Stricker's/Mendota Watershed Study Report

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City of Madison
Madison, WI
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Prepared for
City of Madison, Madison, WI
March, 2022

The City makes no representation about the accuracy of these records and shall not be liable for any damages.

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List of Abbreviations

1D	One-Dimensional
2D	Two-Dimensional
cfs	cubic foot/feet per second
BC	Brown and Caldwell
CIP	Capital Improvement Plan
City	City of Madison
DCIA	directly connected impervious area
ESRI	Environmental Systems Research Institute
H&H	hydrologic and hydraulic
GI	Green Infrastructure
GIS	Geographic Information System
HSG	hydrologic soil group
LiDAR	light detecting and ranging
LOS	Level of Service
MSE	Midwest/Southeast states
NAVD88	North American Vertical Datum of 1988
NOAA	National Oceanographic and Atmospheric Administration
NOI	Notice of Intent
NRCS	Natural Resources Conservation Service
PFCI	Peak Flow Control Infrastructure
PIM	Public Information Meeting
SLU	standard land use
SAS	storm access structure
SWMM	Storm Water Management Model
SWMP	stormwater management plan
TIN	triangular irregular network
USGS	United States Geological Survey
USACE	United States Army Corps of Engineers
VC	Volume Control
WDNR	Wisconsin Department of Natural Resources
WPDES	Wisconsin Pollutant Discharge Elimination System
WSE	water surface elevation
WWI	Wisconsin Wetland Inventory

Executive Summary

Background

Recognizing the changing rain patterns, and likelihood of more frequent future large rain events, the City of Madison (City) is conducting a multi-faceted approach to address stormwater flooding. As one component of that approach, the City is developing comprehensive stormwater management studies for each watershed within the City. The studies are conducted in two phases. Throughout both phases, the City incorporates multiple opportunities for public involvement and interaction.

Phase 1: Development of a hydrologic/hydraulic stormwater runoff model representing the physical and drainage properties of the watershed under existing conditions. The model is then calibrated to measured runoff events and used to identify the areas of the watershed most likely to flood under various rain conditions.

Phase 2: Using the model, evaluate alternative methods and/or infrastructure improvements to eliminate, or reduce flooding impacts from large rain events.

This document reports the methods, procedures, and results of the Stricker's/Mendota Watershed Project. The project area covers approximately 1,411 acres (2.2 square miles) on the west side of Madison and in the city of Middleton.

Figure ES-1 shows the extent of the project area.

City's Flood Mitigation Targets

The analyses conducted for the watershed studies referred back to the City's flood mitigation targets to understand where targets were being met and where there is room for improvement. The City has the following flood mitigation targets. Please note, these targets may change in the future as more information becomes available.

1. No surcharging onto the street for up to the 10-year (10% chance event) design storm
2. Centerline of street to remain passable during 25-year (4% chance event) design storm with no more than 0.2 feet of water at the centerline
3. No home or business will be flooded during the 100-year (1% chance event) design storm.
4. Enclosed depressions to be served to the 100-year (1% chance event) design storm.
5. Greenway crossings at streets to be served to the 100-year (1% chance event) design storm.
6. Safely convey stormwater during the 500-year (0.2% chance event) design storm event.
7. Provide flooding solutions that do not negatively impact downstream properties.

Existing Conditions Results

The existing conditions analysis found the following when compared to the City's flood mitigation targets:

1. Of the 6.1 miles of storm sewer evaluated during the study, approximately 58% of them surcharge during the 10% chance event, thus not meeting the target. Of the 53 storm inlets evaluated during the study, 74% of them do not have adequate capacity during the 10% chance event.

2. Of the 17.7 miles of streets evaluated in the study, approximately 28% of them have more than 0.2 feet of water at the centerline during the 4% chance event, thus not meeting the target.
3. Of the 1,470 structures included in the watershed, approximately 91, or 6% are at risk of flooding during the 1% chance event, thus not meeting the target.
4. The one enclosed depression evaluated during the study, is served to the 1% chance event, thus meeting the target.
5. Of the 3 greenway crossings evaluated during the study, 33% are not served to the 1% chance event, thus not meeting the target.
6. The 0.2% chance event was not explicitly evaluated during this study, however, the results of Section 6 (where the 0.2% chance event was evaluated) indicate there are areas within the watershed that do not meet this target.

Figure ES-1 shows surface flooding locations under the 4% chance storm event and how the performance of the stormwater conveyance system compares to the City's flood mitigation targets.

Proposed Solutions and Cost

Following the existing conditions analysis, an extensive process was conducted to brainstorm, evaluate, and ultimate identify solutions to meet the City's flood mitigation targets. The following table lists the solutions that were selected, along with estimated design and construction cost for each. Figures depicting each solution can be found later in this report.

Table ES-1. Proposed Solutions Stand-Alone Project Cost Estimates
Stricker's/Mendota Watershed Study
City of Madison, WI

Project	Estimated Design Cost	Estimated Construction Cost
Longmeadow Relief Sewer	$176,000	$2.2 million
Upstream Lake Mendota Greenway & University Avenue Culvert	$113,000	$1.6 million
Downstream Lake Mendota Greenway & Camelot Drive Culvert	$109,000	$1.4 million
Stricker's Pond Outlet	$38,000	$475,000
Tiedeman Pond Outlet	$594,000	$7.4 million

Proposed Solutions Results

As the proposed solutions were being evaluated, they were compared to the flood mitigation targets. The proposed conditions modeling analysis, with all solutions implemented, found the following when compared to the City's flood mitigation targets:

1. Of the 6.1 miles of storm sewer evaluated during the study, approximately 4% of them surcharge during the 10% chance event, thus not meeting the target. This is an improvement over existing conditions as 3.3 more miles of storm sewer are now meeting the target. Of the 53 storm inlets evaluated during the study, 100% of them have adequate capacity during the 10% chance event, and thus meet the target.
2. Of the 17.7 miles of streets evaluated in the study, approximately 1% of them have more than 0.2 feet of water at the centerline during the 4% chance event, thus not meeting the target. This

is an improvement over existing conditions as 4.4 more miles of street are now meeting the target.

3. Of the 1,470 structures included in the watershed, approximately 15, or 1% are at risk of flooding during the 1% chance event, thus not meeting the target. As compared to existing conditions, 76 additional structures are now meeting the 1% chance event target.
4. The one enclosed depression evaluate during the study is served to the 1% chance event, thus meeting the target. There is no change in the performance towards this target from existing conditions.
5. Of the 3 greenway crossings evaluated during the study, all are now served to the 1% chance event, thus meeting the target.
6. The 0.2% chance event was not explicitly evaluated during this study, however, the results of Section 12.2 (where the 0.2% chance event was evaluated) indicate there are areas within the watershed that still would not meet this target.

There are still locations where the flood mitigation targets are not met. The targets cannot be met for various reasons including lack of physical space, topographic relief limitations, and land use change concerns. Detailed information can be found in Section 12 of this report.

Figure ES-2 depicts the flood control summary within the watershed with the selected solutions implemented. It shows surface flooding locations under the 4% change storm event and how the performance of the improved stormwater conveyance system compares to City's flood mitigation targets with the selected solutions in place.

Section 1

Introduction

1.1 Project Background and Purpose

The city of Madison has experienced increased frequency and intensity of rainfall events over the past ten to fifteen years. In August 2018, an unprecedented rainfall event occurred on the city of Madison's west side. A nearby United States Geological Survey (USGS) rain gauge recorded 10.5 inches of rain over a 12-hour period. For reference, NOAA Atlas 14 statistics show the 12-hour 0.1% chance event at 8.92 inches for the Madison area. This event caused flash flooding, most significantly across the western half of Madison, and prompted the City of Madison (City) to begin a comprehensive watershed planning process. This process began with watersheds hardest hit by 2018 flooding and included the area identified as the Stricker's/Mendota Watershed. In April of 2019, the City contracted with Brown and Caldwell (BC) to conduct the Stricker's/Mendota Watershed study.

The overall purpose of this study is to develop a comprehensive stormwater management plan (SWMP) for the Stricker's/Mendota watershed that will guide the City in meeting its flood mitigation goals.

This document generally consists of two parts. The first part, including sections 2 through 6, describes the first of phase of the project which consists of: (1) the development of input parameters for the watershed's hydrologic and hydraulic (H&H) model, (2) actual construction of the stormwater H&H model, (3) the calibration process for that model, and (4) the modeling results showing flooding under the watershed's existing physical conditions.

The second phase of this project was the analyses of alternative flood mitigation measures, the flood reductions that can be expected from those mitigation measures, and specific recommendations for flood reduction actions. Sections 9 through 14 of this report documents the second phase of the project.

Figure 1-1 shows the location of the study area within the City. Figure 1-2 provides a more detailed view of the watershed.

1.2 Scope of Study

The project's scope of work included the tasks listed below:

1. Review existing data and provide support for field data collection
   - This task focused on analyzing existing information provided by the City and other agencies to use in the development of the hydrologic/hydraulic model. In addition, the City conducted field survey for specific locations based on data gaps identified by BC.
2. Public engagement
   - BC assisted the City in conducting several public engagement events. The events included three Public Information Meetings (PIMs), and six neighborhood focus group meetings. Appendix E contains specific information regarding these public engagement events.
3. Develop and calibrate existing conditions XPSWMM™ model for the watershed

- The process of model development was a core component of this phase of the project. A detailed explanation of the process is provided in Sections 4 and 5 of this document.

4. Execute existing conditions XPSWMM™ model
   - The calibrated model was then used to model the watershed under its existing physical conditions for a series of rain events. The results of the model runs are documented in tabular and graphical formats and were presented at PIM #2.
5. Evaluation of Flood Mitigation Measures
   - Potential solutions to reduce flooding and meet the City's flood mitigation goals were developed and evaluated within the XPSWMM™ model. Solutions were developed in conjunction with City staff. Selected solutions were evaluated under a series of storm events and the results were documented. The solutions were also presented at a Public Information Meeting.

Each task is described in more detail in the remainder of this document.

It should be noted that portions of the Stricker's/Mendota watershed are located within the city of Middleton. The areas within the city of Middleton were incorporated into the stormwater models so that the complete hydrologic drainage within the watershed could be accounted for. No storm sewer, channel capacity, or flooding analyses were conducted on areas within the city of Middleton.

1.3 Historic Flooding in Watershed

Within the Stricker's/Mendota watershed, there are several areas that have experienced flooding in the past. Figure 1-3 depicts known flooding reports provided by the City in the Stricker's/Mendota watershed. The known flooding locations include flood reports from a variety of data sources, including resident reports, emergency services reports, operations staff reports, and inlets with repetitive clogging history. These flood reports are limited to areas within the city of Madison (city of Middleton areas are not included).

Known flooding locations were discussed with City staff at a meeting on March 19, 2019. The attendees were Joanna O'Brien, Richie Breidenbach, Janet Schmidt, Greg Fries, and Phil Gaebler from the City, and Caroline Burger (BC at time of meeting) and Jim Bachhuber from BC. Figure 1-4 identifies the locations that were discussed during the March 19, 2019 meeting. A summary of the flooding locations discussed at the meeting are described below:

1. **Longmeadow Road, approximately 400-feet west of Gammon Road:** Flooding occurs surrounding the road's low point in this area. It is believed that overland flow may enter the area from Gammon Road and that the existing storm sewer surcharged. Water from the road flows towards the storm sewer easement northwest of the low point.
2. **Westfield Road, approximately 575-feet east of Tramore Trail:** Flooding occurs surrounding the road's low point and flows overland to the north along the sidewalk to Longmeadow Road. Flooding has been observed regularly, during the 50% chance event approximately.
3. **Intersection of Gammon Road and Harvest Hill Road:** The intersection flooded during the August 2018 storm event. Pavement was damaged in the intersection.
4. **Intersection of Gammon Road and Old Sauk Road:** This intersection has experienced flooding during past storm events.
5. **Longmeadow Road, south of Stricker's Pond Forebay:** During the August 2018 storm event, this area was inundated. Pavement was damaged.

6. **Hickory Hollow Condominiums:** The condominium development located at the intersection of University Avenue and Hickory Hollow Drive have experienced flooding. The condominiums are along the Mendota-Grassman Greenway.
7. **Northwest end of Julia Street:** There have been past flooding complaints. High groundwater has been reported, resulting in sumps pumps running continuously. Runoff from southeast of this area flows into Julia Street and may be a component to the observed flooding.
8. **Northwest ends of Blanchard Street and Taychopera Road:** In August 2018, flooding occurred and damaged both of these streets. The streets dead-end at the Mendota-Grassman Greenway.
9. **Tiedeman Pond:** The water level in Tiedeman Pond rose dramatically and flooded Gammon Road. Emergency pumping into the railroad corridor, which ultimately drains into the Mendota-Grassman Greenway, was required to lower the pond level.

1.4 Flood Mitigation Goals

The City established consistent goals for stormwater management flood control (Level of Service or LOS) throughout the City. It is the City's policy to meet the LOS with reconstruction and new construction of its municipal stormwater conveyance system. Specifically, the LOS stormwater flood management goals are:

1. No home or business flooding during the 1% chance event (6.6 inches).
2. Eliminate flooding (surcharging of the storm sewer system onto the municipal streets) for up to the 10% chance event (4.1 inches), with the exception of road low-points.
3. Allow no more than 0.5 feet of stormwater ponding above storm sewer inlet rim elevations at inlet-restricted low points for the 10% chance event (4.1 inches).
4. Maintain drivability of municipal streets (center of the street with no more than 0.2 feet of water) for the 4% chance event (5.0 inches).
5. Enclosed depressions should provide safe storage, or overflow, of stormwater during the 1% chance event (6.6 inches). Flooding should be contained within public lands (streets, greenways, easements, etc.).
6. Where greenways cross streets, there should be no road overtopping during the 1% chance event (6.6 inches).
7. Flooding solutions should not negatively impact downstream properties.

It should be noted that although the City strives to meet the above goals with each of its stormwater infrastructure projects, fully achieving these goals is not always feasible because of specific site conditions, or other factors which cannot be controlled.

Section 2

Water Resources Inventory

2.1 Study Setting

The Stricker's/Mendota watershed is located on the far west side of the City and extends into the city of Middleton (see Figure 1-1) and covers approximately 1,411 acres. The extent of the watershed is shown on Figure 1-2. The watershed project area is actually made up of three separate drainage systems as described below.

1. The drainage to Stricker's Pond encompasses 560 acres (378 acres in Madison and 181 acres in Middleton).
2. A drainage area that discharges from the city of Madison to the city of Middleton near the intersection of Pebble Beach Drive, Clovernook Road, and Hidden Hollow Trail. Runoff from the Madison area enters the city of Middleton's stormwater conveyance system and discharges to Tiedeman Pond. This drainage area encompasses 332 acres (53 acres in Madison and 279 acres in Middleton).
3. The Lake Mendota drainage area conveys runoff from a 518-acre drainage area (392 acres in Madison, and 127 acres in Middleton). This drainage system discharges runoff through the Hickory Hollow channel which enters Lake Mendota just west of Baker Avenue.

The land cover is fully urbanized and dominated by single family residential housing. Other significant land uses include parks/open space, multi-family residential, and commercial. More detail on the watershed's land use is provided in Section 2.4.1

2.2 Topography

The topographic data (provided by the City) was compiled from light detecting and ranging (LiDAR) data on the North American Vertical Datum of 1988 (NAVD88). It should be noted that some data available for the project (such as past construction drawings) are in the previously used City vertical datum. The conversion factor from the historical City datum to NAVD88 was to add 845.6 feet to the City datum elevation. Data provided included two-foot contours, a digital elevation model (raster format), and LiDAR point clouds.

The lowest elevations in the watershed are approximately 923 feet (at Stricker's Pond), 911 feet (at Tiedeman Pond), and 851 feet (at Lake Mendota). The highest elevations are along the extreme southern border of the watershed (along Gammon Road, south of Old Sauk Road) at approximately 1,100 feet.

2.3 Drainage Systems

The Stricker's/Mendota drainage system generally consists of a constructed urban stormwater conveyance system including a mix of open-channels, storm sewers, and detention facilities. The watershed is nearly fully urbanized with curb and gutter street drainage. The Lake Mendota portion of the project area incorporates more significant areas of open channel/grass waterways into the drainage system. These features are discussed more fully below.

