southeast Minnehaha Creek drainage basin are predicted to experience surcharged conditions during both the 10-year and 100-year frequency storm events. This indicates a probability greater than 10 percent *in any year* that the system will be overburdened and unable to meet the desired level of service at these locations. These manholes and catch basins are more likely to experience inundation during the smaller, more frequent storm events of various durations.

Another objective of the hydraulic analysis was to evaluate the level of protection offered by the current stormwater system. Level of protection is defined as the capacity provided by a municipal drainage system (in terms of pipe capacity and overland overflow capacity) to prevent property damage and assure a reasonable degree of public safety following a rainstorm. A 100-year frequency event is recommended as a standard for design of stormwater management basins. To evaluate the level of protection of the stormwater system within the Southeast Minnehaha Creek drainage area, the 100-year frequency flood elevations for the ponding basins and depressed areas were compared to the low elevations of structures surrounding each basin. The low elevations were initially determined using 2-foot topographic information and aerial imagery in ArcView. Where 100-year flood levels of the ponding areas appeared to potentially threaten structures, detailed low house elevations were obtained through field surveys. The areas that were determined to flood and threaten structures during the 100-year frequency storm event are listed in Table 13.5 and highlighted in Figure 13.3. Discussion and recommended implementation considerations for these areas are included in Section 13.3.

13.2.2 Water Quality Modeling Results

The effectiveness of the stormwater system in removing stormwater pollutants such as phosphorus was analyzed using the P8 water quality model. The P8 model simulates the hydrology and phosphorus loads introduced from the watershed of each pond and the transport of phosphorus throughout the stormwater system. Since site-specific data on pollutant wash-off rates and sediment characteristics were not available, it was necessary to make assumptions based on national average values. Due to such assumptions and lack of in-lake water quality data for model calibration, the modeling results were analyzed based on the percent of phosphorus removal that occurred and not based on actual phosphorus concentrations.

Figure 13.4 depicts the results of the water quality modeling for the Southeast Minnehaha Creek drainage basin. The figure shows the fraction of total phosphorus removal for each water body as well as the cumulative total phosphorus removal in the watershed. The individual water bodies are colored various shades of blue, indicating the percent of the total annual mass of phosphorus entering the water body that is removed (through settling). It is important to note that the percent of phosphorus removal is based on total phosphorus, including phosphorus in the soluble form. Therefore, the removal rates in downstream ponds will likely decrease due to the large soluble fraction of incoming phosphorus that was unsettleable in upstream ponds. The watersheds are depicted in various shades of gray, indicating the cumulative total phosphorus removal achieved. The cumulative percent removal represents the percent of the total annual mass of phosphorus entering the watershed that is removed in the pond and all upstream ponds.

Ponds that had an average annual total phosphorus removal rate of 60 percent or greater, under average climatic conditions, were considered to be performing well. For those ponds with total phosphorus removal below 60 percent, the permanent pool storage volume was analyzed to determine if additional capacity is necessary. Based on recommendations from the MPCA publication *Protecting Water Quality in Urban Areas*, March 2000, the permanent pool for detention ponds should be equal to or greater than the runoff from a 2.0-inch rainfall, in addition to the sediment storage for at least 25 years of sediment accumulation. For ponds with less than 60 percent total phosphorus removal, the recommended storage volume was calculated for each pond within the drainage basin and compared to the existing permanent pool storage volume.

13.3 Implementation Considerations

13.3.1 Increased Storm Sewer Capacity Projects

The 100-year frequency hydraulic analysis identified several locations within the Southeast Minnehaha Creek drainage basin where the 100-year level of protection is not provided by the current stormwater system. The problems and potential corrective measures for these areas are discussed below.

13.3.1.1 6213 Ewing Avenue (LP_15)

A depression area on the street adjacent to 6213 Ewing Avenue collects water from a 3.8-acre watershed. The 100-year frequency flood elevation of 884.3 MSL will potentially impact the structure at 6213 Ewing Avenue. It is recommended that the diameters of pipes 1696 and 1695 be increased to 18-inches to provide a 100-year level of protection.

13.3.1.2 3600 West Fuller Street (MHS_4)

The 100-year frequency flood elevation for the backyard depression area directly behind 3600 West Fuller Street is 875.4 MSL. A field survey indicates this elevation is above the low entry (872.6 MSL) at 3600 West Fuller Street. It is recommended that a catch basin be placed in the backyard depression and connected to a new storm sewer system installed east along Fuller Street and south along Beard Avenue to Minnehaha Creek. An existing bituminous drainage channel between Beard Avenue and Minnehaha Creek at this location appears to be a potential access point to Minnehaha Creek for the new pipe. The addition of a pipe system and catch basins extending from Fuller Street to Beard Avenue and then to Minnehaha Creek would provide the additional benefit of handling the significant street flows that occur on Fuller Street and Beard Avenue.

13.3.1.3 5605, 5609, 5613, 5617, 5621, 5625, and 5629 South Beard Avenue (MHS_79)

Water in the alley between Abbott and Beard Avenue and south of West 56th Street rises to an elevation of 880.1 MSL during the 100-year frequency storm and affects the garages in this alley. This is the result of water flowing from West 56th Street to the alley and the limited flow in the pipe leading from the alley to the storm sewer system located on Beard Avenue. Currently the storm sewer system on Beard Avenue does not provide a 10-year level of service and is significantly undersized for the 100-year storm. At the intersection of Beard and West 56th Street, street flow on Beard Avenue reaches a peak of 97 cfs during the 100-year storm while the pipe carries only a peak flow of only 4.7 cfs. The street flow then flows on Beard Avenue to Minnehaha Creek. The following pipe sizes are recommended to protect the structures in the alley during a 100-year storm:

Pipe 1851p .... 12 to 24-inch

Pipe 1852p .... 12 to 24-inch

Pipe 1156 .... 12 to 24-inch

Pipe 1159 .... 27 to 36-inch

Pipe 1158 .... 27 to 36-inch

Pipe 1152 .... 33 to 36-inch

Pipe 1153 .... 15 to 36-inch

An additional catch basin is also required at the low point in the alley. To collect runoff along West 56th Street before it enters the alley, an additional catch basin is recommended on the south side of West 56th Street, east of the alley entrance. These recommendations are not designed to reduce the large street flows that are present on Beard Avenue during the 100-year storm. Further pipe size increases of the entire system and the addition of catch basins would be required to significantly reduce the flow of water along Beard Avenue.

13.3.1.4 5837, 5833, 5829, 5825 South Chowen Avenue (LP_24)

A backyard depression area directly behind 5829 South Chowen Avenue is inundated to an elevation of 884.6 MSL during the 100-year frequency storm and affects the structures at 5837 5833, 5829, and 5825 South Chowen Avenue. It is recommended that a catch basin be placed in the backyard depression area and connected with a 12-inch RCP to the storm sewer node LP_27 located at the intersection of South Chowen Avenue and West 60th Street.

13.3.1.5 Chowen Avenue and West 60th Street (LP_27)

A 100-year frequency flood elevation of 883.9 MSL has been calculated at the intersection of Chowen Avenue and West 60th Street. Although the model shows that there is the potential for significant flooding in this intersection, a thorough survey of the storm sewers and structures in this area needs to be completed to verify their size, invert elevations, and low point of entry.

13.3.1.6 5912, 5916, 5920, 5924, 5928 Ashcroft Avenue and 5925 Concord Avenue (MHS_51)

Water in the backyard depression area of subwatershed MHS_51 will rise to 882.9 MSL during the 100-year frequency storm event. This flood elevation will inundate several of the houses adjacent to the depression. Water frequently ponds in this backyard depression area and either a pumped or gravity outlet from this area with a 3 cfs capacity is required to provide a level of protection.

13.3.1.7 5840 and 5836 Ashcroft Avenue (MHS_89)

The houses at 5840 and 5836 Ashcroft Avenue are located in a shallow depression area that fills with water from a small 0.7-- directly adjacent watershed. The calculated 100-year frequency flood elevation of 884 MSL will inundate the structures at 5840 and 5836 Ashcroft Avenue. It is recommended that a catch basin be placed at this depression and connected to the adjacent storm sewer system on Concord Avenue (node MHS_58). This outflow capacity will reduce the flood elevation to 883 MSL and provide the required level of protection for these structures.

13.3.1.8 5609 and 5605 Dalrymple Road (MHS_24) and 5610 and 5612 St. Andrews Avenue (MHS_66)

The calculated 100-year frequency flood elevation for the depression on Dalrymple Road is 895.3 MSL. This flood elevation is above the lowest entry way for both 5609 (low entry at 893.4 MSL) and 5605 (low entry at 893.25) Dalrymple Road. A field survey of the area indicates that a surface outflow existed between Dalrymple Road and the backyard area of subwatershed MHS_66 but has been filled. It is recommended that either this outflow be reestablished or pipes 1784 and 1240 be upgraded to 24-inch diameter pipes.

The backyard depression area of MHS_66 is inundated to 894.8 MSL during the 100-year frequency flood. This elevation is above the elevation (894.46 MSL) of a back yard entry to 5610 Andrews Avenue, the basement windowsill (891.44 MSL) at 5612 Andrews Avenue, and the basement windowsill (893.53 MSL) at 5608 Andrews Avenue. It is recommended that a surface outflow be established between the backyard depression area and St. Andrews Avenue or pipes 1784 and 1240 be upgraded to 24-inch diameter pipes.