2.3.1 Natural Drainage Features and Wetlands

The most prominent features of the "natural" drainage system are discussed below.

Stricker's Pond Drainage Area

- Stricker's Pond itself is the downstream most point in the drainage area. A 1917 State Geologic and Natural History soils map shows this feature as two separate ponds within a depressional area. It is commonly identified as a kettle formation from the glacial period. The pond's current water surface area (according to the WDNR Surface Water Data Viewer) is 15 acres, although the extent of the water surface has been observed to vary considerably depending upon periods of drought or high rainfall. Measurements from current aerial photography show a surface area of closer to 25 acres. The pond's watershed is completely urbanized. The pond has no natural outlet. The City of Middleton has constructed a 15-inch diameter storm pipe outlet that is controlled by a valve. The outlet storm sewer discharges through Middleton's storm sewer system to the downstream Tiedeman Pond. The City of Middleton controls the pond's level to the extent feasible to prevent shoreline damage from high water in Stricker's Pond without causing shoreline property damage at Tiedeman Pond.
- Stricker's Pond has a constructed forebay at its southern end. The forebay was constructed by the City in the late 1980's for the purpose of trapping coarse sediment before entering the larger pond area. This forebay is separated from the pond by a berm with an asphalt pedestrian/bike path on top of the berm. The hydraulic connections between the forebay and the pond consists of three 29 inch by 45 inch concrete pipes.
- Although not a mapped "greenway" on the City's GIS system, a surface channel (grass waterway) exists along the 54-inch storm sewer northeast of Longmeadow Road between the Stricker's Pond forebay and where the storm sewer crosses Longmeadow Road (west of North Gammon Road). This surface channel is designed to carry high flows that exceed the capacity of the 54-inch storm sewer, and also receives direct surface drainage from the immediate area.

Tiedeman Pond Drainage

- Tiedeman Pond is a natural kettle located completely within the city of Middleton. According to the WDNR Surface Water Data Viewer the pond has a surface area of approximately 9 acres; however, recent aerial photography shows a surface area of 27-acres. An outlet, consisting of a small pump and storm sewer was constructed by the City of Middleton. The pump is operated by the City of Middleton and is under a WDNR Wisconsin Pollutant Discharge Elimination System (WPDES) permit. The outlet discharges through Middleton's storm sewer system and into Lake Mendota.

Lake Mendota Drainage Area

- A channel, commonly referred to as "Hickory Hollow Channel" or the "Mendota-Grassman Greenway" is a surface water feature that starts near Old Middleton Road (between Heim Avenue and Capital Avenue) and flows in a northeasterly direction, crossing University Avenue, and discharging to Lake Mendota near Baker Avenue. The open channel length is approximately 2,650 feet and is identified on the WDNR Surface Water Data Viewer as an intermittent channel. The riparian area of the channel is heavily wooded and the channel within a designated greenway. Recently the City has conducted brush removal operations along the channel. The channel has a low gradient and remains wet most of the year.
- Other surface drainage systems exist with this watershed within the city of Middleton. These systems are designed grass waterways and convey surface runoff to the headwater area of the Hickory Hollow Channel.

Wetlands

- Wisconsin DNR Surface Water Data Viewer, (https://dnr.wi.gov/topic/surfacewater/swdv/) provides locations of wetlands based on the Wisconsin Wetland Inventory (WWI). Figure 2-1 shows the potential wetlands based on this data source. Most notably, wetlands are likely around both Stricker's and Tiedeman Ponds. Smaller wetland areas are shown in areas near the headwater of the Hickory Hollow Channel. The Surface Water Data Viewer only provides a screening tool for wetlands and field investigations would be required to confirm the presence or absence of wetlands for any specific location.

2.3.2 Constructed System

As previously mentioned, the project area is made up of three discrete drainage systems: (1) Stricker's Pond, (2) Tiedeman Pond (within the city of Middleton), and (3) Lake Mendota (via Hickory Hollow Channel).

These major drainage areas are displayed on Figure 1-2. Table 2-1 provides a summary of the constructed stormwater conveyance system within the project area. Figure 2-2 provides a depiction of the drainage system.

Table 2-1. Summary of Constructed Stormwater Conveyance System
Stricker's/Mendota Watershed Study
City of Madison, WI

Municipality	Drainage Area	Storm Sewer System Analyzed (feet)	Open Channel System Analyzed (feet)
Madison	Stricker's Pond	15,254	162
	Tiedeman Pond	1,865	0
	Lake Mendota	16,324	1,870
Middleton	Stricker's Pond	400	0
	Tiedeman Pond	3,286	1,512
	Lake Mendota	5,041	2,302
Total		42,171	5,846

2.4 Runoff Conditions

Stormwater runoff generated from a land surface will vary depending upon several factors including land use, imperious surfaces, soil types, and topography. The factors within the Stricker's/Mendota watershed are discussed in this section.

2.4.1 Land Use

The Stricker's/Mendota watershed includes a mix of land uses, with the largest category being single family residential. Land use data was provided by the cities of Madison and Middleton that categorized the areas within the watershed into 19 different land uses. Table 2-2 provides a

generalized breakdown of the land use within the watershed. A map of the generalized land use categories is shown on Figure 2-3.

Table 2-2. Existing Land Use
Stricker's/Mendota Watershed Study
City of Madison, WI

Land Use Type	City of Madison		City of Middleton		Total	
	Area (acres)	Percent (%)	Area (acres)	Percent (%)	Area (acres)	Percent (%)
Residential	535	65%	358	61%	893	63%
Institutional	19	2%	14	2%	33	2%
Commercial	8	1%	7	1%	14	1%
Industrial	5	1%	0	0%	5	0%
Open Space/Parks	112	14%	59	10%	170	12%
Street Right of Way	138	17%	110	19%	248	18%
Water	6	1%	41	7%	48	3%
Total	821	100%	589	100%	1411	100%

For developing hydrologic factors, the more detailed land use categories were used, and a detailed breakdown of the categories is provided in Appendix B. The detailed land use categories were used to determine the amount of impervious area within each watershed and the portion of the impervious area that is directly connected to the municipal stormwater conveyance system. See Section 4.3.2.1 for further description of the land use categories and how the land use data was used in the development of the XPSWMM™.

2.4.2 Impervious Area

Impervious area data for various land uses was provided by the City as part of the GIS data. The impervious area dataset was divided into three categories: (1) residential, (2) non-residential, and (3) right-of-way areas. The data provided for each area is summarized below.

- For residential parcels the percent impervious of each parcel is incorporated in the dataset from the City. This data reported a square footage of impervious area by parcel but was not delineated within residential parcels.
- For non-residential parcels (industrial, commercial, etc.), the impervious areas are delineated, and thus, this information was used directly for hydrologic conditions. See Figure 2-4 for a map of the imperious areas provided by the City.
- The impervious area within right-of-way areas was estimated by offsetting the street centerline based on the width of the street and any sidewalk present along the roadway. This offset was completed by the City and provided to BC.

For the city of Middleton, no impervious area delineations were available. The impervious area factors within Middleton were strictly based the WinSLAMM standards land use files' impervious area for property within parcel boundaries. The roadways (right-of-way areas), were considered separately.

2.4.3 Soil Types

Soils in the Stricker's/Mendota watershed are predominantly hydrologic soil group (HSG) B soils. The HSG classifications were used to estimate the infiltration parameters for pervious surfaces within the watershed (see Sections 4.3.2.5 and 4.3.2.6). Table 2-3 shows the areas for each soil group in the watershed and the extent of soil group areas are shown on Figure 2-5. This data was obtained directly from the City and is based on the Natural Resources Conservation Service (NRCS) Soil Survey for Dane County.

Table 2-3. Summary Soil Hydrologic Groups
Stricker's Pond/Lake Mendota Watershed Study
City of Madison, WI

Municipality	Drainage Area	Hydrologic Soil Group				
		A (acres)	B (acres)	B/D (acres)	C (acres)	Water (acres)
Madison	Lake Mendota	3.2	376.2	11.9	0.0	0.0
	Stricker's Pond	20.7	345.9	0.0	5.5	6.3
	Tiedeman Pond	7.0	46.4	0.0	0.0	0.0
Middleton	Lake Mendota	1.0	125.5	0.1	0.0	0.0
	Stricker's Pond	2.4	149.2	0.0	9.3	21.0
	Tiedeman Pond	24.2	211.1	3.3	11.2	29.0
Total		58.3	1,254.4	15.4	26.1	56.3

Section 3

Guidance and Data Sources

3.1 City of Madison Model Guidance

As part of this study a Modeling Guidance document was developed by the City, BC, and AE2S (City consultant for Spring Harbor Watershed Study). This document was used to define consistent modeling parameters across the various watersheds that are being analyzed. The Modeling Guidance was developed at the onset of the project and updated throughout the study. The version of the Modeling Guidance dated December 6, 2019 was utilized as part of this report. A copy of the Modeling Guidance as of the date of this report is included in Appendix A.

3.2 List Data Sources

The Stricker's/Mendota watershed study relies on a variety of data sources. A summary of the data sources is provided below.

Provided by City of Madison:

1. Various datasets from the City's Geographic Information System (GIS). GIS data includes; land use, storm sewer (including associated structures), city limits, greenways and ponds, parcels, roads, and other pertinent data sets.
2. The City's GTweb system. Access to this system was provided which contains mapping of various City infrastructure including storm sewer, sanitary sewer, and water main. In some cases, this system contained information (such as pipe size or invert elevation) that was missing from the City's GIS data.
3. Construction plans provided by the City or obtained from the City's network. Of particular note are construction plans obtained from the City for the Mendota-Grassman Greenway, including the University Avenue culvert and Camelot Drive culvert, Ponwood Pond, and Grassman Pond.
4. Photographs of various drainage features were obtained from field investigations conducted by BC and other photographs provided by the City.
5. Field surveys of selected items and locations within the watershed. As part of the model development process, survey locations were identified and the data was collected by City staff. Examples of survey locations include missing storm sewer or culvert inverts at key locations, pond overflow elevations, and cross sections of open channels.
6. Monitoring data to support this study was collected by the City and USGS. Monitoring data included rainfall, flow, and water level data at select locations. Additional information about the data collected and how the data was collected is provided in Section 4.2.2 for rainfall data and Section 5.1 for flow and water level data.

Provided by the City of Middleton

1. WinSLAMM land use coverage from the City of Middleton's GIS system.
2. The City of Middleton's storm sewer system as defined in the GIS system.
3. Drawings of the Stricker's Pond outlet structure.

4. Records of Stricker's Pond water surface elevation measurements as recorded by City of Middleton staff.
5. Information regarding the operation and pumping rates of the Tiedeman Pond outlet lift station.

It should be noted that the City previously used a City vertical datum and the City is in the process of transitioning all data into the NAVD88. The watershed study was conducted in NAVD88. Data that was in the City datum was converted to NAVD88. The City provided the appropriate conversion of adding 845.6 feet to the City datum.

The specific file name and date of the file is listed in Table 3-1.

Table 3-1. Source Files
Stricker's/Mendota Watershed Study
City of Madison, WI

Data Type	File Name	File Date
Land Use	WinSLAMMLanduse.mdb	4/16/2019
LiDAR	Citywide_Raster_small_cell	3/12/2019
Storm Sewer	Storm_Sewer_Pipes	3/21/2019
	Storm_Sewer_Structures	3/11/2019
	Storm_Pipes_Private	1/24/2019
	Storm_Structures_Private	1/24/2019
	STO_E_PVT Graphic Line	3/19/2019
	STO_E_PVT Graphic Cell	3/19/2019
Culverts	Storm_Sewer_Pipes	3/21/2019
	Storm_Sewer_Structures	3/11/2019
Greenways	Greenways_and_Ponds	1/11/2019
	PondGwayPipes	3/14/2019
	PondGwayStructures	3/14/2019
Planimetric Data	Street_Centerlines_and_Pavement_Data	3/11/2019
	Lakes_and_Rivers	10/3/2018
	Greenways_and_Ponds	1/11/2019
	Pond_Contours	1/24/2019
	Stormwater_Impervious_Areas	2/15/2019
Aerial Imagery	WICMAD18_ReDelivery_Gen3_RDG.sid	12/3/2018

Section 4

Model Development

4.1 Modeling Software

To evaluate flooding and stormwater conveyance system capacity within the Stricker's/Mendota watershed, an XPSWMM™ version 2018 model was created to simulate the hydrology and hydraulics within the watershed. XPSWMM™ is a proprietary software product of Innovyze® (see www.innovyze.com/en-us). The model created for the Stricker's/Mendota watershed is a combination One-Dimensional (1D)/Two-Dimensional (2D) H&H model.

4.2 Rainfall Files

The analyses included an evaluation of both design storms and recorded rainfall events. A series of storm events were evaluated as part of this study to identify which event(s) result in flooding, and the severity of that flooding. Both theoretical "design storms", as well as measured local storm events were considered as part of the study. The rainfall events that were used in the analysis are described in the following sections.

4.2.1 Design Rain Events

The watershed flooding analysis included a series of different recurrence interval design storms (50, 20, 10, 4, 2, 1, and 0.2% chance events) with a 24-hour duration. The design storm events used rainfall depths from the National Oceanographic and Atmospheric Administration (NOAA) Atlas 14. The Midwest/Southeast states (MSE)4 rainfall distribution, developed by the NRCS, was used for the rainfall. Table 4-1 lists the rainfall depth that were used in the H&H modeling of this study.

Table 4-1. Design Rain Events
Stricker's/Mendota Watershed Study
City of Madison, WI

Recurrence Interval	Rainfall Depth* (inches)
50% chance	2.8
20% chance	3.5
10% chance	4.1
4% chance	5.0
2% chance	5.7
1% chance	6.6
0.2% chance	8.8

**as reported in the City's Modelling Guidance document.*

4.2.2 Measured Rain Events

Rainfall data was collected from June 2019 through October 2019, across the west-side of Madison in support of the watershed studies. The gauges were installed by the City with support from the USGS. Additionally, existing USGS rain gauges provided data for model input. The Stricker's/Mendota watershed study utilized a combination of five rain gauges within and near the watershed to characterize actual, measured rainfall events. The City provided a Thiessen polygon map showing areas within the Stricker's/Mendota watershed influenced by the five gauges. Rain gauges used as part of the study and their locations are provided in Table 4-2. Figure 4-1 shows the locations of each station.

Table 4-2. Rain Gauge Locations
Stricker's/Mendota Watershed Study
City of Madison, WI

Gauge Location	Operated By
Stricker's Pond Forebay (off Longmeadow Road near Stricker's Pond)	City of Madison
Marshall Park (in city of Madison Marshall Park off Allen Boulevard)	City of Madison
Spring Harbor (northeast of University Avenue; in Spring Harbor Park)	USGS
Yellowstone (intersection of Yellowstone Drive and Gettysburg Drive)	USGS
Owen Park (in Owen Park south of Old Sauk Road)	City of Madison

For gauges operated by the City, rainfall data was obtained from the Trimble Unity website, the City's partner for providing the monitoring data. Rainfall data from gauges operated by the USGS was provided via email from the USGS.

From the monitoring period, three measured rainfall events were selected to be utilized as part of the calibration process under this study. The events selected are provided in Table 4-3. A graph of each event's rainfall distribution at the Stricker's Pond forebay location is provided in Appendix H as Figures H-1 through H-3. These events are the largest rain events that were successfully measured and had good corresponding flow and/or water surface elevation measurements at the monitoring stations (see Sections 5.1 and 5.2). The events were selected as part of a meeting with City staff at which available rainfall and monitoring data was reviewed. A consensus was drawn for the events to be used based on the size of the storm events and successfully collected monitoring data.