13.3.1.9 5701 Dale Avenue (ML_12)

A depression on Dale Avenue, directly adjacent to 5701 Dale Avenue, is inundated to an elevation of 935.8 MSL during the 100-year frequency storm event. According to a field survey, the low entry way at 5701 Dale Avenue is at an elevation of 935.5 MSL, indicating that the storm sewer system on Dale Avenue does not provide a level of protection for the structure at 5701 Dale Avenue during the 100-year frequency storm event. It is recommended that the diameter of pipes 1 and 1826 be increased to 24 inches to protect the structure at 5701 Dale Avenue from flooding.

13.3.1.10 5213 and 5217 Richwood Drive (ML_7)

A wetland area behind 5213 and 5217 Richwood Drive receives runoff from a 3-acre watershed. This wetland receives water from backyard areas, rooftops, and a small section of Windsor Avenue. During the 100-year frequency storm event the water level in this wetland rises to 928.6 MSL. This water level is above the elevation of the low entry for 5213 and 5217 Richwood Drive. It is recommended that the storage capacity of this wetland area be surveyed and the flooding potential be further evaluated.

13.3.2 Construction/Upgrade of Water Quality Basins

When considered individually, the ponds MHS_13, LP_5, and LP_13, and the two bays of Lake Pamela, LP_14 and LP_26 are removing less that 60 percent of the total phosphorus in storm water inflows. Because water from a watershed greater than 500 acres in size is routed through the ponds and the two bays of Lake Pamela before being discharged to Minnehaha Creek, the cumulative phosphorus removal by the ponds should be considered. In addition, ponds MHS_13, LP 5, and LP_13 were recently constructed and were designed to function as a treatment train and not individually. On a cumulative basis, the ponds and Lake Pamela are removing 63 percent of the total phosphorus load from this entire watershed and it is not necessary to upgrade these ponds. Because over 60 percent of the total phosphorus in storm water runoff is being removed by all other ponds and wetlands in the Southeast Minnehaha Creek watershed, no recommendations are given for the construction or upgrade of water quality basins in this watershed.

13.3.3 Stream Improvement Projects

13.3.3.1 Minnehaha Creek Reach 14 Stream Restoration

The MCWD Comprehensive Water Resources Management Plan identified a potential capital improvement project in Edina to implement a stream restoration project on Reach 14 of Minnehaha Creek. This reach extends from France Avenue to 54th Avenue West. This project would include streambank stabilization, in-stream habitat enhancement, and buffer enhancement.

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Table 13.2
Watershed Modeling Results for Subwatersheds in the Minnehaha Creek South East Drainage Area

Watershed Information			100-Year Storm Results 24-Hour Event		10-Year Storm Results 1/2-Hour Event	
Watershed ID	Total Area (ac)	% Impervious Area	Peak Runoff Rate (cfs)	Total Volume Runoff (ac-ft)	Peak Runoff Rate (cfs)	Total Volume Runoff (ac-ft)
LP_1	6.5	10	16.0	1.52	6.0	0.24
LP_2	7.1	8	29.7	1.80	14.6	0.42
LP_3	3.2	20	13.8	0.89	8.4	0.21
LP_4	2.2	21	9.4	0.60	6.1	0.15
LP_5	2.8	10	11.3	0.70	4.9	0.15
LP_6	26.9	27	73.3	7.51	35.9	1.44
LP_7	5.8	20	20.9	1.56	10.5	0.32
LP_8	9.4	20	36.9	2.55	19.7	0.55
LP_9	6.7	20	25.6	1.82	13.5	0.39
LP_10	5.8	20	21.2	1.57	10.8	0.32
LP_11	10.0	20	31.3	2.65	15.2	0.51
LP_12	3.6	10	15.8	1.41	11.1	0.34
LP_13	10.5	10	34.6	2.55	9.4	0.38
LP_14	26.6	26	100.5	9.84	56.7	2.34
LP_15	3.8	20	15.8	1.06	6.3	0.21
LP_16	6.3	20	24.1	1.71	8.6	0.31
LP_17	16.3	13	55.6	4.09	23.5	0.78
LP_18	3.9	20	16.3	1.07	9.3	0.24
LP_19	13.7	20	49.8	3.70	21.8	0.71
LP_20	13.8	20	50.4	3.73	16.0	0.62
LP_21	3.7	20	14.1	1.01	7.3	0.21
LP_22	9.6	10	34.9	2.39	13.4	0.47
LP_23	6.0	20	21.0	1.85	10.7	0.42
LP_24	3.0	0	12.4	0.89	8.7	0.26
LP_25	4.0	5	16.4	1.24	8.0	0.30
LP_26	41.3	24	136.0	14.94	70.0	3.40
LP_27	19.7	20	56.0	6.00	26.5	1.24
LP_28	1.6	20	5.0	0.43	2.4	0.08
MHS_1	2.5	20	5.6	0.78	2.5	0.15
MHS_2	1.6	20	5.2	0.42	5.9	0.11
MHS_3	1.5	19	6.4	0.43	4.1	0.11
MHS_4	1.5	20	6.0	0.42	3.3	0.09
MHS_5	6.5	24	27.5	1.84	11.0	0.36
MHS_6	2.5	22	10.2	0.68	4.2	0.13
MHS_7	6.5	20	17.5	1.70	16.2	0.41
MHS_8	5.5	20	24.6	1.74	19.9	0.46
MHS_9	3.7	20	14.7	1.17	8.3	0.28
MHS_10	3.7	20	16.5	1.49	12.5	0.37
MHS_11	8.3	20	34.8	2.27	20.5	0.52
MHS_12	8.4	20	28.3	2.39	14.1	0.51
MHS_13	8.1	20	26.0	2.16	12.7	0.42
MHS_14	2.2	20	9.0	0.59	4.0	0.12
MHS_15	4.7	20	20.8	1.31	10.6	0.29
MHS_16	1.9	20	8.1	0.51	5.5	0.13
MHS_17	11.0	20	33.7	2.91	17.3	0.57

Table 13.2
Watershed Modeling Results for Subwatersheds in the Minnehaha Creek South East Drainage Area

Watershed Information			100-Year Storm Results 24-Hour Event		10-Year Storm Results 1/2-Hour Event	
Watershed ID	Total Area (ac)	% Impervious Area	Peak Runoff Rate (cfs)	Total Volume Runoff (ac-ft)	Peak Runoff Rate (cfs)	Total Volume Runoff (ac-ft)
MHS_18	1.9	5	6.9	0.58	4.1	0.15
MHS_19	3.2	31	13.6	0.95	10.3	0.23
MHS_20	10.9	20	31.8	2.88	15.3	0.53
MHS_21	6.7	20	12.5	1.64	5.5	0.26
MHS_22	22.3	40	77.9	7.56	40.1	1.76
MHS_23	4.7	40	20.6	1.53	17.7	0.39
MHS_24	7.0	20	23.5	1.89	11.7	0.38
MHS_25	6.1	20	19.1	1.63	9.3	0.31
MHS_26	10.7	20	29.8	3.42	13.9	0.72
MHS_27	5.1	20	15.9	1.35	7.7	0.26
MHS_28	3.5	20	12.9	0.95	6.5	0.20
MHS_29	1.6	20	6.0	0.44	3.1	0.09
MHS_30	1.4	20	5.7	0.39	3.1	0.09
MHS_31	3.6	20	14.3	0.97	7.8	0.22
MHS_32	13.4	18	42.3	3.60	20.2	0.71
MHS_33	2.8	20	7.7	0.74	3.7	0.13
MHS_34	4.9	20	18.2	1.32	9.3	0.28
MHS_35	8.2	5	27.6	1.87	8.5	0.33
MHS_36	1.9	20	7.2	0.57	3.8	0.13
MHS_37	0.8	7	2.2	0.21	0.7	0.04
MHS_38	3.12	20	13.0	0.94	7.6	0.23
MHS_39	7.86	20	30.2	2.33	16.2	0.54
MHS_40	3.8	20	17.1	1.58	15.7	0.39
MHS_41	3.2	46	14.8	1.42	18.4	0.37
MHS_42	1.7	5	5.7	0.51	3.3	0.13
MHS_43	4.3	20	13.6	1.16	12.7	0.26
MHS_44	2.2	20	7.9	0.60	4.0	0.13
MHS_45	37.3	20	68.8	9.17	30.3	1.45
MHS_46	5.6	20	10.2	1.36	3.1	0.26
MHS_47	10.4	20	32.1	2.76	13.5	0.55
MHS_48	20.2	20	40.9	5.11	13.5	0.98
MHS_49	1.3	19	5.7	0.36	4.4	0.09
MHS_50	21.5	20	61.8	5.76	29.8	1.08
MHS_51	2.2	0	9.7	0.64	7.7	0.19
MHS_52	13.4	20	28.6	3.39	13.0	0.56
MHS_53	13.9	17	33.2	3.56	13.5	0.58
MHS_55	1.4	20	5.4	0.39	2.8	0.08
MHS_56	6.0	20	17.4	1.61	8.4	0.31
MHS_57	23.1	20	48.2	5.89	21.9	0.98
MHS_58	3.3	20	11.6	0.97	5.9	0.21
MHS_59	11.3	20	32.9	3.21	15.8	0.65
MHS_60	3.8	20	16.7	1.06	8.4	0.23
MHS_61	9.4	20	20.4	2.42	9.2	0.41
MHS_62	10.0	20	19.5	2.48	8.7	0.40
MHS_63	12.3	26	33.4	3.43	18.7	0.69

Table 13.2
Watershed Modeling Results for Subwatersheds in the Minnehaha Creek South East Drainage Area

Watershed Information			100-Year Storm Results 24-Hour Event		10-Year Storm Results 1/2-Hour Event	
Watershed ID	Total Area (ac)	% Impervious Area	Peak Runoff Rate (cfs)	Total Volume Runoff (ac-ft)	Peak Runoff Rate (cfs)	Total Volume Runoff (ac-ft)
MHS_64	6.7	19	26.0	1.84	10.4	0.35
MHS_65	7.4	20	28.5	2.01	10.0	0.36
MHS_66	2.5	0	8.2	0.60	4.5	0.16
MHS_67	4.6	20	18.8	1.28	10.6	0.29
MHS_68	3.9	20	7.4	0.96	8.5	0.23
MHS_69	1.1	20	4.9	0.31	1.9	0.06
MHS_70	3.4	20	13.1	0.92	4.4	0.16
MHS_71	3.5	19	8.2	0.91	6.7	0.21
MHS_72	3.6	13	14.6	0.95	3.8	0.16
MHS_73	2.4	7	9.8	0.61	4.1	0.13
MHS_74	1.4	20	6.4	0.48	6.3	0.13
MHS_75	2.0	0	6.2	0.43	3.7	0.11
MHS_76	2.5	20	10.5	0.69	6.0	0.16
MHS_77	3.1	20	9.5	0.81	6.6	0.13
MHS_79	2.1	20	8.5	0.68	4.7	0.17
MHS_80	3.5	20	14.4	0.96	8.0	0.21
MHS_81	5.0	13	16.4	0.87	7.5	0.25
MHS_82	2.0	20	6.9	0.56	3.4	0.11
MHS_83	4.3	20	16.6	1.19	11.6	0.40
MHS_84	2.4	20	7.3	0.67	4.2	0.14
MHS_86	2.1	20	8.1	0.70	3.9	0.14
MHS_87	2.6	20	10.1	0.71	5.6	0.16
MHS_88	1.8	10	7.9	0.47	4.6	0.11
MHS_89	0.7	20	3.1	0.14	2.1	0.05
ML_1	6.1	19	21.5	1.68	10.4	0.34
ML_10	4.0	21	17.9	1.13	12.2	0.28
ML_11	4.9	20	16.3	1.33	7.8	0.26
ML_12	9.5	20	30.1	2.54	14.4	0.49
ML_13	42.5	36	87.0	12.42	35.6	2.41
ML_14	5.0	22	14.6	1.35	2.3	0.12
ML_15	2.0	20	8.4	0.55	4.7	0.12
ML_2	7.2	20	30.8	1.97	17.9	0.46
ML_3	26.5	20	86.2	7.11	41.4	1.37
ML_4	19.4	18	56.7	5.07	26.2	0.92
ML_5	5.8	20	22.7	1.58	11.7	0.34
ML_6	4.5	20	17.4	1.22	8.9	0.26
ML_7	3.0	17	11.6	0.81	5.6	0.17
ML_8	27.7	42	124.5	9.39	55.0	1.60
ML_9	9.5	19	33.8	2.53	16.2	0.51

Table 13.3
Hydraulic Modeling Results for XP-SWMM Subwatersheds/Nodes in the Minnehaha Creek South East Drainage Area

Subwatershed or Node	Downstream Conduit	100-Year Storm Results 24-Hour Event				10-Year Storm Results 1/2-Hour Event			
		Flood Elevation (ft)[3]	Type of Storage[4]	NWL (ft)	Flood Bounce (ft)	Node Name	Flood Elevation (ft)	NWL (ft)	Flood Bounce (ft)
1602	outfall	856.9				1602	856.9		
1754	1846P	864.9				1754	864.8		
1758	outfall	858.7				1758	858.7		
1760	outfall	858.7				1760	858.3		
1762	outfall	864.9				1762	864.8		
1764	outfall	851.0				1764	850.7		
1766	1151	863.0				1766	862.8		
1767	1805	851.1				1767	850.7		
1769	1153	875.3				1769	875.1		
1770	outfall	854.3				1770	854.4		
1771	outfall	870.7				1771	871.1		
1775	1157	881.0				1775	880.7		
1776	1158	878.6				1776	878.1		
1778	outfall	853.9				1778	853.6		
1780	1163	882.3				1780	881.9		
1784	1168	870.4				1784	870.3		
1786	1170	870.2				1786	870.0		
1788	outfall	856.3				1788	856.3		
1791	outfall	862.8				1791	862.6		
1793	1174	863.9				1793	863.7		
1794	1175	862.4				1794	862.0		
1796	1177	859.7				1796	859.1		
1798	outfall	856.0				1798	855.8		
1802	1181	(861)	ST			1802	861.3		
1806	outfall	857.4				1806	857.3		
1804	outfall	857.3				1804	857.2		
1808	1185	894.1				1808	893.9		
1809	1186	894.0				1809	893.9		
1810	1187	893.7				1810	893.5		
1811	1188	892.6				1811	892.5		
1812	1189	891.8				1812	891.7		
1813	1190	891.3				1813	891.1		
1814	1191	889.6				1814	889.5		
1815	1192	888.8				1815	888.6		
1820	1196	890.3				1820	889.6		
1822	1198	886.4	ST			1822	886.1		
1823	1954	886.4				1823	885.8		
1824	1845P	885.4	ST			1824	884.2		
1826	1201	887.7				1826	886.8		
1828	1203	886.7				1828	886.7		
1830	1206	881.1				1830	876.5		
1833	1209	877.4				1833	873.9		
1834	1217	876.6				1834	871.6		
1835	1211	880.2				1835	875.6		
1836	1212	877.4				1836	872.6		
1838	1213	865.2				1838	863.9		
1839	outfall/weir	858.2				1839	857.4		
1840	1214	870.3				1840	867.4		
1844	1220	878.9				1844	873.5		
1845	1221	879.1				1845	873.6		
1846	1222	879.3				1846	873.7		
1848	1224	879.6				1848	873.9		

D R A F T

Table 13.3
Hydraulic Modeling Results for XP-SWMM Subwatersheds/Nodes in the Minnehaha Creek South East Drainage Area

Subwatershed or Node	Downstream Conduit	100-Year Storm Results 24-Hour Event				10-Year Storm Results 1/2-Hour Event			
		Flood Elevation (ft)[3]	Type of Storage[4]	NWL (ft)	Flood Bounce (ft)	Node Name	Flood Elevation (ft)	NWL (ft)	Flood Bounce (ft)
1849	1225	879.9				1849	878.8		
1854	1231	882.8				1854	882.6		
1856	1232	883.1				1856	882.0		
1858	1234	882.2				1858	880.9		
1859	1235	881.9				1859	879.7		
1860	1236	883.5				1860	880.1		
1861	1237	885.5				1861	882.0		
1863	1239	891.4	ST			1863	880.3		
1865	1241	891.6				1865	880.6		
1868	1244	893.0				1868	882.9		
1904	outfall	843.5				1904	843.5		
1993	1803	858.6				1993	857.7		
2000	outfall	860.5				2000	860.5		
2003	1590	866.2				2003	862.7		
2005	1592	866.4				2005	863.5		
2007	1595	876.4				2007	876.4		
2008	1596	878.6				2008	878.0		
2009	1597	880.8				2009	879.7		
2011	1599	885.0				2011	882.3		
2012	1600	885.3				2012	882.8		
2111	1673	866.7				2111	866.6		
2112	1675	863.8				2112	863.6		
2114	1677	862.7				2114	862.0		
2116	1678	862.0				2116	861.3		
2118	1679	860.9				2118	860.3		
2119	1681	859.1				2119	858.9		
2123	1804	859.0				2123	857.4		
2125	1684	860.1				2125	858.5		
2127	1686	860.4				2127	858.9		
2130	1689	865.5				2130	862.9		
2131	1690	865.7				2131	863.2		
2132	1691	869.7				2132	869.7		
2134	1693	868.9				2134	865.5		
2136	1695	879.3				2136	875.8		
2240	1779	(863)				2240	860.6		
2241	outfall	859.1				2241	859.1		
2247	outfall	869.6				2247	869.5		
2257	outfall	864.4				2257	864.4		
2259	outfall	881.0				2259	881.0		
2261	outfall	878.3				2261	878.1		
2263	outfall	867.6				2263	866.9		
2265	outfall	869.9				2265	869.9		
2281	outfall	850.7				2281	850.3		
2335	outfall	872.1				2335	872.1		
2336	1778P	864.3				2336	864.2		
2338	1848P	879.9				2338	876.4		
2340	1850	880.8	ST			2340	878.3		
2342	1852P	880.1				2342	878.8		
2425	1933	890.6				2425	890.1		
LP_1	1674	882.2				LP_1	881.3		
LP_2	1682	859.9	ST			LP_2	858.9		
LP_3	1680	860.9				LP_3	860.2		

D R A F T

Table 13.3
Hydraulic Modeling Results for XP-SWMM Subwatersheds/Nodes in the Minnehaha Creek South East Drainage Area