Table 4-3. Rain Events Selected for Calibration Process
Stricker's/Mendota Watershed Study
City of Madison, WI

Event Date	Rain Depth (inches)*	Rain Duration	Approximate Annual Exceedance Probability
August 5, 2019	1.1 – 1.2	3.5 hours	> 100%
August 11, 2019	0.9 – 1.5	4.5 hours	> 100%
October 1 – 2, 2019	3.0 – 3.6	19 hours	50% - 10%

** rain depth varied by station*

The October storm event was the largest event that was successfully measured in 2019, at the relevant rain gauges. The October event (total rain depth and duration) falls in the range of a 50% to 10% recurrence interval based on NOAA Atlas 14 Volume 8 Version 2 data. Both August events (total rain depth and duration) were greater than a 100% recurrence interval.

4.3 Hydrologic Model Development

This section describes the steps taken to generate the hydrologic factors used in the XPSWMM™ model.

4.3.1 SWMM Runoff Description

Hydrologic calculations were performed in the XPSWMM™ model using Storm Water Management Model (SWMM) runoff methodology. SWMM hydrology uses a combination of drainage area size and shape, slope, land cover (pervious, impervious not connected, impervious connected), and soil infiltration parameters to generate runoff from a rain event. Discussions with City staff concluded that the SWMM hydrologic method was preferred over the "curve number" approach because of the urban land cover conditions. Although the curve number method is used in urban settings, it was originally developed for application in rural/agricultural watersheds.

The SWMM runoff methodology and associated parameters is defined in the Modeling Guidance document and is found in Appendix A. The calculations were performed for each sub-watershed that was delineated within the watershed. The model developed a runoff hydrograph based on the model input parameters and this is entered by the model into the hydraulic portion of the software.

4.3.2 Subwatershed Input Data

The Stricker's/Mendota watershed was divided into 81 sub-watersheds. The subwatersheds are shown on Figure 4-2. Subwatersheds were delineated based on the storm sewer maps, drainage features (such as open channel versus storm sewer), land use, and topography. For each subwatershed, hydrologic input parameters were calculated. Each subwatershed included three subcatchments based on the land use within the subwatershed. The subcatchments were defined as:

1. Directly connected impervious area: impervious areas that drain directly to the conveyance system
2. Indirectly connected impervious area: impervious areas that drain over a pervious surface prior to entering the conveyance system
3. Pervious area: vegetated land surfaces or areas with no impervious surface

The input parameters and calculation methodology for hydrologic input parameters are described below. The XPSWMM™ model input parameters for each subwatershed are listed in Table B-2.

It should be noted that within the city of Middleton, the subwatersheds were generally larger than the subwatersheds within the city of Madison. The drainage system in the city of Middleton is not being analyzed as part of the study. Subwatersheds in Middleton were delineated such that they would appropriately route water into the receiving waters (Stricker's or Tiedeman ponds), or the city of Madison (the Mendota-Grassman Greenway).

4.3.2.1 Subwatershed and Subcatchment Areas

The area for each subwatershed was calculated using the GIS data developed for the project. Subsequently, the areas for each of the three subcatchments were calculated for each subwatershed. Subcatchment areas were calculated using the impervious area information provided by the City (see Section 2.5.2). How each subcatchment area was calculated is described below.

1. For areas in the city of Madison, the total impervious area for each subwatershed was calculated based on the impervious area data from the City. For areas in the city of Middleton, the total impervious area was calculated based on the WinSLAMM standard land use files (SLU). Impervious area delineations were not available from the City of Middleton. The percent impervious from the WinSLAMM SLU files was used to calculate the total impervious area in a subwatershed based on the composite land use within a subwatershed. The SLU files estimate the source areas for typical land cover conditions for a variety of land uses. The SLU impervious area conditions were originally developed based on extensive aerial photo analyses and field verifications of urban land cover in several Wisconsin cities.
    a. The directly connected impervious area (DCIA) was estimated using WinSLAMM SLU files for both the cities of Madison and Middleton. As part of the source area data, the SLU files identified whether a source area was directly or indirectly connected to the municipal stormwater conveyance system. For each land use, the percentage of DCIA was calculated (see Table B-1). Based on the land use present in a subwatershed, the total DCIA was calculated.
    b. Indirectly connected impervious area was calculated by subtracting the DCIA from the total impervious area in a subwatershed.
2. Pervious area was calculated by subtracting the total impervious area from the subwatershed area.

It should be noted that the WinSLAMM SLU files incorporate the street right-of-way as part of the land use category. For example, Medium Density Single Family Residential (No Alleys) SLU data includes the impervious areas of the associated streets and sidewalks. The City's GIS land use coverage did not include street right-of-ways under a land use category, and treated street right-of-ways as a separate "land use". This meant that the calculated directly connected and disconnected impervious areas for each land use had to account for this difference between the WinSLAMM and City's GIS land use categories. As such, the street areas were subtracted from the DCIA and total impervious area in the SLU files. The percentage of DCIA was calculated based on the impervious areas outside of the street areas.

Within XPSWMM™, the indirectly connected impervious area was routed onto the pervious area within each subwatershed.

4.3.2.2 Subwatershed and Subcatchment Width

In SWMM hydrology, "width" refers to the general shape of a hydrologic unit (subwatershed) and the relationship of the surface flow path to the shape of the subwatershed. A line was drawn to represent the longest typical flow path for each subwatershed. The length of this line was calculated and the subwatershed area was divided by the flow path length to calculate the overall width. This width was then pro-rated based on the DCIA of each subwatershed. The pro-rated width for indirectly connected impervious area and pervious area was the same and was equal to the overall width minus the DCIA width. For example, if a total subwatershed width of 100 feet was calculated and the directly connected impervious areas were 25 percent of the subwatershed, the DCIA width was 25 feet, and the width of the indirectly connected impervious area and pervious area was 75 feet.

It should be noted that the subwatershed width was used as a calibration parameter. See Section 5 for modifications that were made to develop the calibrated existing conditions model.

4.3.2.3 Slope

A slope for the flow path described under in Section 4.3.2.2 was calculated. The elevation at the upstream and downstream end of the flow path was assigned based on the topographic data provided by the City. The elevations were used with the flow path length to calculate the slope.

4.3.2.4 Soils and Infiltration

Soils within the watershed are classified by the HSG. HSG mapping provided by the City as part of the City's "Curve Number Generator" tool was utilized in the project. The soils conditions of the watershed are represented in the hydrologic calculations through the infiltration parameters selected for the study.

The Horton soil infiltration methodology was used within XPSWMM™, and this approach is consistent with the City's Modeling Guidance. This methodology establishes a maximum infiltration rate, a minimum infiltration rate, and the decay rate of infiltration for each HSG. Input parameters were developed for each of HSG and Table 4-4 provides the infiltration values.

Table 4-4. Horton Infiltration Parameters
Stricker's/Mendota Watershed Study
City of Madison, WI

HSG[1]	Maximum Infiltration Rate (inches/hour)	Minimum Infiltration Rate (inches/hour)	Decay Rate (1/hour)	Dry Days
A	4.0	1.0	4.0	3.1
B	2.0	0.5	4.0	4.4
C	1.0	0.2	4.0	7.0
D	0.5	0.1	4.0	9.9
Water	0	0	0	0

[1]Where soils are classified as A/D, B/D, or C/D a HSG D was assumed.

The area within each subwatershed was classified by HSG. For each subwatershed composite, infiltration parameters were developed by area-weighting by each parameter based on the amount of each HSG within a subwatershed. For example, if a subwatershed is 50-percent HSG A and 50-percent HSB B, the maximum infiltration rate would be 3.0 inches/hour.

It should be noted that the values shown in Table 4-4 are the "base conditions" values. Infiltration rates that were used as a calibration parameter may be modified to better represent actual conditions. See Section 5 for modifications that were made to develop the "calibrated existing conditions" model.

4.3.2.5 Antecedent Runoff Conditions

The antecedent moisture condition represents whether there are saturated or exceptionally dry soil conditions at the start of a storm event. In saturated conditions, the maximum infiltration rate of soils would be decreased and the depressional storage may be reduced. In dry conditions, the maximum infiltration rate may be higher than typical. For this analysis, typical antecedent moisture conditions were used and are represented by the parameters listed in Table 4-4.

The antecedent moisture conditions for the October 1–2, 2019 storm event were considered as part of the calibration process. See Section 5 for modifications that were made to develop the calibrated existing conditions model.

4.3.2.6 Depressional Storage

Within a subwatershed, there are surface depressions that collect runoff (puddles) and reduce the amount of runoff generated from a rainfall. Depressional storage is incorporated into the runoff calculations to account for these areas. For each subwatershed, a depression storage of 0.05 inches for impervious areas and 0.15 inches for pervious areas was included. These values meet the criteria defined in the City's Modeling Guidance.

4.3.2.7 Internally Drained Areas

As described earlier, Stricker's and Tiedeman Ponds are both natural kettles that were previously internally drained. A constructed outlet for both ponds now exists.

Within the Lake Mendota tributary area, there is one internally drained area which, in this study, is referred to as the Highland depression. A natural depression exists northeast of Highland Avenue along the eastern watershed boundary. This area is approximately 12 feet deep (more significant than the "depressional storage" factor used in the model). Figure 4-2 shows the location of the internally drained area. During storm events, it is possible for overland flow to enter the depression area from Highland Avenue and Willow Lane, thus the Highland depression has its own subwatershed delineation.

There are additional depressional areas that do not have internally drained subwatersheds delineated. These areas may consist of backyards or other small, local depressions. These depressions are accounted for in the hydrology calculations through the depressional storage parameters described in Section 4.3.2.6. It is possible that small depressions not incorporated may have localized flooding conditions (such as individual back yards); however, the scope of this study did not allow for the evaluation of each individual area.

4.4 1D Hydraulic Model Development

The 1D hydraulic portion of the XPSWMM™ model represents the storm sewers, culverts, open channels, and detention basins that comprise the drainage system within the Stricker's/Mendota watershed. The hydraulic input parameters required by XPSWMM™ vary depending on the different parts of the drainage system. The source data used to compile the hydraulic model input data is summarized below. Table C-1 and C-2 in Appendix C provides hydraulic input parameters from the XPSWMM™ model. Figure C-1 in Appendix C shows a layout of the model network. Within the

city of Middleton, a limited amount of storm sewers, culverts, open channels, and detention basins were included as part of the XPSWMM™ model.

4.4.1 Open Channel Conveyance System

Open channels that are part of the City's stormwater conveyance system within the Stricker's/Mendota watershed are generally included as part of the 1D hydraulic model. If a modeled pipe discharges into an open channel, that channel is included as part of the 1D hydraulic model. Other channels (generally smaller channels and those located upslope from the storm sewer system) are simulated as part of the 2D hydraulic model (see Section 4.5). The 1D open channel features define the primary channel (within the top of banks). Adjacent areas (i.e., floodplain areas) were defined in the 2D hydraulic model.

Survey data was collected for open channels at selected locations within the watershed. The survey data was used in conjunction with LiDAR data, City GIS data, and available construction plans to develop cross sections and longitudinal invert elevations for open channels. Aerial photography and site photos were used to select Manning's n values (roughness coefficients) for the open channels.

Within the city of Middleton, open channels within the Lake Mendota tributary area were included as part of the model to assist in simulating the flow from the city of Middleton that enters Madison. For these open channels, survey data was not collected. LiDAR data and a site visit were used to define the parameters for the city of Middleton open channels.

4.4.2 Closed Conduit Conveyance System – Storm Sewers and Culverts

City-owned storm sewer mains 18-inches in diameter or greater were included in the XPSWMM™ model, per the project's scope of work. Additionally, selected storm sewers that were smaller than 18-inches were included if they were deemed critical to representing the conveyance systems performance. Smaller storm sewers, private storm sewers, and inlet leads were not included in the model because this phase of the project is focused on identifying and resolving major flooding issues. Future phases of the process will likely incorporate smaller components of the conveyance system to aid in the design of specific management infrastructure.

Each storm sewer "link" requires upstream and downstream invert elevations, pipe length, and Manning's n (roughness). Additionally, hydraulic minor losses were added to the model.

The source of the closed conduit conveyance system data for the model included GIS data provided by the City, and information from the City's GTviewer system, construction plans, and field surveys at select locations. Where missing data remained, assumptions were developed to fill data gaps. The assumptions made are listed below.

1. Missing invert elevations were obtained by interpolating between the nearest upstream and downstream invert elevations. Where known bounding inverts were unavailable (as in the upper most reaches of the storm sewer), the next downstream slope was continued upstream.
2. Where pipe sizes were unknown, the size of the nearest upstream pipe was used.
3. Missing pipe material was assumed to be the same as the nearest upstream pipe.

Entrance and exit losses (minor losses) were added to storm sewers and culverts based on the Modeling Guidance document. Losses were split evenly between the entry pipe and exit pipe at a storm access structure (SAS). For example, at a 90-degree SAS a total loss of 0.5 was assigned. An exit loss of 0.25 was assigned to the influent pipe and an entry loss of 0.25 was assigned to the effluent pipe. At a tee, or cross SAS structures, a loss of 0.5 was applied to each pipe.

Selected city of Middleton storm sewers were included in the model. This decision was made based on the expected impact to the modeling results.

1. **Stricker's Pond Tributary Area:** There are no city of Middleton or city of Madison storm sewers that connect to each other/discharge across the city limits occurs in the Stricker's Pond area. The main impact to the city of Madison's storm sewer system from city of Middleton runoff is the volume of runoff that reaches Stricker's Pond. Most downstream segments of city of Middleton storm sewer that discharge into Stricker's Pond were included in the model to simulate the rate of discharge from Middleton into the pond. Additionally, the outlet sewer from Stricker's Pond to Tiedeman Pond was included in the model. The input data from this outlet sewer was based on as-built drawings provided by the City of Middleton.
2. **Tiedeman Pond Tributary Area:** A city of Madison storm sewer discharges into the city of Middleton along Pebble Beach Drive, near the intersection of Hidden Hollow Trail. This storm sewer discharges directly into a city of Middleton storm sewer. The city of Middleton storm sewer from this location along Clovernook Drive, downstream to Tiedeman Pond, was included in the model.
3. **Lake Mendota Tributary Area:** Within the Lake Mendota tributary area, there is discharge from the city of Middleton into the city of Madison via an open channel southeast of Willow Trail/southwest of Rough Lee Court. Upstream of this area, culverts and storm sewers are included to route runoff from the city of Middleton into Madison.

4.4.3 Existing Inlet Capacity

The majority of runoff in the Stricker's/Mendota watershed enters the drainage system through surface inlets. Most typically, the inlets are within streets, along the curb and gutter. The inlets include a grate within the gutter and an open area within the casting along the curb face. The location and capacity of inlets can impact the stormwater conveyance systems' performance. If there is insufficient inlet capacity, runoff cannot enter the stormwater conveyance system, and may pond on the surface or flow overland to another location. The capacity of inlets within the watershed was incorporated into the model by aggregating inlets at the subwatershed level. A composite rating curve was developed to represent and aggregate inlet capacity for each subwatershed. Runoff from each subwatershed is restricted by the inlet capacity rating before it enters the storm sewer system.

Runoff may also enter the drainage system through overland flow into open channels or ponds, or through culverts. Subwatersheds that have these features were not restricted with inlet capacity.

A detailed description of the inlet capacity methodology and supporting documentation is included in Appendix E. A brief description of the inlet capacity analysis is provided below.

Existing inlets were categorized based on their inlet type (such as Neenah R-3067) and condition (sag or slope). A rating curve for each type of inlet that is present was developed using HEC-22 methodology (rating curves are included as Charts E-1 through E-11 in Appendix E). At the subwatershed level, a composite rating curve was developed based on the number and type of City inlets present within the subwatershed. Table E-1 shows the number and type of inlets within each subwatershed. Table E-2 shows the composite rating curve developed for each subwatershed.

Two tables were prepared to evaluate the inlet capacity in conjunction with the XPSWMM™ model. Table E-3 in Appendix E compares the runoff from a subwatershed to the cumulative inlet capacity. Table E-4 in Appendix E compares the capacity of existing pipes to the inlet capacity upstream of the pipe. The inlet capacity was compared at two water surface depths: 1) 0.25-feet which would be a level at which nuisance ponding / flooding may start occurring, and 2) 0.55-feet. A depth of 0.55-feet

is used to approximate the water depth at which the 25-year flood control goal would not be met for a typical 36-foot wide road (0.2' above the centerline).