Subwatershed or Node	Downstream Conduit	100-Year Storm Results 24-Hour Event				10-Year Storm Results 1/2-Hour Event			
		Flood Elevation (ft)[3]	Type of Storage[4]	NWL (ft)	Flood Bounce (ft)	Node Name	Flood Elevation (ft)	NWL (ft)	Flood Bounce (ft)
LP_4	1676	865.6				LP_4	864.1		
LP_5	1582	880.7				LP_5	877.9		
LP_6	1672	869.4				LP_6	869.3		
LP_7	1685	864.9	ST			LP_7	863.3		
LP_8	1692	881.4	ST			LP_8	878.5		
LP_9	1688	865.0	ST			LP_9	862.1		
LP_10	1687	863.4				LP_10	860.6		
LP_11	1593	875.0	ST			LP_11	874.8		
LP_12	1931	861.0	ST			LP_12	860.9		
LP_13	1601	885.3	ST			LP_13	884.1		
LP_14	1841	(861)	P	855.0	3.2	LP_14	857.3	856.4	0.9
LP_15	1696	884.3	ST			LP_15	879.0		
LP_16	1694	879.2				LP_16	875.6		
LP_17	1588	862.5				LP_17	862.2		
LP_18	1591	866.5				LP_18	864.5		
LP_19	1589	865.0				LP_19	861.2		
LP_20	1617	892.3				LP_20	892.1		
LP_21	landlocked	862.6	BYD	858.6	4.0	LP_21	860.5	858.6	1.9
LP_22	1584	863.3				LP_22	858.5		
LP_23	1598	883.1				LP_23	881.4		
LP_24	landlocked	884.6	BYD	882.8	1.8	LP_24	883.9	882.8	1.1
LP_25	outfall/weir	858.2	P	856.5	1.7	LP_25	857.4	856.5	0.9
LP_26	between bays	(861)	P	855.0		LP_26	857.6	856.5	1.1
LP_27	1602	883.9	ST			LP_27	882.2		
LP_28	landlocked	885.5	BYD	884.0	1.5	LP_28	885.3	884.0	1.3
MHS_1	1172	(859)				MHS_1	866.1		
MHS_2	1840P	870.6				MHS_2	870.6		
MHS_3	1148	(854)				MHS_3	868.4		
MHS_4	landlocked	875.4	BYD	872.4	3.0	MHS_4	873.7	872.4	1.3
MHS_5	1147	882.5				MHS_5	881.1		
MHS_6	1833P	891.4	ST			MHS_6	889.8		
MHS_7	1146	(863)	ST			MHS_7	867.5		
MHS_8	907	858.4				MHS_8	858.1		
MHS_9	1178	859.2				MHS_9	858.6		
1804	outfall	857.3				1804	857.2		
MHS_10	1183	862.1				MHS_10	860.1		
MHS_11	1176	862.3				MHS_11	861.2		
MHS_12	1179	863.2				MHS_12	862.4		
MHS_13	1215	871.3				MHS_13	871.0		
MHS_14	landlocked	882.9	BYD	880.7	2.2	MHS_14	882.0	880.7	1.3
MHS_15	1216	876.1				MHS_15	871.2		
MHS_16	landlocked	879.7	BYD	877.1	2.6	MHS_16	878.7	877.1	1.6
MHS_17	1219	882.3	ST			MHS_17	873.4		
MHS_18	1195	891.1	BYD	888.5	2.6	MHS_18	891.2	888.5	2.7
MHS_19	1200	886.9	P	885.0	1.9	MHS_19	885.7	885.0	0.7
MHS_20	1242	892.8				MHS_20	881.0		
MHS_21	1184	897.1				MHS_21	895.8		
MHS_22	1243	894.3	P	893.5	0.8	MHS_22	893.8	893.5	0.3
MHS_23	1143	894.9				MHS_23	894.9		
MHS_24	1784P	895.3	ST			MHS_24	894.3		
MHS_25	ditch	896.9				MHS_25	896.9		
MHS_26	1226	880.1				MHS_26	878.9		

Table 13.3
Hydraulic Modeling Results for XP-SWMM Subwatersheds/Nodes in the Minnehaha Creek South East Drainage Area

Subwatershed or Node	Downstream Conduit	100-Year Storm Results 24-Hour Event				10-Year Storm Results 1/2-Hour Event			
		Flood Elevation (ft)[3]	Type of Storage[4]	NWL (ft)	Flood Bounce (ft)	Node Name	Flood Elevation (ft)	NWL (ft)	Flood Bounce (ft)
MHS_27	landlocked	898.2	BYD	896.4	1.8	MHS_27	898.1	896.4	1.7
MHS_28	overland path	904.2				MHS_28	904.1		
MHS_29	landlocked	897.0	BYD	895.0	2.0	MHS_29	896.1	895.0	1.1
MHS_30	1229	891.0				MHS_30	883.0		
MHS_31	1150	(854.5)				MHS_31	875.6		
MHS_32	1162	881.6				MHS_32	881.4		
MHS_33	1161	(857)				MHS_33	873.1		
MHS_34	overland path	888.1				MHS_34	888.1		
MHS_35	landlocked	898.8	BYD	895.1	3.7	MHS_35	896.2	895.1	1.1
MHS_36	1169	(861)				MHS_36	864.9		
MHS_37	1783P	(859)				MHS_37	872.0		
MHS_38	creek	NA				MHS_38	NA		
MHS_39	creek	NA				MHS_39	NA		
MHS_40	1182	(861)				MHS_40	861.6		
MHS_41	1180	859.9	P	857.0	2.9	MHS_41	857.9	857.0	0.9
MHS_42	1870	876.7	BYD	874.7	2.0	MHS_42	875.0	874.7	0.3
MHS_43	1194	895.1				MHS_43	895.0		
MHS_44	1193	885.2				MHS_44	884.0		
MHS_45	1173	872.7				MHS_45	872.5		
MHS_46	1208	879.0				MHS_46	875.0		
MHS_47	1953P	882.0				MHS_47	879.6		
MHS_48	1238	889.6				MHS_48	879.9		
MHS_49	1790	(869)				MHS_49	875.3		
MHS_50	1164	884.7				MHS_50	884.4		
MHS_51	landlocked	882.9	BYD	880.2	2.7	MHS_51	882.0	880.2	1.8
MHS_52	1167	876.2				MHS_52	876.0		
MHS_53	1223	882.2	ST			MHS_53	873.9		
MHS_55 [2]	1152	(856)				MHS_55	879.1		
MHS_56 [1]	1159	880.6				MHS_56	880.2		
MHS_57	1230	884.5				MHS_57	883.8		
MHS_58	1233	882.9				MHS_58	881.6		
MHS_59	1228	880.1	BYD	867.7	12.5	MHS_59	879.0	867.7	11.3
MHS_60	1273	(854.5)				MHS_60	862.5		
MHS_61	1205	885.0				MHS_61	881.6		
MHS_62	1165	884.9	ST			MHS_62	879.8		
MHS_63	ditch	862.5				MHS_63	862.4		
MHS_64	1149	863.8				MHS_64	854.1		
MHS_65	1218	883.9				MHS_65	872.7		
MHS_66	1240	894.8	BYD	886.1	8.7	MHS_66	893.1	886.1	7.0
MHS_67	1794P	(867)				MHS_67	877.2		
MHS_68	overland path	896.6	ST			MHS_68	896.6		
MHS_69	1793P	(867)				MHS_69	873.3		
MHS_70	1792	(867)				MHS_70	887.9		
MHS_71	1791P	(867)				MHS_71	886.9		
MHS_72	1815P	877.0				MHS_72	876.8		
MHS_73	1844P	879.2				MHS_73	876.8		
MHS_74	1166	872.3	BYD	867.3	5.1	MHS_74	872.0	867.3	4.8
MHS_75	1849	881.6	BYD	877.4	4.2	MHS_75	880.0	877.4	2.7
MHS_76	1847P	880.5	BYD	874.9	5.6	MHS_76	877.4	874.9	2.5
MHS_77	overland path	882.5	ST			MHS_77	882.4		
MHS_79	1851P	880.1	ST			MHS_79	879.1		
MHS_80	1932	895.6	ST			MHS_80	892.1		

Table 13.3
Hydraulic Modeling Results for XP-SWMM Subwatersheds/Nodes in the Minnehaha Creek South East Drainage Area

Subwatershed or Node	Downstream Conduit	100-Year Storm Results 24-Hour Event				10-Year Storm Results 1/2-Hour Event			
		Flood Elevation (ft)[3]	Type of Storage[4]	NWL (ft)	Flood Bounce (ft)	Node Name	Flood Elevation (ft)	NWL (ft)	Flood Bounce (ft)
MHS_81	1944	(861)	P	856.0	2.2	MHS_81	857.4	856.0	1.4
MHS_82	1197	890.2	ST			MHS_82	889.4		
MHS_83	1955	886.3	ST			MHS_83	885.4		
MHS_84	1202	888.2				MHS_84	887.2		
MHS_86	1204	881.9				MHS_86	878.2		
MHS_87	1207	880.3	ST			MHS_87	875.9		
MHS_88	1961	895.6	BYD	891.4	4.2	MHS_88	895.1	891.4	3.7
MHS_89	landlocked	884.0	BYD	881.6	2.4	MHS_89	883.3	881.6	1.7
102	2	919.9				102	915.7		
103	3	913.1				103	910.0		
104	1949	909.7				104	908.4		
109	8	897.4				109	897.4		
110	9	895.1				110	895.1		
112	11	900.5				112	898.2		
113	12	895.8				113	889.7		
118	17	903.0				118	900.0		
119	outfall	885.0				119	885.0		
2374	1882	911.6				2374	911.6		
2375	1883	910.3				2375	910.3		
2376	1884	907.1				2376	907.0		
2444	1950	908.1				2444	907.6		
ML_1	6	896.3				ML_1	896.1		
ML_10	1965	916.0	BYD	912.6	3.3	ML_10	915.0	912.6	2.4
ML_11	1	935.9				ML_11	934.4		
ML_12	1826	935.8	ST			ML_12	934.7		
ML_13	908	897.8	ST			ML_13	897.8		
ML_14	1820	912.8	ST			ML_14	910.6		
ML_15	1821	912.9	ST			ML_15	912.5		
ML_2	5	907.0				ML_2	906.9		
ML_3	15	902.5	ST			ML_3	897.2		
ML_4	10	916.5				ML_4	912.1		
ML_5	7	907.7				ML_5	907.0		
ML_6	16	916.2	ST			ML_6	912.4		
ML_7	landlocked	928.6	BYD	924.3	4.3	ML_7	926.5	924.3	2.2
ML_8	1966 (force main)	891.8	P	887.4	4.4	ML_8	888.4	887.4	1.0
ML_9	1881	913.7				ML_9	913.6		

[1] Catch basin inflows limited to 24 cfs
[2] Catch basin inflows limited to 15 cfs
[3] Flood elevations in parenthesis indicate a 100-year flood elevation based on the 100-year flood elevation of Minnehaha Creek, according to the Federal Emergency Management Agency Flood Insurance Study for the City of Edina
[4] ST=Street, BYD=Back Yard Depression, P=Pond

Table 13.4
Conduit Modeling Results for Subwatersheds in the Minnehaha Creek South East Drainage Areas

Conduit ID	Upstream Node	Downstream Node	Conduit Shape	Conduit Dimensions* (ft)	Roughness Coefficient	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Conduit Length (ft)	Slope	100Y Peak Flow Through Conduit (cfs)	10Y Peak Flow Through Conduit (cfs)
907	MHS_8	1602	Circular	1.25	0.013	856.3	856	150	0.20	5.3	4.6
1143	MHS_23	1754	Circular	1.25	0.024	887.1	863.6	340	6.91	10.5	10.5
1146	MHS_7	1758	Circular	1.25	0.013	860.5	857.5	390	0.77	9.9	9.6
1147	MHS_5	1760	Circular	1	0.010	880.67	857.8	261	8.76	14.7	5.8
1148	MHS_3	1762	Circular	1.5	0.024	867.87	864.29	39	9.18	6.4	4.1
1149	MHS_64	1764	Circular	1.5	0.013	851	849.49	285	0.53	20.9	10.4
1150	MHS_31	1766	Circular	1.5	0.013	874.75	872.15	30	8.67	14.3	7.8
1151	1766	1767	Circular	1.5	0.013	862.3	854.76	49	15.39	14.3	7.8
1152	MHS_55 (2)	1769	Circular	2.75	0.013	871.43	869.74	98	1.73	34.0	32.9
1153	1769	1770	Circular	1.25	0.013	864.19	853.14	75	14.73	26.8	26.7
1154	1769	1771	Circular	1	0.013	864.19	870.23	26	-23.23	8.9	8.7
1157	1775	MHS_56	Circular	1	0.013	874.68	873.55	303	0.37	4.7	4.7
1158	1776	MHS_55 (2)	Circular	2.25	0.013	872.66	871.43	168	0.73	26.3	26.2
1159(1)	MHS_56	1776	Circular	2.25	0.013	873.55	872.66	101	0.88	26.6	26.6
1160	MHS_56	MHS_33	Circular	1.25	0.013	876	874.32	145	1.16	12.1	12.0
1161	MHS_33	1778	Circular	1.25	0.013	871.87	852.65	280	6.86	16.6	15.1
1162	MHS_32	1775	Circular	1	0.013	875.4	874.68	327	0.22	3.5	4.3
1163	1780	MHS_32	Circular	2	0.013	876.6	875.4	323	0.37	9.9	10.1
1164	MHS_50	1780	Circular	2	0.013	877.6	876.6	325	0.31	18.6	18.8
1165	MHS_62	MHS_74	Circular	1	0.013	878.92	867.25	152	7.68	10.6	8.5
1166	MHS_74	1784	Circular	1	0.013	867.25	866	150	0.83	4.3	4.8
1167	MHS_52	1784	Circular	1.25	0.013	869.2	866	302	1.06	8.9	8.9
1168	1784	1786	Circular	1.25	0.013	866	865.3	218	0.32	6.6	6.7
1169	MHS_36	1788	Circular	1	0.013	863.8	855.43	175	4.78	8.4	8.4
1170	1786	MHS_1	Circular	1.25	0.013	865.3	863.5	235	0.77	7.3	8.3
1172	MHS_1	1791	Circular	1.25	0.013	863.5	861.8	42	4.05	12.8	10.3
1173	MHS_45	1793	Circular	1.5	0.013	866.32	858.3	272	2.95	21.4	21.2
1174	1793	1794	Circular	1.5	0.013	858.3	856.12	47	4.64	26.7	24.5
1175	1794	MHS_11	Circular	2.75	0.013	856.12	856	16	0.75	38.8	31.3
1176	MHS_11	1796	Circular	2.75	0.013	856	853.9	234	0.90	53.2	46.2
1177	1796	MHS_9	Circular	3	0.013	853.9	853.6	62	0.48	46.4	43.9
1178	MHS_9	1798	Circular	3.5	0.024	853.6	853.6	169	0.00	57.8	50.5
1179	MHS_12	MHS_41	Circular	1.5	0.024	857.34	851.5	134	4.36	10.0	10.6
1180	MHS_41	1802	Circular	1.25	0.024	857	856.86	142	0.10	-6.0	-4.5
1181	1802	MHS_40	Circular	1.25	0.013	856.86	856.72	36	0.39	8.1	-5.9
1182	MHS_40	MH1804	Circular	1.5	0.024	856.72	856.02	125	0.56	11.4	9.7
1183	MHS_10	1806	Circular	1.5	0.013	856.6	856	145	0.41	16.5	12.5
1184	MHS_21	1808	Circular	1.25	0.013	891.85	888.7	271	1.16	7.0	5.5
1185	1808	1809	Circular	1.25	0.013	888.7	888.4	22	1.36	5.3	4.4
1186	1809	1810	Circular	1.25	0.013	888.4	888.2	39	0.51	8.1	9.2
1187	1810	1811	Circular	1.25	0.013	888.2	886.9	162	0.80	8.0	9.0
1188	1811	1812	Circular	1.25	0.013	886.9	886.05	94	0.90	8.2	9.1
1189	1812	1813	Circular	1.25	0.013	886.05	885.45	62	0.97	8.2	9.2
1190	1813	1814	Circular	1.25	0.013	885.45	884	123	1.18	8.4	9.5
1191	1814	1815	Circular	1.25	0.013	884	883.05	57	1.67	8.7	10.0
1192	1815	MHS_61	Circular	1.25	0.013	883.05	878.4	303	1.53	8.7	10.4
1193	MHS_44	MHS_61	Circular	2	0.013	878.8	877	315	0.57	13.3	7.7
1193	MHS_44	MHS_61	Circular	2	0.013	878.8	877	315	0.57	13.2	7.7
1194	MHS_43	1809	Circular	1	0.010	890.63	888.4	407	0.55	4.7	5.4

Table 13.4
Conduit Modeling Results for Subwatersheds in the Minnehaha Creek South East Drainage Areas