4.4.4 Existing Detention Ponds

Seven existing detention ponds were identified within the watershed and incorporated into the 1D component of the XPSWMM™ model. These ponds are the larger detention features and have the most impact on the Stricker's/Mendota stormwater conditions. A combination of available site plans, aerial photography, LiDAR data, and site visits was used to determine the appropriate model input data for the detention ponds. Input data included the stage-area relationship to represent the storage in the pond and data to represent the pond outlet. The detention basins included under the existing conditions are summarized in Table C-2 in Appendix C. The locations of detention basins included in the XPSWMM™ model are on Figure 4-3.

There are other smaller, privately-owned detention facilities that may serve a single property within the watershed. The smaller detention ponds have minimal effect on the stormwater flooding conditions which are the focus of this project.

Additionally, Stricker's and Tiedeman Ponds were included into the 1D portion of the XPSWMM™ model, similar to the detention ponds described above.

4.4.5 Open Water/Backwater Effects

Open water impacts each of the three tributary areas of the Stricker's/Mendota watershed. A starting water surface elevation for each area was incorporated into the model. For Stricker's and Tiedeman ponds, the XPSWMM™ model simulated the water level of the ponds over the course of a rain event. The Lake Mendota water level was constant during the course of an event. The starting water surface elevation used in the analysis are summarized in Table 4-5.

Table 4-5. Design Storm Starting Water Surface Elevations
Stricker's/Mendota Watershed Study
City of Madison, WI

Location	Starting Water Surface Elevation	Data Source
Stricker's Pond	923.0	Maximum Water Surface Elevation as per City of Middleton Stricker's/Tiedeman ponds WDNR permit
Tiedeman Pond	911.0	Maximum Water Surface Elevation as per City of Middleton Stricker's/Tiedeman ponds WDNR permit
Lake Mendota	851.1	Modeling Guidance

For the measured rainfall events the Stricker's pond, starting water surface elevation was set based on the monitoring data collected by the City. The Tiedeman Pond starting water surface elevation was based on daily water level measurements collected by the City of Middleton (provided to BC as part of this study).

It should be noted that a pond level sensitivity analysis was conducted for Stricker's Pond. This analysis is described in Section 4.8.

4.5 2D Hydraulic Model Development

The 2D portion of the hydraulic model is utilized to represent the overland flow across the land's surface. The 2D model uses topographic data to simulate the overland flow which may occur throughout the watershed in areas, such as along streets, between buildings, or over undeveloped lands. The 2D model is connected to the 1D model to allow runoff to pass from the 1D elements in the model into the 2D part of the model and vice-versa. The components of the 2D model are further described in the sections below.

4.5.1 Description of Areas Modeled in 2D

Except for defined open channels (see Section 4.4.1.1) and detention ponds (see Section 4.4.4), all other city of Madison land areas of the Stricker's/Mendota watershed are modeled in 2D. In the city of Middleton, all areas tributary to Lake Mendota were included in the 2D model. Additionally, areas south of Tiedeman Pond, including the area surrounding Stricker's Pond, were included. Areas north of Tiedeman Pond were excluded because they do not have an impact on the city of Madison. Specific information on how the 2D area is modeled is provided below.

4.5.2 Topographic Data

A triangular irregular network (TIN) was created within XPSWMM™ to represent the topography within the study area. The City-provided elevation raster (Citywide_Raster_small) was used as the basis for the TIN creation. This raster file was clipped to the approximate project extents. It was converted to an ESRI grid format and imported into the XPSWMM™ model.

4.5.3 2D Grid

XPSWMM™ uses a grid comprised of squares to complete the 2D model calculations. Water enters the grid and is transferred between grid cells. Elevations are assigned to the vertices and center of each grid cell from the topographic data. The grid size for this project is 10 by 10 feet. The 2D grid covers the entire area model in 2D (as described in Section 4.5.1).

4.5.4 2D Land Use and Roughness Values

As part of the 2D model, the land cover is defined, and each land use is assigned a Manning's n. This factor represents the roughness of the land's surface and ability to impede flow. For the Stricker's/Mendota watershed, the land cover was divided into ten categories and each category was assigned a unique Manning's n value. The land cover categories were right-of-way, commercial, park, residential, water, impervious, pervious, wooded, prairie, and open space. The land cover was imported to XPSWMM™ from GIS data developed for the watershed.

The land cover categories were selected based on available data. For areas with impervious area delineations (non-single-family residential parcels in the City), the data was used to classify land use as either impervious or pervious, and a Manning's n was assigned.

City residential parcels, parks, and right-of-ways, and city of Middleton areas within the study area do not have impervious areas delineated. For these areas, the WinSLAMM SLU files were used to estimate a Manning's n for residential areas and the other land uses present in Middleton. The building areas were excluded from this calculation because there will not be overland flow across building roofs.

The City provided data with the estimated impervious area within the right-of-way (streets and sidewalks). This data was used to estimate the percent impervious of the street areas and a composite Manning's n was calculated. The streets in the city of Middleton were assumed to have a similar percent impervious as the Madison streets, and thus, the same Manning's n was used for all streets.

Parks and open space were assigned a roughness value for pervious area. Additionally, areas along the Mendota-Grassman Greenway were reviewed. The area along the greenway is heavily wooded in many parts and is prairie in others. The Manning's n for these areas differ from the other land use categories. These areas were segregated and categorized appropriately.

The Manning's n corresponding to each land use is provided in Table 4-5. The land use for the 2D roughness is shown in Figure 4-6.

Table 4-6. 2D Manning's Roughness
Stricker's/Mendota Watershed Study
City of Madison, WI

Land Use	Manning's n
Right of Way	0.16
Commercial	0.18
Impervious	0.1
Park/Open	0.24
Wooded	0.4
Prairie	0.15
Pervious	0.24
Residential	0.2
Water	0.01

4.5.5 Inactive Areas

Inactive areas are defined as areas where surface water cannot flow because of physical barriers (such as buildings) or areas already represented by the 1D model. Inactive areas were identified and added to the 2D model to represent building footprints and areas that were represented by 1D open channels or ponds. These are areas where the 2D modeled flow will not occur. Building footprints were imported from the Dane County GIS data. Open channel and pond extents were delineated by BC to correspond with the areas modeled in 1D.

4.5.6 1D/2D Interface

The 1D and 2D models interfaced in two types of areas: (1) model nodes, and (2) 1D/2D interface lines. The interface configurations are described below:

1. **Model Nodes:** Runoff can be transferred from the 1D storm sewer network onto the 2D grids at selected nodes within the model. As described previously, inlet capacity was accounted for at the subwatershed level, and these nodes restrict the flow of runoff into and out of the 1D portions of the model. In the immediate area surrounding an inlet capacity node, other 1D nodes are "sealed" to prevent runoff from bypassing the inlet capacity node and entering or exiting the 1D system unrestricted. In addition to the inlet capacity nodes, runoff is allowed to enter/exit the 1D network at model nodes that are not in the immediate area of an inlet capacity note.
2. **1D/2D Interface Lines:** Interface lines are included around the perimeter of open channels and detention ponds that are modeled in 1D (see Sections 4.4.1 and 4.4.4). The interface lines allow runoff to transfer from the 1D area onto the 2D grid.

4.5.7 2D Boundary Conditions

The boundary of the 2D model—the perimeter of the 2D grid defined for the study—is created in the model to be closed and acts as a vertical wall. The model results were reviewed, and overland flow outfalls were added (termed by XPSWMM™ as "head boundaries") along Lake Mendota where water ponded along the "edge" of the model. These are locations where overland flow leaves the study area and enters Lake Mendota.

4.5.8 Peer Review #1

As part of the existing conditions model development process a "Peer Review" occurred. For the peer review the XPSWMM™ model was provided to the City and AE2S (City consultant for Spring Harbor watershed study). The model was reviewed and comments were provided to BC. The peer review was discussed at the meeting with City, AE2S, and BC staff on December 9, 2019. Based on the peer review comments, and meeting discussion, updates to the existing conditions model were made. A summary of Peer Review #1 is included in Appendix G.

4.6 Existing Conditions Non-Calibrated Model Results

The XPSWMM™ model was constructed and executed for each of the design storms (identified in Section 4.2.1), and the measured storm events (identified in Section 4.2.2) under the existing land use and conveyance system conditions. Table D-1 in Appendix D summarizes the peak water surface elevation and the duration of flooding at selected locations throughout the Stricker's/Mendota watershed during the design storms. Figure 4-6 provides the location of each of the reporting locations in Table D-1.

4.7 Pond Level Sensitivity Analysis

The city of Madison storm sewers that discharge into Stricker's Pond can be impacted by the water level of the pond. The pipes connecting the forebay to the main pond are at least partially submerged under most conditions (they were at least partially submerged for the entire 2019 monitoring period). The four inlet sewers to the forebay can also be partially submerged. The largest inlet, the 60-inch inlet from the southeast, has a discharge invert elevation of 923.1. This also was below the pond elevation over the entire course of the 2019 monitoring period. To gain further understanding on the impact of the Stricker's Pond water level on the City's storm sewer system a pond level sensitivity analysis was conducted.

The water level in Stricker's Pond fluctuates. The City of Middleton has a WDNR permit that dictates a water level between 920.5 and 923.0 should be maintained in the pond. The ability to maintain the water level is limited by the outlet from the pond. The outlet consists of a 15-inch diameter storm sewer leaving the pond and a valve located within a manhole in Middleton Street (south of Voss Parkway). The valve is operated by the City of Middleton. The City of Middleton has indicated that the valve is operated to try and balance the water levels in Stricker's Pond and Tiedeman Pond so that both ponds are within their target ranges. The valve is manually operated depending on the water level conditions of both ponds.

The pond level sensitivity analysis was conducted with the pond starting water levels list in Table 4-7.

Table 4-7. Sensitivity Analysis Starting Water Surface Elevations
Stricker's/Mendota Watershed Study
City of Madison, WI

Starting Water Surface Elevation	Level Description
920.5	Minimum pond water surface elevation as per City of Middleton permit
925.5	Maximum pond water surface elevation observed during 2019 (measured on October 2, 2019)
923.0	Maximum pond water surface elevation as per City of Middleton permit

The Stricker's/Mendota XPSWMM™ model was executed for each of these starting water surface elevation under the 10%, 4%, and 1% chance event. The water levels were compared at six points in the model. The comparison points were selected based on their proximity to the pond. The results of the analysis are displayed on Figure 4-6. The impact of the pond starting water surface elevation has a substantial impact of the peak water surface elevation that is reached within the pond itself. There is also a noticeable impact in Longmeadow Road if the pond elevation is elevated. Further upstream from the pond there is little, or no, impact.

Section 5

Model Calibration

The scope of work for the calibration effort is identified below:

> Calibration will be attempted for no more than three (3) 2019-monitored storm events. The three (3) events will be selected by City, AE2S, and BC. For purposes of this project, the model will be considered to be calibrated if the overall average model bias for water surface elevations is within +/- 5 percent with reasonable effort made to minimize the largest absolute error while at the same time balancing that effort with the relative importance of the model results at each monitoring site location. The largest absolute error at each monitored location is defined as +/- 25 percent. It is understood that there may be some circumstances where calibration cannot be accomplished.

The calibration process focused on identifying consistent model input parameters that would provide reasonably comparable results for each of the three storm events. However, it is understood that the hydrologic conditions and how runoff is generated from the land surface will vary from storm to storm. Also, it is commonly found that hydrologic factors that best represent larger rain events may not be appropriate for use in smaller rain events. The focus of the calibration effort was placed on the largest monitored storm event (October 1–2, 2019) because the goal of this study is to assess flooding from large storm events. If this model is used in the future to analyze smaller rain events, additional review of the calibration parameters should be conducted, and modifications should be considered to better represent the expected runoff from smaller storms.

As part of the model calibration process, the following steps were taken:

1. The overall watershed was evaluated with various scenarios to assess the impact of modifications and compare the modeled results to the measured values. Both H&H factors were evaluated.
2. Odana Road/Hilltop Drive flow data was provided by the USGS. This data was not available at the start of the calibration process. This monitoring location is located in the Wingra West watershed and the drainage area is an isolated medium-density single family residential neighborhood with characteristics similar to many areas within the Stricker's/Mendota Watershed.
3. Calibration to the Odana Road/Hilltop Drive flow data was conducted.
4. Calibration parameters from Odana Road/Hilltop Drive were applied to the Stricker's/Mendota watershed for areas of similar land use and soils.

5.1 Monitored Pond Level and Flow Data

There are five monitoring locations within the Stricker's/Mendota Watershed that were used as part of the calibration process.

1. Stricker's Pond Elevation: monitored by the City, data obtained from Trimble Unity website
2. Stricker's Pond Forebay Elevation: monitored by the City, data obtained from Trimble Unity website

3. Longmeadow Storm Sewer Flow: monitored by City, data obtained from Trimble Unity website
4. Skyview Pond Elevation: monitored by City, data obtained from Trimble Unity website
5. Grassman Pond Elevation: monitored by City, data obtained from Trimble Unity website

5.2 Selected Runoff Events

The rain events selected for the calibration process are defined in Section 4.2.2. The events were selected based on the completeness of recorded data and the severity of the rain event. As mentioned previously, significant flooding events did not occur during the monitoring period. The October 1–2, 2019 event was the largest rain (3.0 to 3.6 inches over 19 hours). This event (based on total rainfall depth and duration) falls within the range of a 50% to 10% recurrence interval based on NOAA Atlas 14 Volume 8 Version 2 data. Both August events (total rain depth and duration) were greater than a 100 percent annual exceedance probability.

5.3 Calibration Process

An extensive calibration process was conducted on the Stricker's/Mendota watershed using the three selected measured rain events in August and October of 2019. The process is fully documented in a Technical Memo found in Appendix H. The Technical Memo contains the process, parameters modified, and results in tabular and graphical formats.

5.4 Calibration Results

Calibration results are provided in Appendix H. As a summary, Tables 5-1 through 5-4 show the calibration parameters in comparison to the measured results.

Table 5-1. Stricker's Pond Calibration Results – Pond Level (ft.)
Stricker's/Mendota Watershed Study
City of Madison, WI

	Peak Pond Level (ft.)		
	8/5/2019 Storm	8/11/2019 Storm	10/1/2019 Storm
Starting Pond Level	923.6	923.6	923.6
Gauge Peak Pond Level	923.7	923.8	925.5
Modeled Peak Pond Level	924.0	924.0	925.5
Absolute Difference (ft.)	+0.3	+0.2	0.0
% Difference (calculated based on increase in pond level)	264%	95%	-1%

Table 5-2. Stricker's Forebay Calibration Results – Pond Level (ft.)
Stricker's/Mendota Watershed Study
City of Madison, WI

	Peak Pond Level (ft.)		
	8/5/2019 Storm	8/11/2019 Storm	10/1/2019 Storm
Starting Pond Level	923.6	923.6	923.6
Gauge Peak Pond Level	924.1	923.9	926.6
Modeled Peak Pond Level	924.5	924.3	926.6
Absolute Difference (ft.)	+0.4	+0.4	+0.1
% Difference (calculated based on increase in pond level)	74%	105%	3%

Table 5-3. Skyview Pond Calibration Results – Pond Level (ft.)
Stricker's/Mendota Watershed Study
City of Madison, WI

	Peak Pond Level (ft.)		
	8/5/2019 Storm	8/11/2019 Storm	10/1/2019 Storm
Starting Gauge Level	896.5	896.5	896.5
Gauge Peak Pond Level	897.7	897.2	899.6
Starting Pond Level	893.7	893.7	893.7
Modeled Peak Pond Level	895.7	895.0	900.1
Absolute Difference in Peak WSE (ft.)	N/A	N/A	+0.5
% Difference (calculated based on peak WSE)	N/A	N/A	9%

Table 5-4. Grassman Pond Calibration Results – Pond Level (ft.)
Stricker's/Mendota Watershed Study
City of Madison, WI

	Peak Pond Level (ft.)		
	8/5/2019 Storm	8/11/2019 Storm	10/1/2019 Storm
Starting Pond Level	884.3	884.4	884.6
Gauge Peak Pond Level	885.6	885.6	887.9
Modeled Peak Pond Level	886.1	885.9	887.7
Absolute Difference (ft.)	+0.4	+0.4	-0.3
% Difference (calculated based on increase in pond level)	33%	31%	-9%

5.5 Peer Review #2

As part of the model calibration process a second "Peer Review" occurred. For the peer review the calibrated XPSWMM™ model, and a memo describing the calibration process, was provided to the city of Madison and AE2S (city consultant for Spring Harbor watershed study). The model was reviewed and comments were provided to BC. The peer review was discussed at the meeting with City, AE2S, and BC staff on February 10, 2020. As a result of the peer review there were no modifications made to the calibrated model. A summary of Peer Review #2 is included in Appendix I.