Conduit ID	Upstream Node	Downstream Node	Conduit Shape	Conduit Dimensions* (ft)	Roughness Coefficient	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Conduit Length (ft)	Slope	100Y Peak Flow Through Conduit (cfs)	10Y Peak Flow Through Conduit (cfs)
1195	MHS_18	1820	Circular	0.75	0.020	888.5	887.4	130	0.85	1.9	2.4
1196	1820	MHS_82	Circular	1	0.024	887.4	887.1	29	1.03	1.9	2.4
1196	1820	MHS_82	Circular	1	0.024	887.4	887.1	29	1.03	3.1	2.4
1197	MHS_82	1822	Circular	1.25	0.024	884.2	882.5	167	1.02	5.3	5.0
1198	1822	1823	Circular	1.25	0.013	882.5	882.2	34	0.88	5.1	4.9
1200	MHS_19	1826	Circular	0.75	0.010	884.54	882.97	142	1.11	-2.4	-1.9
1201	1826	MHS_84	Circular	1	0.024	882.97	882.34	28	2.29	-2.4	-2.0
1202	MHS_84	1828	Circular	1	0.013	882.34	880.95	128	1.09	3.8	2.9
1203	1828	MHS_44	Circular	1	0.024	880.95	880.7	350	0.07	2.1	1.7
1204	MHS_86	1830	Circular	2	0.013	873.35	871.54	206	0.88	19.5	18.9
1205	MHS_61	1830	Circular	2	0.013	877	875.24	327	0.54	28.7	25.0
1206	1830	MHS_87	Circular	2	0.013	875.3	874.6	140	0.50	20.4	8.7
1207	MHS_87	MHS_46	Circular	2	0.013	874.6	873.3	248	0.52	17.3	12.5
1208	MHS_46	1833	Circular	2	0.013	873.3	872.3	116	0.86	29.0	19.1
1209	1833	1834	Circular	2.5	0.013	872.3	870.86	131	1.10	28.7	19.0
1210	1830	1835	Circular	2.5	0.013	871.5	870.8	71	1.04	40.3	40.5
1211	1835	1836	Circular	2.5	0.013	870.8	867.1	467	0.80	39.1	38.8
1212	1836	MHS_15	Circular	2.5	0.013	867.1	865.9	131	0.88	39.0	38.9
1213	1838	1839	Circular	4	0.013	860	857.1	298	0.97	127.9	107.3
1214	1840	1838	Circular	4	0.013	861.45	860	547	0.27	127.9	107.8
1215	MHS_13	1840	Circular	1	0.013	867.2	867.05	50	0.30	6.8	6.9
1216	MHS_15	1840	Circular	4	0.013	862.6	861.45	605	0.19	124.1	101.1
1217	1834	MHS_15	Circular	4	0.013	862.91	862.79	28	0.43	83.9	62.7
1218	MHS_65	1834	Circular	3.5	0.013	864.25	862.91	333	0.40	68.0	46.5
1219	MHS_17	MHS_65	Circular	3.5	0.013	864.9	864.25	328	0.20	67.6	42.5
1220	1844	MHS_17	Circular	3.5	0.013	864.45	864.9	108	-0.42	58.5	34.8
1221	1845	1844	Circular	3.5	0.013	865.5	864.45	220	0.48	58.5	34.7
1222	1846	1845	Circular	3.5	0.013	865.7	865.5	172	0.12	58.5	33.8
1223	MHS_53	1846	Circular	3.5	0.013	865.8	865.7	162	0.06	58.5	33.0
1224	1848	MHS_53	Circular	3.5	0.013	865.5	865.8	160	-0.19	50.5	28.1
1225	1849	1848	Circular	3.5	0.013	865.4	865.5	16	-0.63	48.7	27.9
1226	MHS_26	1849	Circular	3.5	0.013	866.25	865.4	153	0.56	48.6	24.7
1228	MHS_59	MHS_26	Circular	3.5	0.013	867.65	867.45	27	0.74	-79.6	-32.9
1229	MHS_30	1854	Circular	1.25	0.013	881.75	879	288	0.95	4.0	3.9
1230	MHS_57	1856	Circular	1.25	0.013	879.23	878.46	230	0.34	6.1	6.7
1231	1854	MHS_58	Circular	1.25	0.013	879	878.1	225	0.40	2.9	4.5
1232	1856	MHS_58	Circular	1.25	0.013	878.46	877.87	147	0.40	5.8	6.1
1233	MHS_58	1858	Circular	1.25	0.013	877.87	877.1	188	0.41	6.2	6.9
1234	1858	1859	Circular	1.25	0.013	877.1	875.82	211	0.61	6.4	6.6
1235	1859	MHS_59	Circular	1.25	0.013	875.82	873	219	1.29	8.3	6.2
1236	1860	MHS_26	Circular	3	0.013	867.8	866.25	340	0.46	65.9	29.5
1237	1861	1860	Circular	3	0.013	871.25	867.8	120	2.88	76.8	29.2
1238	MHS_48	1861	Circular	3	0.013	874.3	871.25	279	1.09	76.9	29.3
1239	1863	MHS_48	Circular	3	0.013	875.6	874.3	362	0.36	51.0	18.9
1240	MHS_66	1865	Circular	1	0.013	886.07	884.4	164	1.02	8.0	7.1
1241	1865	1863	Circular	3	0.013	878	875.6	394	0.61	38.3	25.1
1242	MHS_20	1865	Circular	3	0.013	879.8	878	360	0.50	38.1	15.2
1243	MHS_22	1868	Circular	2	0.013	893.5	888.4	220	2.32	12.8	1.3
1244	1868	MHS_20	Circular	2	0.013	882.5	882.1	50	0.80	18.9	1.3
1273	MHS_60	1904	Circular	1	0.024	859.34	842.65	97	17.24	8.4	8.4

Table 13.4
Conduit Modeling Results for Subwatersheds in the Minnehaha Creek South East Drainage Areas

Conduit ID	Upstream Node	Downstream Node	Conduit Shape	Conduit Dimensions* (ft)	Roughness Coefficient	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Conduit Length (ft)	Slope	100Y Peak Flow Through Conduit (cfs)	10Y Peak Flow Through Conduit (cfs)
1582	LP_5	LP_12	Circular	1	0.013	877.6	855.8	245	8.90	10.1	4.9
1584	LP_22	1993	Circular	2	0.013	855.71	855.42	288	0.10	27.3	13.4
1588	LP_17	2000	Circular	1.5	0.013	859.03	857.64	68	2.04	16.2	15.4
1589	LP_19	LP_26	Circular	3.5	0.013	858.7	857.33	185	0.74	121.9	77.4
1589	LP_19	LP_26	Circular	3.5	0.013	858.7	857.33	185	0.74	150.2	75.8
1590	2003	LP_19	Circular	1.5	0.013	860.0	858.7	62	2.05	20.1	21.6
1591	LP_18	2003	Circular	1.5	0.013	860.87	859.97	179	0.50	13.6	21.6
1592	2005	LP_19	Circular	3.5	0.013	862.2	858.7	285	1.23	55.9	34.9
1593	LP_11	2005	Circular	2	0.013	866.39	862.2	333	1.65	37.1	32.7
1595	2007	LP_11	Circular	2	0.013	866.5	866.39	175	0.06	25.4	23.6
1596	2008	2007	Circular	2	0.013	866.83	866.5	165	0.20	25.4	22.8
1597	2009	2008	Circular	2	0.013	867.15	866.83	162	0.20	25.4	22.8
1598	LP_23	2009	Circular	2	0.013	867.72	867.15	173	0.33	25.4	22.8
1599	2011	LP_23	Circular	1.5	0.013	871.76	870.9	165	0.52	10.3	6.8
1600	2012	2011	Circular	1.5	0.013	872.59	871.76	110	0.75	9.4	6.8
1601	LP_13	2012	Circular	1.5	0.013	874.14	872.59	290	0.53	7.9	8.0
1602	LP_27	LP_23	Circular	2	0.013	869.64	867.72	427	0.45	22.2	20.3
1617	LP_20	LP_27	Circular	1.5	0.013	880.0	875.0	660	0.75	14.0	13.3
1672	LP_6	2111	Circular	2	0.013	863.03	861.64	267	0.52	23.2	24.6
1673	2111	2112	Circular	2	0.013	861.6	859.6	250	0.80	23.2	23.3
1674	LP_1	2112	Circular	1	0.013	880.9	859.6	145	14.65	11.9	6.3
1675	2112	2114	Circular	2	0.013	859.64	857.35	248	0.92	22.4	22.4
1676	LP_4	2114	Circular	1	0.013	860.4	857.4	72	4.28	7.8	6.1
1677	2114	2116	Circular	2.5	0.013	857.9	856.7	215	0.52	25.8	23.7
1678	2116	LP_3	Circular	2.5	0.013	856.7	855.6	220	0.53	25.8	23.7
1679	2118	LP_3	Circular	1	0.013	858.0	855.6	60	4.07	-0.2	-1.5
1680	LP_3	2119	Circular	2.5	0.013	857.52	856.55	174	0.56	36.9	32.1
1681	2119	LP_25	Circular	2.5	0.013	856.55	856.1	120	0.38	36.8	32.6
1682	LP_2	LP_25	Circular	1.5	0.013	855.98	855.2	194	0.40	11.2	11.6
1684	2125	2123	Circular	1.5	0.010	856.9	855.9	170	0.58	11.3	10.4
1685	LP_7	2125	Circular	1.25	0.013	859	856.88	165	1.28	11.4	10.5
1686	2127	2123	Circular	2.5	0.010	856.4	855.9	100	0.50	40.4	30.7
1687	LP_10	2127	Circular	2.25	0.013	857.6	856.4	148	0.80	40.4	30.7
1688	LP_9	LP_10	Circular	2	0.013	858.0	857.6	102	0.42	25.8	20.1
1689	2130	LP_9	Circular	1.5	0.013	861.3	858.0	158	2.08	9.2	6.8
1690	2131	2130	Circular	1.5	0.013	862.0	861.3	29	2.31	7.1	6.7
1691	2132	2131	Circular	1	0.013	865.0	862.0	195	1.55	6.5	6.5
1692	LP_8	2132	Circular	1	0.013	875.1	865.0	138	7.32	10.3	8.8
1693	2134	LP_18	Circular	1.25	0.013	863.11	860.87	243	0.92	9.2	13.6
1694	LP_16	2134	Circular	1.25	0.013	874.74	863.11	293	3.97	12.2	13.9
1695	2136	LP_16	Circular	1.25	0.013	874.88	874.74	43	0.33	7.9	5.3
1696	LP_15	2136	Circular	1.25	0.013	878.2	874.9	401	0.84	7.9	5.3
1778P	2336	2240	Circular	2.5	0.013	863.6	859.3	140	3.07	11.7	10.5
1779	2240	2241	Circular	2.5	0.013	859.3	858	327	0.40	11.6	10.5
1783P	MHS_37	2247	Circular	1.5	0.013	871.8	869.3	44	5.68	2.2	0.7
1784P	MHS_24	MHS_66	Circular	1	0.013	887	886.07	162	0.58	5.7	5.3
1790	MHS_49	2257	Circular	1	0.013	865.7	863.4	234	1.00	9.6	7.4
1791P	MHS_71	2259	Circular	1.25	0.013	886.24	880.46	57	10.14	8.2	6.7
1792	MHS_70	2261	Circular	1	0.024	887.2	877.5	93	10.48	6.3	4.7
1793P	MHS_69	2263	Circular	1	0.013	872.97	866.61	92	6.95	10.3	1.9