5.6 Calibration Conclusions

The shape and timing of the modeled results compares well to the monitored data. Overall, the average percent difference at the four measurement locations is 124 percent for the August 5 event, 77 percent for the August 11 event, and 0 percent for the October 1 event. However, the largest absolute difference in peak WSE at any measured location is 0.5 feet (6-inches). It is important to consider the absolute difference between modeled and measured peak WSEs in addition to the relative difference. During the August 5 event, the calibrated model predicted a peak WSE nearly 260 percent higher than was measured at the gauge. Yet, the absolute difference between these two values is only 0.3 feet (3.5-inches).

The calibration goals were met for the October 1 event as there is an overall average difference (0 percent) of less than 5 percent, and the largest percent difference (9 percent) at a monitoring location is less than 25 percent. These goals were not met for the August 5 and August 11 events. The focus of the calibration effort was placed on the largest monitored storm event (October 1-2, 2019) because the goal of this study is to assess flooding from large storm events. It is commonly found that hydrologic factors that best represent larger rain events may not be appropriate for use in smaller rain events, such as the August events. The calibration was considered to be accomplished because, for the purposes of this study, we are developing a single set of parameters that can be used for larger storm events, such as the October event.

Section 6

Model Results

6.1 Existing Conditions Calibrated Model Results

The calibrated XPSWMM™ model was executed for each of the design storms. Table D-2 in Appendix D summarizes the peak water surface elevation and the duration of flooding at selected locations throughout the Stricker's/Mendota watershed. Figure 4-6 provides the location of each of the reporting locations in Table D-2.

The Existing "Maximum Water Depth" maps for each modeled event are found in figures 6-1–6-7. (rain events from the 50% chance to the 0.2% chance events). As expected, widespread surface flooding is shown for the larger rain events (2%, 1% and 0.2% chance events). It should also be noted that presence of shallow water (0–0.25 feet) in the street right of way under the smallest modeled event (50% chance event), does not necessarily indicate "flooding" or a stormwater conveyance capacity problem. Runoff water is expected in the streets during this event. Discussion of Long Duration, Back-to-Back Model Results

6.2 Model Results Evaluation

By reviewing the 20- and 10- percent chance events, the most flood-prone areas can begin to be identified. Flooding depths greater than half a foot in the 20% and 10% chance events are indications of flood-prone areas.

The areas that appear to be most flood-prone, based on a review of the 10% chance event include:

1. Along the Mendota-Grassman Greenway from Old Middleton Road to Lake Mendota
2. Tramore Trail south of Westfield Street
3. Westfield Street east of Tramore Trail
4. Longmeadow Road, south of Stricker's Pond, and just west of Gammon Road
5. Gammon Road from Old Sauk Road to Longmeadow Road
6. Harvest Hill Road from Glenside Circle to Pebble Beach Drive
7. Blue Ridge Parkway, north of Old Sauk Road

The factors causing the flooding conditions are not fully determined at this time. Several conditions can influence the flooding including inlet capacity, storm sewer capacity, overland flow from other sources, or a combination of all of these conditions. During Phase 2 of the project, these areas will be further evaluated to assess the causes and develop mitigation measures.

6.2.1 Comparison to City Flood Control Goals

The existing conditions flooding results were compared to the City's flood control goals to quantify the performance of the stormwater conveyance system in the Stricker's/Mendota watershed. The performance of the system relative to greenway crossings, pipe capacity, inlet capacity, and street flooding were considered.

6.2.1.1 Greenway Crossings

At locations where a greenway crosses under a street, the City's goal is to safely pass the 1% chance event without overtopping the street. The crossing was determined to be overtopped if the elevation at the upstream side of the culvert is above the street crossing elevation. There are three greenway crossings within the Stricker's/Mendota watershed. The performance (whether the street is overtopped) at these locations is summarized in Table 6-1.

Table 6-1. Greenway Crossing Performance
Stricker's/Mendota Watershed Study
City of Madison, WI

Location	1%, 24-hr Design Storm Performance	Notes
Old Middleton Road	No Overtopping	Ponding observed on street from local storm sewer surcharging.
University Avenue	No Overtopping	Ponding observed on street from local storm sewer surcharging.
Camelot Drive	Overtopped	

6.2.1.2 Pipe Capacity

The City's goal is to eliminate surcharging from the storm sewer system onto City streets for up to the 10% chance event. The pipe capacity was determined to be exceeded if the peak water surface elevation at the upstream end of the pipe was above the ground surface elevation. Within the XPSWMM™ model, there are a total of 214 pipes, of which 125 are surcharged at the upstream end during the 10% chance event. This equates to 58 percent of the pipes not meeting the pipe capacity goal. Figure 6-10 graphically displays the pipes that have their capacity exceeded.

The 214 pipes result in a total pipe length of 31,980-feet, of which 18,930-feet are surcharged during the 10% chance event. This equates to 59 percent of the pipe length not meeting the capacity goal.

6.2.1.3 Inlet Capacity

For inlet capacity, the flood mitigation goal is to allow no more than 0.5 feet of stormwater ponding above storm sewer inlets rim elevations at inlet restricted low-points for the 10% chance event. As part of this study, inlet capacity was evaluated at the subwatershed level (see Section 4.4.3 for additional detail). Within the study area, there are 53 subwatersheds that were evaluated for inlet capacity (the remaining subwatersheds were not evaluated because they are outside the city of Madison or drain directly to an open channel or pond). Of the 53 subwatersheds with inlet capacity incorporated, 39 (74 percent) have ponding depth of greater than 0.5 feet above the inlet rim elevation during the 10% chance event. This is graphically displayed on Figure 6-11.

6.2.1.4 Street Flooding

Within streets, the City's goal is to maintain drivability of municipal streets for the 4% chance event. Drivability is defined as having no more than 0.2 feet of flooding at the center of the street. Within the watershed, there are a total of 17.7 miles of streets, of which 5.0 miles have a water depth of more than 0.2 feet at the street centerline during the 4% chance event. This equates to 28 percent of the streets not meeting the drivability goal. Street areas where the flood mitigation goal is not met are identified on Figure 6-12.

6.2.2 Comparison to Known Flooding in Watershed

In Section 1-3, known flooding areas in the watershed, based on City staff accounts, were identified. The areas that were identified are shown on Figure 1-4. The model results were reviewed for these known flooding areas. Flooding is observed in the model for each of the areas. A summary of the known flooding locations identified by City staff, and how the model depicts flooding in these areas, are described below.

1. **Longmeadow Road, approximately 400-feet west of Gammon Road**
   a. **Flooding Description:** Flooding occurs surrounding the road's low point in this area. It is believed that overland flow may enter the area from Gammon Road and that the existing storm sewer surcharged. Water from the road flows towards the storm sewer easement northwest of the low point.
   b. **Model Results:** Ponding of less than 0.25-feet occurs in the 50% chance event and overland flow enters the area from Gammon Road. During large events, the pond becomes more substantial, and, during the 4% chance and larger events, water flows from the road into the storm sewer easement. (See Location #16 on Figure 4-5 and Tables D-1 and D-2)
2. **Westfield Road, approximately 575-feet east of Tramore Trail**
   a. **Flooding Description:** Flooding occurs surrounding the road's low point and flows overland to the north along the sidewalk to Longmeadow Road. Flooding has been observed regularly, approximately during the 50% chance event.
   b. **Model Results:** Ponding is observed during the 50% chance event. In the 4% chance and larger events, overflow along the sidewalk towards Longmeadow Road is observed. (See Location #15 on Figure 4-5 and Tables D-1 and D-2)
3. **Intersection of Gammon Road and Harvest Hill Road**
   a. **Flooding Description:** The intersection flooded during the August 2018 storm event. Pavement was damaged in the intersection.
   b. **Model Results:** Flooding in excess of 0.5-feet begins to be observed during the 20% chance event and increases for larger events. (See Location #18 on Figure 4-5 and Tables D-1 and D-2)
4. **Intersection of Gammon Road and Old Sauk Road**
   a. **Flooding Description:** This intersection has experienced flooding during past storm events.
   b. **Model Results:** During the 20% chance event, flood depths above 0.5-feet are seen at low-points in this intersection. Depths become greater during larger events. (See Location #20 on Figure 4-5 and Tables D-1 and D-2)
5. **Longmeadow Road, south of Stricker's Pond Forebay:**
   a. **Flooding Description:** During the August 2018 storm event, this area was inundated. Pavement was damaged.
   b. **Model Results:** In the August 2018 storm event, depths in excess of 3 feet are observed. During design storms up to the 4% chance event, ponding in this area is shown as a result of insufficient inlet and pipe capacity. In the 2% chance and larger events, the elevation of water in the Stricker's Pond Forebay causes backwater and flooding onto the road. (See Location #14 on Figure 4-5 and Tables D-1 and D-2)

6. **Hickory Hollow Condominiums**
    a. **Flooding Description:** The condominium development located at the intersection of University Avenue and Hickory Hollow Drive have experienced flooding. The condominiums are along the Mendota-Grassman Greenway.
    b. **Model Results:** Results from smaller design storm events (50% to 4% chance) show overland flow from Heim Avenue and University Avenue that flows through the condominiums. During larger events (above the 2% chance event), water in the greenway is in close proximity to the condominiums. (See Location #4 on Figure 4-5 and Tables D-1 and D-2)
7. **Northwest end of Julia Street**
    a. **Flooding Description:** There have been past flooding complaints. High groundwater has been reported resulting in sumps pumps running continuously. Runoff from southeast of this area flows into Julia Street and may be a component to the observed flooding.
    b. **Model Results:** During all model events, ponding in Julia Street and overland flow from the southeast is observed. Flood depths at the end of Julia Street exceed 1 foot in the 1% chance event. (See Location #5 on Figure 4-5 and Tables D-1 and D-2)
8. **Northwest ends of Blanchard Street and Taychopera Road**
    a. **Flooding Description:** In August 2018, flooding occurred and damaged both of these streets. The streets dead-end at the Mendota-Grassman Greenway.
    b. **Model Results:** The model results for the August 2018 event show water levels from the greenway above the elevation at the end of both of these streets. (See Location #2 on Figure 4-5 and Tables D-1 and D-2)
9. **Tiedeman Pond**
    a. **Flooding Description:** The water level in Tiedeman Pond rose dramatically and flooded Gammon Road. Emergency pumping into the railroad corridor, which ultimately drains into the Mendota-Grassman Greenway, was required to lower the pond level.
    b. **Model Results:** Water level shown in the model for the August 2018 event exceeds the elevation of Gammon Road. It should be noted that this area is in the city of Middleton. Modeling within the city of Middleton was conducted to inform impacts to the city of Madison only. A direct comparison between modeled and observed flooding depths was not made. (See Location #11 on Figure 4-5 and Tables D-1 and D-2)

6.2.3 Comparison to Focus Group Flooding Reports

As part of the public engagement effort for this project, "Focus Group" meetings were conducted (see Section 7 for additional information). The initial focus group meetings were focused on allowing City and BC staff to gain an understanding on past flooding conditions that were experienced by residents. Subsequent focus group meetings during PIM #2 were focused on confirming that the flooding depicted by the model matched the residents observations from past storm events. The flooding described by residents during focus group meetings is similar to what is depicted on the flood inundation mapping.

6.3 Discussion of Long Duration, Back-to-Back Model Results

An additional design storm model run was conducted to represent the extreme condition of "back-to-back 1% chance events occurring. Figure 6-8 is a hyetograph of the rain event showing the peak rain intensities occurring 12 hours apart. Another way to describe this condition would be having two 6.6-inch rain events occurring within 36 hours. The modeled results of the maximum water depth map for this event is shown on Figure 6-9, and tabular results are shown in Table D-2. Under this event, extensive areas of flooding are shown with the most severe areas indicated adjacent to Stricker's Pond, along Westfield Road, along Gammon Road including Harvest Hill Road, Fiskdale Circle and Longmeadow Road, Blue Ridge Parkway north of Old Sauk Road, and along the Mendota-Grassman Greenway.

6.4 Model Uncertainty

In general, all models are approximations, and as such, there is a certain amount of uncertainty in the results. This uncertainty is due to approximations in the input data, simplification of the methods used to calculate flow and level, uncertainty in the measured flow and level data, etc. This model is built following the City's Modeling Guidance document and is calibrated to monitored storm events as described in previous sections. The model was constructed at the watershed-level and is intended to identify flooding problems at that scale. It can be used to determine if the City's flood control goals are met within the watershed. Caution should be exercised when evaluating flooding problems at finer scales, additional refinement of model input parameters may be required.

The model calibration was focused on developing a single set of input parameters that would represent large storm events. Additionally, only a limited amount of calibration data was available for this study. The number of field monitoring locations and the length of the monitoring period were limited. If this model is used in the future to analyze smaller rain events, additional review of the calibration parameters should be conducted, and modifications should be considered to better represent the expected runoff from smaller storms (storm events smaller than the design storms considered in this analysis, such as the August 2019 storm events included as part of the calibration).

Alternatively, the October 2019 storm event, which was the largest calibration event, was less than a 10-year storm event. There is uncertainty with how model input parameters and the results associated with them project to larger design storm events, such as the 1% chance event. It is believed that the calibrated model accurately depicts the impacts of flooding from large storm events because the input parameters are within accepted ranges and the model results correlate to anecdotal flooding information from both City staff and residents.

As part of the design and implementation of flood mitigation solutions, the City may wish to further evaluate the model uncertainty and consider how mitigation solutions could be impacted.

1. **Design flexibility.** To address model uncertainty as well as uncertainty associated with changing future conditions, design flexibility could be considered. An example of design flexibility is to consider increases (or decreases) in pipe sizes as part of a storm sewer improvement flood mitigation measure. For instance, a 48-inch diameter storm sewer may be identified as the required size to provide the desired level of service (elimination of surcharging from the 10% chance event). Increased pipe sizes could be considered to determine the added level of service that is provided (i.e., is surcharging prevented in the 4% chance event?). This can then be evaluated to determine if it provides a cost-effective factor of safety/increase in level of service.
2. **Sensitivity analysis.** A sensitivity analysis could be conducted to determine how changes to model input parameters impact the model results and performance of mitigation measures. If

changes to input parameters result in only limited impacts, the level of uncertainty associated with the model would be decreased.

Section 7

Public Engagement

As part of the Stricker's/Mendota watershed study, the City carried out an extensive public information effort with assistance from BC. In addition to various social media and web-based communication methods, public meetings were held as summarized below. Additional public engagement information, and copies of each of the Public Information Meeting (PIM) presentations is included on the City's project webpage: https://cityofmadison.com/engineering/projects/strickers-mendota-watershed-study.

7.1 Public Information Meetings (#1 and #2)

An initial PIM was held on April 22, 2019, at Asbury United Methodist Church. According to the sign-in sheet, 39 residents attended the meeting. The purpose of this meeting was to inform the public of the initiation of the study, provide an overview of what will be accomplished during the study, and to collect feedback from residents on flooding experienced. Residents also had the opportunity to request a neighborhood "focus group" meeting with City and BC staff. Based on resident requests, focus group meetings were held with smaller groups in specific geographic areas that have experienced flooding.

A second PIM was held on March 9, 2020, at Asbury United Methodist Church, and was attended by 52 residents (based on a count of people during the presentation). The purpose of this meeting was to update the public on the status of the study, provide an overview of the work conducted to date, and to display flood inundation mapping for the watershed. The PIM included an open house at the start, a presentation, question and answer session, and focus group break-out meetings.

7.2 Focus Group Meetings

During the initial phase of the Stricker's/Mendota watershed study, four focus group meetings were held. The meetings discussed flooding issues that residents have experienced and allowed for additional information to be collected. A summary of each focus group meeting is included in Appendix F. The location of each meeting is provided below and shown on Figure 7-1.

1. Julia Street and Baker Avenue (August 27, 2019, 13 attendees)
2. Hickory Hollow (August 27, 2019, 11 attendees)
3. Baker Avenue and Lake Mendota (August 27, 2019, 20 attendees)
4. Longmeadow/Backbay Circle (September 9, 2019)

As part of PIM #2, focus group meetings were held. These meetings were held for each of the four areas listed above, along with a focus group for the remaining areas of the watershed (residents not located in one of the areas shown on Figure 7-1). These meetings were held simultaneously after the presentation and general question and answer session at PIM #2. Flood inundation mapping for the 10%, 1%, and August 2018 storm event was shared with the focus groups.

7.3 Public Information Meeting #3

The third PIM for the Stricker's/Mendota Watershed Study was held virtually (due to the Covid-19 pandemic) on May 20, 2021. The PIM was attended by approximately 30 residents (based on a

count of participants within the zoom meeting). At this meeting information on the selected solutions were shared with residents. The PIM included a presentation, question and answer session and focus group break-out meetings. The focus group breakout meetings were held for each of the stand-alone flood mitigation solutions within the City of Madison, and for the local storm sewer improvements, described in Section 10. These focus group meetings were held simultaneously. A copy of the PIM #3 presentation is available on the City's project website listed above.

7.4 Public Comment Period

A public comment period for review of the Draft Final Report was held between February 4, 2022 and March 4, 2022. The Draft Final Report was posted on the project website and the public was encouraged to submit comments and feedback regarding the Draft Final Report. The City received one comment that was submitted for the Spring Harbor, Stricker's/Mendota, and Wingra West Watershed Studies. The City responded to the comment. That comment and the response is found in Appendix O.

Section 8

Proposed Solutions Considerations

Upon completion of the existing conditions portion of this project (Phase 1), which is summarized in Sections 1 through 6 of this report, those portions of the report were reviewed by the City and those sections were considered "final." The project then prepared to move into the "Phase 2" scope of work. As described in the existing agreements between the City and BC, the Phase 2 tasks are listed below. These tasks outline the general type of proposed solutions that were considered and evaluated in this study.

1. Evaluate Flood Mitigation Alternatives
    a. Volume Control: The use of "Volume Control" (VC) infrastructure, also commonly referred to as Green Infrastructure (GI) was considered as part of a larger GI analysis completed by the City. These measures would be distributed throughout the watershed to provide infiltration of stormwater and ultimately work towards meeting the LOS goals for the watershed. This study did not include a VC analysis specific to the Stricker's/Mendota watershed.
    b. Peak Flow Control: BC conducted this analysis to focus on "Peak Flow Control Infrastructure" (PFCI) and evaluate approaches to achieving the targeted LOS for stormwater management within the Stricker's Mendota watershed. Peak flow control includes a variety of approaches to convey or store runoff that is currently not being managed to the City's performance goals. Specific components and approaches are described in detail in Section 9.
2. Public Engagement
    a. During this phase of the project, additional opportunities for public interaction were conducted.

Section 9

Proposed Solutions Development

The proposed solutions development process focused on identifying "Peak Flow Control" (PFC) solutions to resolve flooding. PFC solutions are defined by the City of Madison as, any stormwater control measure that has the ability to store or convey water, but not infiltrate water.

The use of volume control (VC) measures, also commonly referred to as green infrastructure (GI), was considered as part of a larger GI analysis completed by the City. These measures would be distributed throughout the watershed to provide infiltration of stormwater and ultimately work towards meeting the LOS goals for the watershed. This study did not include a VC analysis specific to the Stricker's/Mendota watershed. The City completed a distributed green infrastructure analysis in parallel. Information on the results of that study will be made available once it is ready for public release.

9.1 Overall Evaluation Process Methodology

The process utilized to evaluate potential solutions, and ultimately to select solutions proposed for implementation, is described in the following sections. This section (Section 9.1) includes the process used for solution development. Section 9.2 describes various processes considered, for solutions that were selected and solutions that were not selected.

9.1.1 Data Review

To commence the solutions development process, the existing conditions results were further reviewed to identify constriction points within the watershed. Constriction points were identified by considering existing flooding conditions and identifying the cause, or causes, of flooding at individual areas. Constriction points identified included the following types of areas: where a larger storm sewer discharges into a smaller sewer, a storm sewer that is undersized, inadequate inlet capacity, and/or the lack of an overland flow path.

Additionally, pertinent data within the watershed was reviewed to further determine restrictions to implementation of potential solutions. The following restrictions were identified:

- Stricker's Pond peak water surface elevations. The rise in elevation within the pond as a result of a storm event was considered a constraint. The proposed solutions need to result in no increase in the peak water surface elevation the pond reaches following a storm.

9.1.2 Solution Brainstorming

Following the initial data review, a meeting was held on May 6, 2020 with City of Madison Engineering Staff and BC to discuss the initial data review, consider various constriction points across the watershed, discuss conceptual scenarios, and identify potential opportunities for flood mitigation measures.

9.1.3 Evaluation of Potential Solutions

Following the solutions brainstorming, BC evaluated various potential solutions to flooding. The calibrated existing conditions XPSWMM™ model developed as part of Phase I of this study was utilized to evaluate the flood control performance of the various potential solutions. Within the

XPSWMM™ model, the hydraulic input parameters for various components of the storm water conveyance system were modified to simulate potential improvements. The evaluation of various potential solutions is described below.

1. **Inlet Capacity Improvements:** As identified in the existing conditions analysis, there are inlet capacity limitations throughout the watershed. The first step in the analysis was to remove inlet capacity restrictions from the model.
2. **Local Storm Sewers:** Throughout the Stricker's/Mendota watershed there is also flooding caused by insufficient storm sewer capacity. An initial step of the evaluation of potential solutions was to identify proposed "local" storm sewer improvements. Improvements to these storm sewers can have an impact on the sizing of other mitigation measures such as greenway and culvert improvements. Enlarged upstream storm sewers can result in increased peak flow rates into ponds and greenways and impact the pond's peak water surface elevation. For the purposes of the Stricker's/Mendota watershed the majority of storm sewers within the system were considered local storm sewers. As part of this study, local storm sewers were defined as those that are not impacted by upstream flood solutions. To determine potential improvements to these areas the following steps were taken.
    a. Based on the layout of the storm sewer system within the watershed, individual sections of storm sewer were isolated and evaluated for improvements.
    b. Improvements were incorporated into the isolated section of storm sewer with a target of meeting the City's 10% chance event level of service goal.
    c. After the 10% chance event target was met, the 1% chance event was executed in the XPSWMM™ model, and the results were reviewed. Additional storm sewer enhancements were made until the 1% chance event goal, of maintaining flooding within the right-of-way was met. In cases, where the 1% chance event could not be maintained within the right-of-way an alternative goal of preventing structure flooding was considered.
    d. Subsequent sections of the storm sewer system were then evaluated until all areas of local storm sewer were evaluated.
    e. The local storm sewer improvements were consolidated into an overall watershed XPSWMM™ model the impacts of the local improvements in conjunction with regional improvements were considered. Local storm sewer were then modified iteratively with regional improvements.
3. **Regional Stormwater Detention Improvements:** At various locations in the watershed (described in Sections 9.2.1.2 and 9.2.1.3) additional stormwater detention volume was considered. The detention improvements were evaluated within the XPSWMM™ model by modifying the stage-area relationship and outlet structure of existing ponds. The detention improvements were considered after local storm sewer improvements (limited initial evaluation was started prior to local storm sewer sizing). Generally, an initial evaluation of a detention improvement was conducted using an approximation of a potential expansion (for instance, increasing an existing stage-area relationship by 50%). Following, the initial evaluation, a more detailed review of the potential detention grading and outlet modifications were considered, and implemented into, the XPSWMM™ model.
4. **Relief/Mainline Sewer Improvements:** After initial regional detention improvements were considered, relief storm sewer and mainline storm sewer improvements were considered. These improvements were considered in conjunction within detention improvements, as the size of relief of mainline sewer improvements are generally tied to detention improvements, and local storm sewer improvements, within the watershed.

5. **Greenway and Culvert Improvements:** In the greenway that conveys flow from Grassman Pond to Lake Mendota, flow capacity improvements were considered to address large-scale regional flood impacts. The greenway improvements were evaluated within the XPSWMM™ model by modifying the channel cross-section, reducing roughness, and increasing the slope to convey higher peak flows at lower depths of flow. Additionally, improvements to the culverts that convey flow between greenway sections at University Avenue and Camelot Drive were considered.
6. **Stricker's Outfall:** Modeling did not indicate that improvements to City of Madison storm sewers was likely to significantly impact peak WSEs in Stricker's Pond. However, to mitigate any potential increase that could occur, modifications to the existing outlet connecting Stricker's Pond and Tiedeman Pond were considered, including upsizing the existing outlet and installing a separate parallel outlet at the existing invert elevation.
7. **Tiedeman Outfall:** Any improvement to the Stricker's Pond outfall will result in an increase in peak WSE at Tiedeman Pond. To mitigate this increase, a new outlet connecting Tiedeman Pond with the Lake Mendota watershed in the City of Madison was considered. Varying slopes and daylight locations were analyzed for their impact at Tiedeman Pond and with the existing and proposed infrastructure in the Lake Mendota watershed.

9.1.4 Discussion of Potential Solutions with City Engineering Staff

Following the initial evaluation of potential solutions, a meeting was held to discuss the solutions evaluated, and the corresponding modeling results. The first meeting to discuss potential solutions was held on August 7, 2020. Following that meeting additional analysis was conducted to evaluate a range of scenarios for the Lake Mendota greenway area. Subsequent follow-up discussions also occurred with City Engineering Staff in Summer and Fall of 2020.

9.1.5 Convergence on Solutions

As the evaluation progressed, a set of solutions (described below) were determined to provide the most viable path towards meeting the flood control goals for the project. This convergence of solutions was based upon performance of the solutions, technical feasibility, and the input from City Engineering Staff.

9.1.6 City Agency Meetings

Following the convergence on solutions for the Stricker's/Mendota Watershed, City Engineering Staff met with various City of Madison agencies to discuss the potential solutions and challenges/obstacles to implementation of those solutions. Meetings were held with the Mayor's Office, Water Utility, Parks Department, Fire Department, Metro Transit, Planning Department, Operations Department, Streets/Forestry, Transportation Engineering, and Streets Design Division. Notes from the meetings are included in Appendix J.

9.1.7 Finalization of Solutions

The City agency meetings did not result in any revisions to the solutions developed for the Stricker's/Mendota watershed. Following this, the solutions were finalized.

9.1.8 Peer Review #3

As a final step of the solutions development process, a third "Peer Review" occurred. For the peer review, the proposed conditions XPSWMM™ model and a presentation describing the solutions development process was provided to the City and AE2S (City consultant for Spring Harbor watershed study). The model was reviewed, and comments were provided to BC. The peer review was discussed at the meeting with City, AE2S, and BC staff on April 1, 2021.

As a result of the peer review, BC made minor modifications to pipe roughness and inlet capacity input parameters throughout the model for consistency. BC also modified the proposed greenway cross-section to eliminate the potential for "double counting" of storage in the area and modified the University Avenue culvert inlet configuration. The modifications did not significantly impact model results or the selected solutions. A summary of Peer Review #3 is included in Appendix K.

9.2 Description of Solutions Considered

Stormwater control measures were considered in various locations across the Stricker's/Mendota watershed. Ultimately, a variety of solutions were selected for implementation, and there were a number of solutions that were reviewed, but not selected. The following sections provide information about all solutions that were considered.

9.2.1 Solutions Reviewed – Not Selected

The following flood mitigation measures were considered as part of the evaluation process; however, they were not selected for implementation. It should be noted that the potential solutions which were reviewed but eliminated from consideration were not evaluated in as much detail as the selected solutions. It may be possible that if the selected solutions cannot be implemented, these solutions could be implemented instead. However, there may be barriers to implementation that were not identified due to the less-thorough evaluation.

9.2.1.1 New Stormwater Detention

1. **Conceptual Project Description:** Construct new stormwater detention facilities in existing green space to reduce peak flows into mainline storm sewer/greenway systems and limit the required size of downstream stormwater infrastructure.
2. **Reason for Exclusion:** An evaluation of available space in the Stricker's/Mendota watershed did not reveal any promising locations for new stormwater detention. Existing green spaces in the watershed were typically located at topographic high points or were in upstream portions of the watershed that were not considered hydraulically viable.

9.2.1.2 Skyview Pond Detention Improvements

1. **Conceptual Project Description:** Increase available storage in the existing Skyview Pond to reduce peak flows into downstream Grassman Pond and the Mendota Greenway.
2. **Reason for Exclusion:** Reduced flows from Skyview Pond did not result in significant improvement to flooding in downstream greenway areas. Modeling showed completely eliminating flow from Skyview Pond into the Mendota Greenway would not negate the need for greenway and culvert improvements. Because the downstream projects would still be required even with substantial improvements at Skyview Pond, this alternative was eliminated.

9.2.1.3 Grassman Pond Detention Improvements

1. **Conceptual Project Description:** Expand the footprint of existing Grassman Pond to maximize storage. The increased footprint would include the existing Old Middleton North and South Ponds. Increased storage volume would result in reduced peak flows entering the downstream Mendota Greenway.
2. **Reason for Exclusion:** Maximizing the available storage at Grassman Pond did not reduce flows in the Mendota Greenway enough to eliminate the need for downstream greenway and culvert improvements. Because the downstream projects are still required, this alternative was not considered for a more-detailed evaluation.

9.2.2 Solutions Reviewed – Selected

This section provides a brief description of solutions that are selected for implementation as flood mitigation measures in the Stricker's/Mendota watershed. The locations of the various solutions are displayed on Figure 9-1. Further detail for each of the proposed solutions is provided in Section 10. The selected solutions generally fall into two categories 1) local improvements (storm sewer and inlet capacity) that are dispersed across the watershed and will be implemented as part of street reconstruction projects, and 2) stand-alone solutions that will be implemented as individual Capital Improvement Plan (CIP) projects.

9.2.2.1 Local Storm Sewer Improvements

1. **Conceptual Project Description:** Improve storm sewers along various streets throughout the watershed. Improvements include increasing pipe size and/or modifying pipe elevations/slopes.
2. **Iterations Considered:** Various pipe sizes were considered.

9.2.2.2 Inlet Capacity Improvements

1. **Conceptual Project Description:** Improve inlet capacity at various locations throughout the watershed. Improvements may include increasing the number of inlets and/or modifying the type of inlets.
2. **Iterations Considered:** None.

9.2.2.3 Longmeadow Relief Sewer

1. **Conceptual Project Description:** Install separate parallel relief sewer along Gammon Road and under Longmeadow Road that discharges to Stricker's Forebay. New sewer will drain East Harvest Hill Road area and provide additional flow capacity for the Stricker's Pond watershed.
2. **Iterations Considered:** Increasing size of existing sewer, as well as various pipe sizes for proposed relief sewer, were considered. Additionally, different levels of connection between relief sewer and existing sewer were evaluated to optimize hydraulic performance.

9.2.2.4 Mendota Greenway Improvements

1. **Conceptual Project Description:** Improve flow capacity in existing Mendota Greenway. Excavate channel to increase dimensions, reduce roughness by clearing vegetation, and increase channel slope.
2. **Iterations Considered:** Impacts of each factor were considered independently (channel dimensions, roughness, slope) to determine which were required to meet performance goals. The channel improvements were considered with and without upstream improvements (specifically increased storage at Skyview Pond and/or Grassman Pond) and with and without culvert improvements at University Avenue and Camelot Drive.

9.2.2.5 University Avenue Culvert Improvements

1. **Conceptual Project Description:** Install circular 84" RCP culvert parallel to existing box culvert at a lower invert elevation to improve flow capacity.
2. **Iterations Considered:** Various improvements to the existing culvert including lowering in place, removing and replacing with a larger culvert, and modifying inlet configuration were analyzed. Several iterations of parallel culvert sizes and inverts were also considered.