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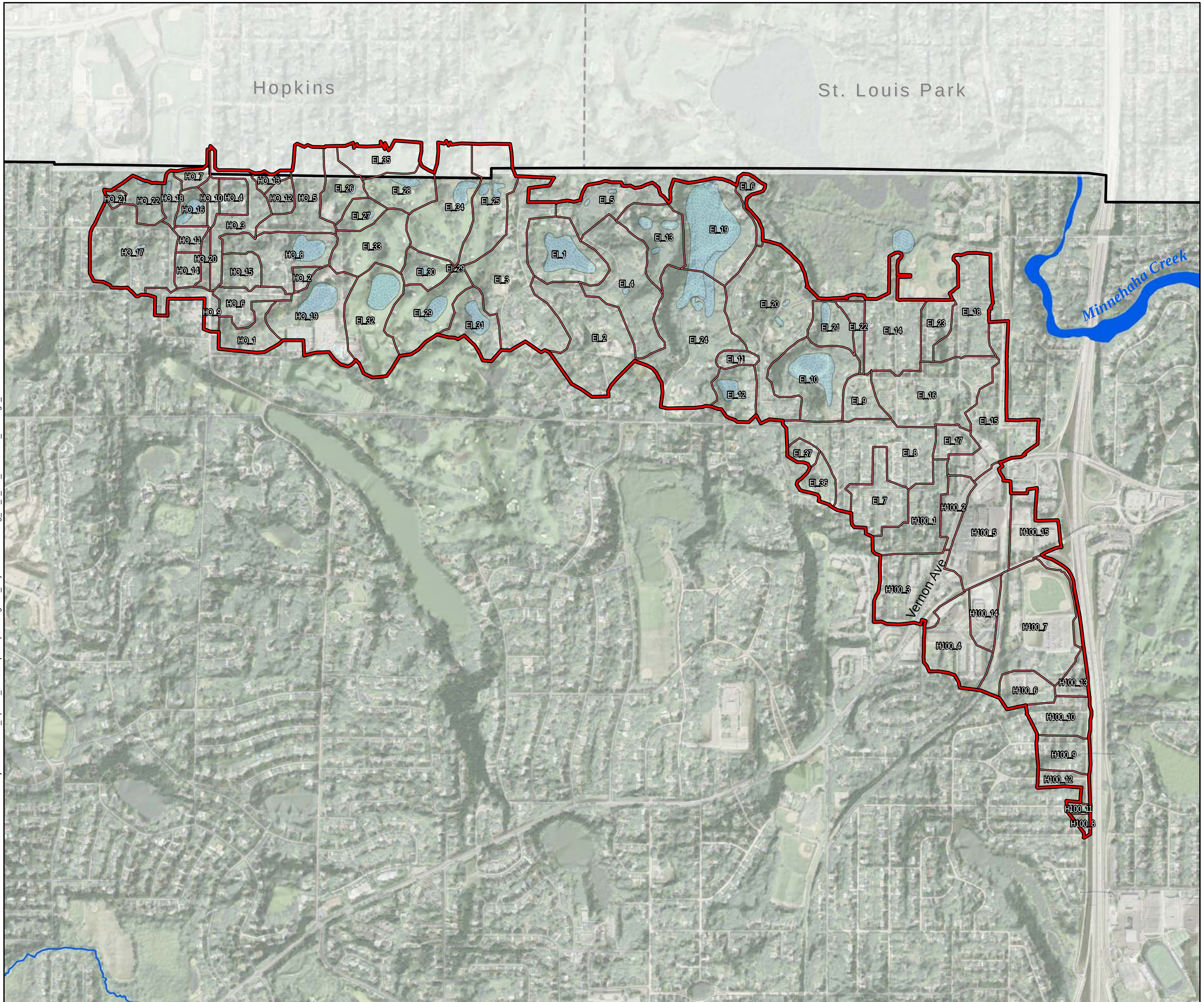
Table 13.4
Conduit Modeling Results for Subwatersheds in the Minnehaha Creek South East Drainage Areas

Conduit ID	Upstream Node	Downstream Node	Conduit Shape	Conduit Dimensions* (ft)	Roughness Coefficient	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Conduit Length (ft)	Slope	100Y Peak Flow Through Conduit (cfs)	10Y Peak Flow Through Conduit (cfs)
1794P	MHS_67	2265	Circular	1	0.013	872.02	868.86	86	3.67	10.7	10.5
1803	1993	LP_26	Circular	2.5	0.013	855.42	854.9	50	1.04	27.3	13.4
1804	2123	LP_14	Circular	3	0.013	854.4	853.4	80	1.21	50.9	41.1
1805	1767	2281	Circular	2.5	0.024	849.8	849.4	16	2.31	14.3	7.8
1815P	MHS_72	MHS_73	Circular	1	0.013	874.27	873.24	321	0.32	-3.0	2.1
1833P	MHS_6	MHS_23	Circular	1.25	0.013	888.3	887.1	169	0.71	-9.4	-8.7
1840P	MHS_2	1786	Circular	1.25	0.013	869.1	865.3	25	15.20	5.2	5.9
1841	LP_14	2334	Circular	2.5	0.013	855.0	853.5	150	1.00	53.8	44.9
1844P	MHS_73	2335	Circular	1	0.013	873.24	871.19	329	0.62	5.4	4.4
1845P	1824	MHS_44	Circular	1.25	0.013	879.2	878.8	24	1.67	9.9	6.0
1846P	1754	2336	Circular	2.5	0.013	863.6	863.6	36	0.00	11.7	10.5
1847P	MHS_76	2338	Circular	1.25	0.010	874.92	874.6	200	0.16	7.1	5.9
1848P	2338	MHS_46	Circular	1.25	0.013	874.6	873.9	181	0.39	7.1	5.9
1849	MHS_75	2340	Circular	1	0.010	877.35	875.85	181	0.83	4.2	5.9
1850	2340	MHS_86	Circular	1.25	0.013	874.25	873.85	27	1.48	13.2	6.4
1851P	MHS_79	2342	Circular	1	0.013	876.15	875	215	0.53	4.0	3.5
1852P	2342	MHS_56	Circular	1	0.013	875	873.39	151	1.07	4.0	3.5
1870	MHS_42	1848	Circular	1.25	0.013	874.7	874.2	62	0.81	6.4	8.6
1931	LP_12	LP_26	Circular	1	0.010	855.1	855.0	350	0.00	4.1	5.8
1932	MHS_80	2425	Circular	1	0.015	889.2	888.0	309	0.39	4.0	3.8
1933	2425	MHS_49	Circular	1	0.015	888	886	231	0.87	4.0	3.7
1944	MHS_81	LP_25	Circular	5	0.013	852.62	852.23	167	0.23	59.9	54.8
1953P	MHS_47	MHS_86	Circular	2	0.013	875	873.37	430	0.38	18.3	14.0
1954	1823	MHS_83	Circular	1.25	0.013	882.2	881.1	106	1.04	5.1	4.9
1955	MHS_83	1824	Circular	1.25	0.013	881.1	879.2	182	1.04	9.5	6.1
1961	MHS_88	MHS_43	Circular	1	0.010	891.4	890.4	145	0.69	3.3	4.1
1	ML_11	102	Circular	1.250	0.013	929.1	914.95	329.00	4.3	14	7.7
10	ML_4	112	Circular	1.500	0.013	910	892.84	220.00	7.8	28	26.0
11	112	113	Circular	1.500	0.013	892.84	887	75.00	7.8	28	26.0
12	113	ML_8	Circular	2.000	0.013	887	885.9	55.00	2.0	48	26.0
15	ML_3	ML_8	Circular	2.000	0.013	896	885	131.00	8.4	57	41.3
16	ML_6	118	Circular	1.000	0.013	895.7	895	220.00	0.3	10	9.6
17	118	ML_8	Circular	1.000	0.024	895	885	55.00	18.2	9	8.5
1966 (force main)	ML_8	119	Circular	1.000	0.02	907.59	911.36	NA	NA	4	4.0
1820	ML_14	ML_13	Circular	1.250	0.013	910	909.24	86.00	0.9	9	2.3
1821	ML_15	ML_13	Circular	1.000	0.013	908.44	907.76	332.00	0.7	4	3.7
1826	ML_12	ML_11	Circular	1.250	0.013	929.5	927.83	328.00	0.5	8	6.2
1881	ML_9	2374	Circular	1.250	0.013	907.48	905.08	80.00	3.0	9	9.4
1882	2374	2375	Circular	1.250	0.013	905.08	903.86	76.00	1.6	7	8.2
1883	2375	2376	Circular	1.250	0.013	903.86	900.42	215.00	1.6	7	7.4
1884	2376	ML_5	Circular	1.250	0.013	900.42	899.67	27.00	2.8	8	8.2
1949	104	2444	Circular	1.250	0.013	905	901.6	60.00	5.7	12	8.9
1950	2444	ML_2	Circular	1.250	0.013	901.6	900.2	42.00	3.3	12	9.1
1965	ML_10	ML_13	Circular	1.000	0.013	912.64	911.59	101.00	1.0	6	5.0
2	102	103	Circular	1.250	0.013	914.95	907.62	235.00	3.1	12	8.0
3	103	104	Circular	1.250	0.013	907.62	905	90.00	2.9	12	8.5
5	ML_2	ML_1	Circular	1.250	0.013	900.2	890	170.00	6.0	16	16.6
6	ML_1	ML_8	Circular	1.500	0.013	888	887.2	80.00	1.0	25	24.0
7	ML_5	109	Circular	1.250	0.013	899.67	889.71	293.00	3.4	12	11.9
8	109	110	Circular	1.250	0.013	889.71	888.86	85.00	1.0	9	9.5

Table 13.4
Conduit Modeling Results for Subwatersheds in the Minnehaha Creek South East Drainage Areas

Conduit ID	Upstream Node	Downstream Node	Conduit Shape	Conduit Dimensions* (ft)	Roughness Coefficient	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Conduit Length (ft)	Slope	100Y Peak Flow Through Conduit (cfs)	10Y Peak Flow Through Conduit (cfs)
9	110	ML_1	Circular	1.250	0.013	888.86	888	86.00	1.0	-6	7.5
908	ML_13	ML_8	Circular	3.500	0.013	886.56	886	48.00	1.2	105	46.5

[1] Catch basin inflows at node MHS_56 limited to 24 cfs
[2] Catch basin inflows at node MHS_55 limited to 15 cfs