9.2.2.6 Camelot Drive Culvert Improvements

1. **Conceptual Project Description:** Replace existing parallel 48-inch culverts with parallel 4-foot by 8-foot concrete box culverts and eliminate upstream drop structure to lower the channel upstream of the culvert.
2. **Iterations Considered:** Various culvert replacement sizes and shapes were considered. The existing upstream drop structure was also analyzed for its impact on current flood issues and potential benefits of its removal.

9.2.2.7 Stricker's Pond Outfall

1. **Conceptual Project Description:** Install additional outlet connecting Stricker's Pond with Tiedeman Pond to mitigate potential for increase in peak WSE from upstream improvements in Madison.
2. **Iterations Considered:** Various outlet sizes were considered.

9.2.2.8 Tiedeman Pond Outfall

1. **Conceptual Project Description:** Install a gravity outlet connecting Tiedeman Pond in Middleton with the Skyview Pond in Lake Mendota watershed in Madison.
2. **Iterations Considered:** Various slopes, discharge locations, and sizes for the outlet were considered.

Section 10

Selected Solutions

The selected solutions were introduced in Section 9 of this report. Figure 9-1 shows an overall proposed improvement map for the Stricker's/Mendota watershed.

In Sections 10.1 to 10.9, the proposed improvements for the Stricker's/Mendota watershed are described in detail. Included is pertinent information regarding the nature of the proposed solutions, the flood reduction benefits, and other considerations.

10.1 Local Storm Sewer Improvements

Detailed Project Description

During this study, BC determined that much of the existing flooding issues in the Stricker's/Mendota watershed are a result of undersized local storm sewers that are incapable of conveying peak flows during intense rainfall events. During these events, the undersized pipes operate in a surcharged condition, which pushes stormwater to the ground surface and results in overland flow and flood impacts.

To better understand and ultimately address these issues, BC split the existing conditions XPSWMM™ model for the watershed into smaller sections consisting of relatively independent stretches of storm sewer. These sections were each run separately for the 10% chance event with the model's 2D engine inactive. BC assumed each separate model was drained by a free outfall at the downstream end. Pipes were then upsized iteratively until the 10% chance event met the City's design goal of no surface flooding. Pipes were also lowered and slopes were modified as needed to meet the flood control goals.

The individual models were then incorporated into the overall watershed model which was run with the 2D engine active. After verifying the proposed pipes continued to meet the 10% chance event goal of no street surcharging in the combined model, BC ran the model for the 4% and 1% chance event. Where the proposed pipes did not meet the 4% and 1% chance event goals, they were further modified until City goals were met, where feasible. It should be noted that there are some locations where goals were not met. These are described in further detail in Section 12.

Locations of local storm sewer improvements are shown on Figure 10-1.

Associated Flood Reduction Benefits

As a result of the local storm sewer improvements, the City's flood control goals will be met in the following flood reporting locations and Focus Group areas:

1. Highland Avenue Low Point–South of Skyline Drive
2. North End of Blue Ridge Parkway North of Appalachian Way
3. Intersection of Capital Drive and Lake Mendota
4. Westfield Road Low-Point – Between Apple Hill Circle and Tramore Trail
5. Intersection of Longmeadow Road and Quail Ridge Drive
6. Gammon Road Low Point – Between Longmeadow Road and Stone Glen Road
7. Intersection of Gammon Road and Harvest Hill Road

8. Harvest Hill Road – Between Strathfield Circle and Morningdale Circle
9. Intersection of Gammon Road and Old Sauk Road
10. Intersection of Harvest Hill Road and Pebble Beach Drive

The level of flood reduction associated with the local storm sewer improvements varies. The local sewer improvements are spread across the watershed and the benefits related to these improvements are best described by the comparison to the City's flood reduction goals as documented in Section 11.

Project Constraints/Considerations

Because local storm sewer improvements involve the replacement of storm sewer in its existing alignment, there are relatively few project constraints. Work will be contained within City-owned right-of-way and will not impact privately owned property.

Potential conflicts with existing utilities may occur in some locations where upsized pipes must be lowered to maintain cover requirements. As part of this, there are likely to be conflicts with existing water mains and water laterals, which would need to be lowered. Additionally, BC has noted potential sanitary sewer conflicts in the following locations:

1. Longmeadow Road Low Point - South of Stricker's Forebay
2. Intersection of Longmeadow Road and Gammon Road
3. Intersection of Sawmill Road and Gammon Road
4. Intersection of Harvest Hill Road and Pebble Beach Drive
5. Intersection of Spyglass Court and Pebble Beach Drive
6. North of Intersection of Old Sauk Road and Everglade Drive
7. Highlands Avenue, 230 feet north of Willow Lane
8. Intersection of Willow Lane and Highlands Avenue
9. Intersection of Larch Circle and Highlands Avenue
10. Intersection of Appalachian Way and Blue Ridge Parkway
11. Intersection of Harvest Hill Road and Strathfield Circle
12. Intersection of Capital Avenue and Greening Lane

Conflicts encountered can be resolved by lowering sanitary sewer, if feasible, or installing a sanitary sewer siphon.

Water Quality Benefits

Local storm sewer improvements will not provide water quality benefits.

Additional Notes/Information

Local storm sewer improvements will increase peak flows to downstream discharge locations including wet ponds (Stricker's Pond, Grassman Pond), dry ponds (Skyview Pond), greenways (Lake Mendota Greenway), and mainline storm sewers (as in Gammon Road). The impact of these improvements on downstream flows have been considered and are incorporated into the selected solutions discussed later in this section.

10.2 Inlet Capacity Improvements

Detailed Project Description

The existing conditions model indicated that in some locations, insufficient inlet capacity is a factor that contributes to flooding. As part of inlet capacity improvements, additional inlets and/or inlets with a larger capacity will be installed. The exact location and type of inlets to be installed were not identified as part of this study. The inlet capacity analysis was conducted at a subbasin level (as described in Section 4.4.3). Figure 10-2 identifies the subbasins where additional inlet capacity is needed. As part of the implementation process, the detailed drainage patterns of the subbasins will need to be considered and further analysis completed to determine the number and type of inlets needed.

To evaluate the impacts of improved inlet capacity, the existing conditions model was updated to eliminate the composite rating curves simulating inlet capacity restrictions. Instead, the XPSWMM™ rating curves were converted to weirs, the nodes upstream of the weirs were disconnected from the 2D surface, and the nodes downstream of the weirs were linked to 2D. The weirs were used to ensure all runoff generated at the hydrology node was transferred to the downstream storm sewer. Stormwater was only transferred to the 2D surface if the downstream pipe was in surcharge condition.

Associated Flood Reduction Benefits

Eliminating inlet capacity restrictions improved flooding within the watershed. However, additional improvements, such as storm sewer improvements, are typically needed to meet the City's goals.

The level of flood reduction associated with the inlet capacity improvements varies and the direct benefit is difficult to measure because in most locations in the watershed they are proposed in conjunction with local storm sewer improvements. The benefits related to these combined improvements are best described by the comparison to the City's flood reduction goals in Section 11.

Project Constraints/Considerations

Inlet capacity improvements will be contained within City right-of-way and should not impact any nearby property owners. These improvements will likely be incorporated during the street reconstruction schedule along with local storm sewer improvements (discussed in Section 3.1). The exact location and type of new inlets will be determined during the design of the local storm sewer improvements.

Water Quality Benefits

Inlet capacity improvements will not provide any water quality benefits.

Additional Notes/Information

As with local storm sewer improvements, inlet capacity improvements will increase peak flows downstream as water is moved through the system more efficiently, including at Stricker's Pond and the Lake Mendota Greenway. The impact of these improvements is factored into the selected solutions described later in this section.

The evaluation of inlet capacity conducted as part of this study only included inlets within the City right-of-way. In some areas of the watershed, particularly areas of commercial development, there is significant private storm sewer and private inlets. As part of the design of inlet capacity improvements, the private system should be considered and incorporated into the analysis.

10.3 Longmeadow Relief Sewer

Detailed Project Description

The existing conditions model shows that much of the flooding in the Gammon Road area upstream of Stricker's Pond is a result of the Gammon Road mainline storm sewer being undersized for its drainage area. During intense rainfall events, the storm sewer is in a surcharged condition which results in impacts to nearby structures.

To evaluate this area, BC looked at the areas contributing flow to the Gammon Road mainline storm sewer, including areas that drain directly to Gammon Road, the area that drains through the East Harvest Hill Road storm sewer and the area that drains through Fiskdale Circle. The Gammon Road storm sewer was then modeled to determine the size required to meet the City's design goals. In conjunction with this analysis, BC "turned off" the Harvest Hill Road drainage area from the model to determine whether the existing Gammon Road sewer could meet the City's 1% chance event design goals for the remaining areas. Results confirmed that much of the existing storm sewer was adequately sized to handle Fiskdale Circle and local Gammon Road flows. BC then modeled the system with the Harvest Hill Road area routed through a new relief sewer running parallel to the existing storm sewer in Gammon Road and discharging to Stricker's Pond. This concept met the design goals while limiting the size of new storm sewer required in this area and is displayed on Figures 10-3A and 10-3B.

Associated Flood Reduction Benefits

As a result of the Longmeadow Relief Sewer, the City's design goals are met in the following known flooding locations and Focus Group areas:

1. Stricker's Pond Forebay
2. Intersection of Longmeadow Road and Quail Ridge Drive
3. Intersection of Gammon Road and Harvest Hill Road
4. Intersection of Gammon Road and Old Sauk Road
5. Longmeadow Focus Group Area

Project Constraints/Considerations

The majority of this project will be contained within City right-of-way and stormwater easements. Downstream of Longmeadow Road the existing storm sewer is within an easement along the rear lot lines for homes that are on the northside of the road. The evaluation of this solution utilized the same alignment (a parallel sewer). To fully avoid impacting the homeowner on the north side of Longmeadow Road where the current mainline storm sewer crosses the road, it is expected that the proposed relief sewer and the existing sewer will need to turn west and follow Longmeadow Road for approximately 100 feet before turning north and connecting with the existing alignment north of Longmeadow Road.

The City has indicated that a preferable relief sewer alignment would be to keep the storm sewer within the road right-of-way, instead of following the existing alignment north of Longmeadow Road. The alternative route would follow Longmeadow Road from the Quail Ridge Drive intersection to the Stricker's Forebay rather than running alongside the existing storm sewer through the stormwater easement north of Longmeadow Road. During final design, this alternative alignment should be evaluated for construction feasibility and performance.

There are several utility conflicts expected in Gammon Road and at the Longmeadow Road crossing. BC has noted potential utility conflicts in the following locations:

1. The sanitary sewer at the intersection of Gammon Road and Harvest Hill Road. It is anticipated that the sanitary sewer along Gammon Road from Sawmill Road to Harvest Hill Road would need to be reconstructed, and lowered, to eliminate the conflict.
2. Where the storm sewer crosses Longmeadow Road (as described above) the storm sewer is expected to jog to the west to avoid a house. It is anticipated the sanitary sewer would also need to jog to the west.
3. The proposed storm sewer would cross water mains and laterals at several locations. It is assumed the water main would need to be lowered at each of the locations. In addition, there are likely conflicts with water laterals that would need to be lowered.

Based on the size and location of the project, WDNR permitting for a Notice of Intent (NOI) and a new outfall may be needed. A NOI would be required if the disturbed area associated with the project exceeds 1-acre. A Chapter 30 permit for a new outfall may be needed due to the outlet from the sewer into Stricker's Forebay.

Additionally, there are mapped wetlands surround Stricker's Pond and Stricker's Forebay. There is a chance the Longmeadow Relief Sewer will impact these wetlands and require WDNR and USACE wetland permitting prior to implementation.

Water Quality Benefits

The relief sewer will not provide water quality benefits.

Additional Notes/Information

The Longmeadow Relief Sewer is sized to convey flow from the proposed local storm sewer improvements in the Harvest Hill Road area as well as to help convey flow from Gammon Road and Fiskdale Circle. To avoid worsening flood impacts along Gammon Road, the Longmeadow Relief Sewer should be constructed prior to upstream improvements.

10.4 Upstream Lake Mendota Greenway

Detailed Project Description

The Upstream Lake Mendota Greenway between Old Middleton Road and University Avenue is highly vegetated with a shallow channel and wide, flat overbanks. Nearby properties on either side of the channel, including a series of condominiums at Hickory Hollow Drive, are located near the greenway and are prone to flooding during intense rainfall events. The goal for this area is to meet the City's 1% chance event flood goal of no structure flooding.

The "critical point" in this area appears to be the elevation of the nearest Hickory Hollow Drive condominium building. Based on available topographic data, the lowest ground elevation adjacent to the building is at an elevation of approximately 871.5 feet (it should be noted this elevation was estimated from LiDAR data and is not representative of the building's first floor elevation). The bottom of the existing channel nearby is approximately 868.5 feet. To meet the City's design goals at the critical point, modeling indicated additional storage in and near the greenway channel and additional peak flow capacity would be needed.

To efficiently analyze this area, the portions of the model upstream of Grassman Pond including Stonefield Pond in Middleton and Skyview Pond in Madison (plus local storm sewer improvements), were removed from the 2D model. Instead, the flows out of both ponds, after accounting for local storm sewer improvements, were added as user-defined inputs. This allowed the model to include the flows into the greenway from upstream areas while reducing the model size and runtime. Changes to upstream Grassman Pond, greenway dimensions, roughness, and slope were then

analyzed iteratively to determine their individual impacts on greenway flow capacity and peak WSE at the critical point and other nearby structures. It was determined that even with a large increase in storage at Grassman Pond, downstream improvements were still required, so this component was eliminated from further consideration. The dimensions, roughness, and slope changes were then analyzed together without Grassman Pond improvements and modified until the City's flood goals were met. Finally, the upstream areas were "turned on", the user-defined flow inputs were removed, and the entire model was re-run to verify the modeled improvements still worked. The results of these iterations were combined into various scenarios and the analysis is summarized in Table 10-1.

Table 10-1. Upstream Lake Mendota Greenway Scenarios
Stricker's/Mendota Watershed Study
City of Madison, WI

Scenario	Improvements Included	Peak WSE at the Upstream Lake Mendota Greenway Critical Point (Elev. 871.5)
Existing Conditions	N/A	873.2
Base Conditions	Upstream storm sewer improvements, Tiedeman Pond outfall, no inlet capacity restrictions	873.7
1	Base Conditions and Grassman Pond Expansion	873.5
2	Grassman Pond Expansion, No Flow from Skyview Pond or Tiedeman Pond	870.8
3	Base Conditions with Grassman Pond Expansion, Greenway Cross-Section Improvements, and Existing University Avenue Culvert Lowered	869.7
4	Base Conditions with Grassman Pond Expansion, Greenway Cross-Section Improvements, and Parallel 72" Culvert at University Avenue	870.9
5 (Selected Solution)	Base Conditions with Upstream and Downstream Greenway Cross-Section Improvements and Parallel 84" Culvert at University Avenue	871.3

The selected solution for the Upstream Mendota Greenway includes the excavation of the existing channel to provide a more well-defined flow path for stormwater, the clearing of dense vegetation to reduce channel roughness, and the lowering of the downstream channel invert to allow for a steeper slope along the channel. Figure 10-4 below shows the conceptual cross-section used in the selected solution. Figure 10-5 provides an overview of the greenway improvements and the conceptual grading for the improvements. For these improvements to be effective, additional downstream improvements at the University Avenue culvert crossing and the Downstream Lake Mendota Greenway area are also needed. These projects are described in Sections 10.5 and 10.6 respectively.