City of Edina Boundary
Roads/Highways
Lake/Wetland
Creek/Stream
Minnehaha Creek - Northwest Drainage Basin
Subwatershed

Imagery Source: Aerials Express, 2008

N

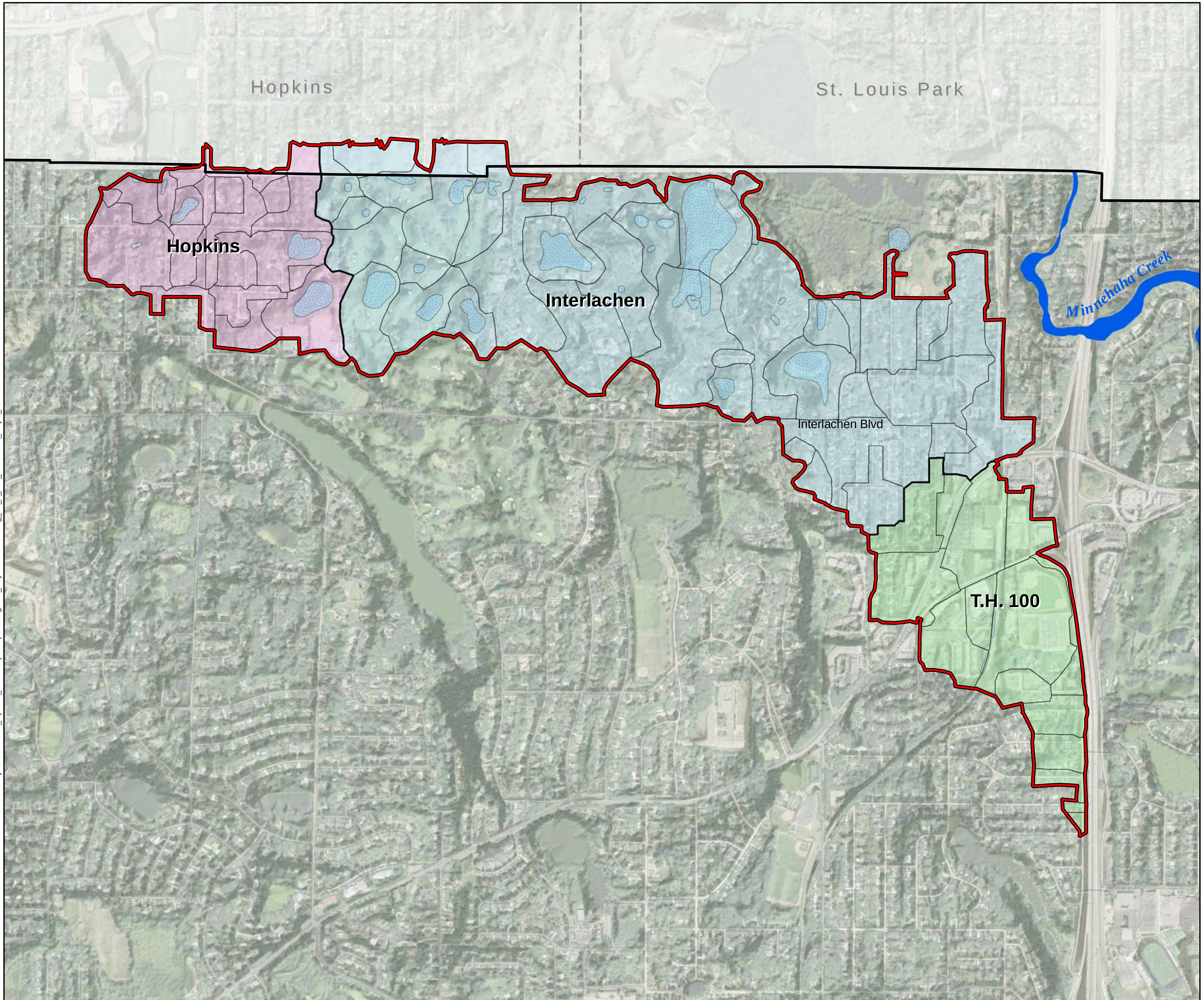
Feet
1,000 0 1,000

Meters
300 0 300

DRAFT

Figure 14.1

NORTHWEST MINNEHAHA CREEK DRAINAGE BASIN
Comprehensive Water Resource Management Plan
City of Edina, Minnesota



City of Edina Boundary
Roads/Highways
Creek/Stream
Lake/Wetland
Minnehaha Creek - Northwest Drainage Basin
Major Watershed
Subwatershed

Imagery Source: Aerials Express, 2008

N

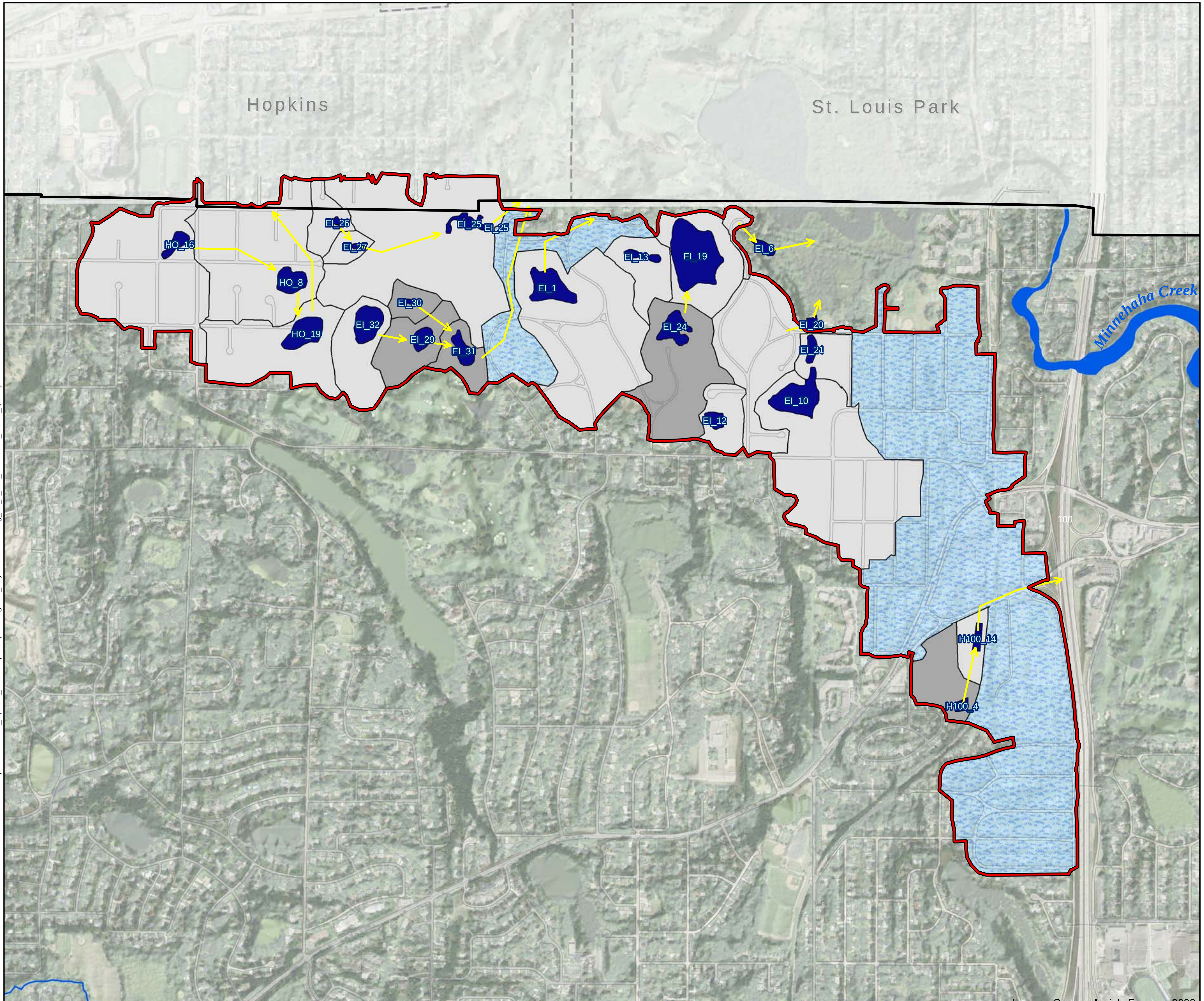
Feet
1,000 0 1,000

Meters
300 0 300

DRAFT

Figure 14.2

NORTHWEST MINNEHAHA CREEK
MAJOR WATERSHEDS
Comprehensive Water Resource
Management Plan
City of Edina, Minnesota



Percent TP Removal in Water Body*
This number represents the percent of the total annual mass of phosphorus entering the water body that is removed.

- 0 - 25% (Poor/No Removal)
- 25 - 40% (Moderate Removal)
- 40 - 60% (Good Removal)
- 60 - 100% (Excellent Removal)

Cumulative TP Removal in Watershed*
This number represents the percent of the total annual mass of phosphorus entering the watershed and upstream watersheds that is removed in the pond and all upstream ponds.

- 0 - 25% (Poor/No Removal)
- 25 - 40% (Moderate Removal)
- 40 - 60% (Good Removal)
- 60 - 100% (Excellent Removal)

*Data based on results of P8 modeling.

- Area Draining Directly to Minnehaha Creek
- Flow Direction

N

Feet
1,000 0 1,000

Meters
300 0 300

DRAFT

Figure 14.4

NORTHWEST MINNEHAHA CREEK
WATER QUALITY
MODELING RESULTS
Comprehensive Water Resource
Management Plan
City of Edina, Minnesota