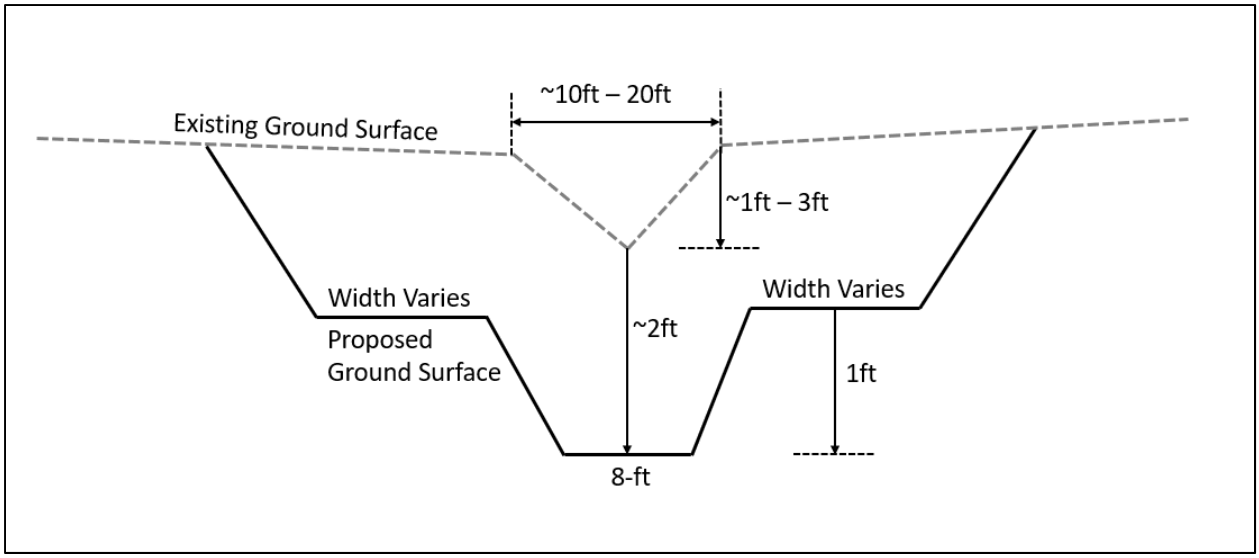


Figure 10-4. Mendota Greenway Conceptual Cross-Section (not to scale)

Associated Flood Reduction Benefits

Modeling indicates the City's 1% chance event flood control goals of no structure flooding can be met with the selected solution. The modeled peak water surface elevation at the Hickory Hollow Drive condominiums is below the critical point and is below other nearby structures with the selected alternative in place.

The City's flood control goal of no structure flooding under the 1% chance event is met at these locations as a result of the selected alternative:

1. Mendota Greenway – Between University Avenue and Old Middleton Road
2. Northwest End of Julia Court
3. Hickory Hollow Focus Group

Project Constraints/Considerations

While the Lake Mendota Greenway is in City-owned property, some grading may be required on nearby private property depending on the final design. The existing greenway is heavily wooded. As a result of the proposed grading required, significant tree removal within the existing greenway would be needed.

A wetland delineation completed by the City for the project area shows wetlands along the greenway. WDNR and USACE wetland/waterway permitting will be required for implementation of the project. Additionally, it is anticipated that a NOI permit will be needed.

There are no known utility conflicts in the greenway.

As mentioned above, additional improvements to the University Avenue culvert crossing will be required for this solution to be effective. There appear to be utility conflicts at University Avenue that will need to be considered in the final design. These will be discussed in Section 10.5.

Water Quality Benefits

The greenway improvements are not expected to provide significant water quality benefits.

Additional Notes/Information

The implementation of improvements to the Upper Mendota Greenway alone will not achieve all flood goals along the channel. Improvements to the University Avenue culvert are required in conjunction with these improvements to mitigate flooding at the Hickory Hollow Drive condos. The increase in peak flows passing through the Upstream Mendota Greenway will lead to higher peak flows downstream. These impacts are addressed later in this section.

Implementation of the Upstream Lake Mendota Greenway improvements are currently ongoing as part of the Mendota-Grassman Greenway Flood Mitigation and Restoration Design project. The project should be consulted for further information on these improvements.

10.5 University Avenue Culvert Crossing

Detailed Project Description

The University Avenue culvert crossing connecting the Upstream and Downstream Lake Mendota Greenways is currently a 6-foot by 10-foot box culvert in good condition. However, the existing upstream culvert invert elevation is in close proximity to nearby structures along the greenway which makes it difficult to address upstream flooding without including culvert improvements. The invert elevation of the culvert is 866.9, which is about 4.5-feet lower than the critical point elevation (871.5) described above in Section 10.4. Thus, prior to the culvert reaching its full flow depth of 6-feet there are flood impacts to nearby structures. The flood control goal for the University Avenue Culvert Crossing is to meet the City's 1% chance event goal of no structure flooding upstream and downstream of the culvert.

To evaluate the University Avenue crossing, the simplified model described in Section 10.4 was used to limit model runtimes while accounting for all upstream flow to the culvert. Culvert sizes and configurations were iterated in conjunction with upstream and downstream greenway improvements to eliminate structure flooding during the 1% chance event. Modeled alternatives included replacing the existing box culvert, lowering the existing culvert in-place, and installing a separate parallel culvert at a lower invert elevation. Various culvert sizes and inverts were analyzed for their impact on flooding in the upstream and downstream greenways. The results of these iterations were summarized into various scenarios and the analysis is documented in Table 10-2.

Table 10-2. University Avenue Scenarios
Stricker's/Mendota Watershed Study
City of Madison, WI

Scenario	Upstream Improvements Included	Culvert Size	Flow Through University Avenue Culvert (cfs)	Peak WSE at the Upstream End of University Ave Culvert
Existing Conditions	N/A	Existing (6' x 10')	463	873.2
Base Conditions	Upstream storm sewer improvements, Tiedeman Pond outfall, no inlet capacity restrictions	Existing (6' x 10')	518	873.7
1	Base Conditions and Grassman Pond Expansion	Existing (6' x 10')	490	873.5
2	Grassman Pond Expansion, No Flow from Skyview Pond or Tiedeman Pond	Existing (6' x 10')	225	870.8
3	Base Conditions and Grassman Pond Expansion, Greenway Cross-Section	Existing (6' x 10')	509	869.7

Table 10-2. University Avenue Scenarios
Stricker's/Mendota Watershed Study
City of Madison, WI

Scenario	Upstream Improvements Included	Culvert Size	Flow Through University Avenue Culvert (cfs)	Peak WSE at the Upstream End of University Ave Culvert
	Improvements, Existing University Avenue Culvert Lowered			
4	Base Conditions and Grassman Pond Expansion, Greenway Cross-Section Improvements, Parallel 84" Culvert at University Avenue	Existing (6' x 10') and Parallel 72"	478	870.9
5 (Selected Solution)	Base Conditions and Upstream and Downstream Greenway Cross-Section Improvements, Parallel 84" Culvert at University Avenue	Existing (6' x 10') and Parallel 84"	587	871.3

The existing box culvert is in good condition and replacing/lowering this culvert would require open-cut construction and impacts to University Avenue which was recently reconstructed. The selected solution for the University Avenue culvert crossing, shown on Figure 10-6, is the installation of a separate parallel 84-inch RCP culvert adjacent to the existing culvert. Ideally, this culvert would be installed via trenchless methodology to minimize impacts to University Avenue. The proposed culvert will be installed with an upstream invert elevation approximately 3 feet lower than the existing culvert and will fully convey flows from events up to the 10% chance event. The larger existing culvert will help convey flows from storms larger than the 10% chance event. The lowered invert facilitates the excavation and lowering up the upstream greenway to prevent flood impacts at nearby structures.

Associated Flood Reduction Benefits

In conjunction with upstream greenway improvements, modeling shows the University Avenue culvert improvements eliminate flood impacts for nearby structures, including at the "critical point" in the Upstream Mendota Greenway described in Section 10.4. Specifically, the culvert improvements help meet flood control goals for the 1% chance event at the following locations:

1. Hickory Hollow Condominiums
2. Mendota Greenway–Between University Avenue and the Julia Street Outfall

Project Constraints/Considerations

The University Avenue culvert improvements are contained within City-owned property in the Lake Mendota Greenway and County right-of-way. No impacts to nearby property owners are anticipated.

The relief culvert will be located underneath University Avenue which is a County Highway MS. Coordination with, and Dane County permitting, will be required to install the culvert.

BC noted the existence of several utilities in the University Avenue corridor that will need to be considered in final design. It is anticipated that existing utilities may need to be moved as part of the construction.

Water Quality Benefits

There are no expected water quality benefits to this solution.

Additional Notes/Information

This project requires improvements to the upstream and downstream greenways and the culvert crossing at Camelot Drive to be effective.

Implementation of the University Avenue Culvert Crossing is currently ongoing as part of the Mendota-Grassman Greenway Flood Mitigation and Restoration Design project. The project should be consulted for further information on these improvements.

10.6 Downstream Mendota Greenway

Detailed Project Description

The Downstream Lake Mendota Greenway between University Avenue and Camelot Drive is similar to the Upstream Lake Mendota Greenway described in Section 10.4. It is highly vegetated with a shallow channel and wide, flat overbanks. There are numerous nearby properties located roughly four feet above the channel bottom that experience flood impacts during large storm events. At the downstream end, the channel passes through a drop structure before entering the culverts under Camelot Drive. The goal for this area is to meet the City's 1% chance event flood goal of no structure flooding.

This area was initially modeled using the simplified 2D model described in Section 10.4. Changes to the greenway dimensions, roughness, and slope were analyzed iteratively to determine their individual impacts on greenway flow capacity and peak WSE at the critical point and other nearby structures. The drop structure was also eliminated from the model to allow for a steeper slope in the greenway and greater vertical separation from the channel invert to nearby buildings. The improved dimensions, roughness, and slope changes were then analyzed together and modified as needed until the City's 1% chance event flood goals were met.

As with the Upstream Mendota Greenway, the selected solution for the Downstream Mendota Greenway includes the excavation of the existing channel to provide a more well-defined flow path for stormwater, the clearing of dense vegetation to reduce channel roughness, and the lowering of the downstream channel invert to allow for a steeper slope along the channel. The existing drop structure was eliminated to facilitate the increase in slope. Upstream improvements at the University Avenue culvert crossing and downstream improvements at the Camelot Drive culvert crossing were modeled in conjunction with this project. These projects are described in Sections 10.5 and 10.7 respectively.

Model results showed the City's 1% chance event flood control goals of no structure flooding can be met with the selected solution (see Figure 10-7). The modeled peak water surface elevation in the channel was below that of nearby structures with the selected alternative and the proposed upstream and downstream improvements in place. The results of these iterations were summarized into various scenarios and the results of the analysis are provided in Table 10-3.

Table 10-3. Downstream Lake Mendota Greenway Scenarios
Stricker's/Mendota Watershed Study
City of Madison, WI

Scenario	Upstream Improvements Included	Peak WSE at Downstream Greenway Critical Point (Elev. 860.7)
Existing Conditions	Existing Conditions	862.5

Table 10-3. Downstream Lake Mendota Greenway Scenarios
Stricker's/Mendota Watershed Study
City of Madison, WI

Scenario	Upstream Improvements Included	Peak WSE at Downstream Greenway Critical Point (Elev. 860.7)
Base Conditions	Upstream storm sewer improvements, Tiedeman Pond outfall, no inlet capacity restrictions	862.8
1	Base Conditions and Grassman Pond Expansion	862.6
2	Grassman Pond Expansion, No Flow from Skyview Pond or Tiedeman Pond	861.5
3	Base Conditions and Grassman Pond Expansion, Greenway Cross-Section Improvements, Existing University Avenue Culvert Lowered	859.1
4	Base Conditions and Grassman Pond Expansion, Greenway Cross-Section Improvements, Parallel 72" Culvert at University Avenue	859.1
5 (Selected Solution)	Base Conditions and Upstream and Downstream Greenway Cross-Section Improvements, Parallel 84" Culvert at University Avenue	858.8

Associated Flood Reduction Benefits

The City's flood control goal of no structure flooding under the 1% chance event is met along the Mendota Greenway between Camelot Drive and University Avenue as a result of the greenway improvements.

Project Constraints/Considerations

While the Lake Mendota Greenway is in City-owned property, some grading may be required on nearby private property, particularly near the Camelot Drive culverts. The existing greenway is heavily wooded. As a result of the proposed grading required, significant tree removal within the existing greenway would be needed.

A wetland delineation completed by the City for the project area shows wetlands along the greenway. WDNR and USACE wetland/waterway permitting will be required for implementation of the project. Additionally, it is anticipated that a NOI permit will be needed.

There are no known utility conflicts in the greenway.

This solution should be implemented with the Upstream Lake Mendota Greenway, University Avenue culvert crossing and Camelot Drive culvert crossings described elsewhere in this section to be effective.

Water Quality Benefits

The greenway improvements are not expected to provide significant water quality benefits.

Additional Notes/Information

The increase in peak flows passing through the Downstream Lake Mendota Greenway will lead to higher peak flows through the Camelot Drive culverts. The increase in peak flows is accounted for in the solution described in Section 10.7.

Implementation of the Downstream Lake Mendota Greenway improvements are currently ongoing as part of the Mendota-Grassman Greenway Flood Mitigation and Restoration Design project. The project should be consulted for further information on these improvements.

10.7 Camelot Drive Culvert Crossing

Detailed Project Description

The Camelot Drive culvert crossing at the end of the Downstream Lake Mendota Greenway currently consists of a pair of 48-inch CMP culverts in poor condition. The upstream greenway is connected to the culverts via a concrete drop structure. The limited flow capacity through the existing culverts and the impact of the drop structure on the greenway slow are factors that contribute to flood impacts in this area. The flood control goal for the Camelot Drive Culvert Crossing is to meet the City's 1% chance event goal of no structure flooding upstream and downstream of the culvert.

To evaluate the Camelot Drive crossing, the simplified model described in Section 3.3 was used to limit model runtimes while accounting for all upstream flow to the culvert. Culvert sizes and configurations were iterated in conjunction with upstream greenway improvements. The existing drop structure was modeled both, in-place, and removed for these iterations. Alternatives included replacing the existing culverts with variously sized circular RCP culverts and concrete box culverts.

The selected solution for the Camelot Drive culvert crossing includes the removal of the existing drop structure to facilitate slope improvements upstream and the replacement of existing culverts with a pair of parallel 4-foot by 8-foot concrete box culverts. See Figure 10-8 for a concept of the improvements. The proposed culvert inverts will be the same as existing inverts. In conjunction with upstream improvements, the removal of the drop structure and installation of larger culverts allows the City's 1% chance event goals to be met for this area.

Associated Flood Reduction Benefits

In conjunction with upstream greenway and culvert improvements, modeling shows the Camelot Drive culvert improvements eliminate flood impacts for nearby structures. Specifically, the culvert improvements help meet flood control goals for the 1% chance event along the Mendota Greenway upstream of Camelot Drive and by preventing overtopping of Camelot Drive.

Project Constraints/Considerations

The Camelot Drive culvert improvements are contained within City-owned property in the Lake Mendota Greenway and in City-owned right-of-way. However, the culverts are in close proximity to private property on the south side of the upstream end of the culverts. The exact location will need to be reviewed and potential impacts to adjacent property considered.

Camelot Drive is the only road accessing the area immediately west/northwest of the greenway. The construction of the culvert improvements will need to be staged to allow for access to and from this area.

There are no known utility conflicts.

Water Quality Benefits

There are no expected water quality benefits to this solution.

Additional Notes/Information

This project requires improvements to the upstream greenway to maximize its effectiveness.

Implementation of the Camelot Drive Culvert Crossing is currently ongoing as part of the Mendota-Grassman Greenway Flood Mitigation and Restoration Design project. The project should be consulted for further information on these improvements.

10.8 Stricker's Pond Outlet

Note: This is a preliminary solution located in the City of Middleton. Any improvements to the Stricker's Pond outfall will require coordination between the cities of Madison and Middleton. This potential concept was developed by the City of Madison as a possible measure that could be implemented to offset the potential for increased peak WSE's in Stricker's Pond.

Detailed Project Description

The existing outfall connecting Stricker's Pond to Tiedeman Pond is a 15-inch RCP. It is located on the northeast side of the pond and extends into Middleton Street which it follows to the north before turning east on Voss Parkway and emptying into Tiedeman Pond in Woodside Heights Park. The outfall is owned and maintained by the City of Middleton.

The proposed improvements in the Stricker's Pond watershed in Madison will produce an increase in peak flows to Stricker's Pond under intense rainfall events. Modeling showed the increase in peak flows led to a more rapid rise in water level but did not increase the final peak WSE in the pond. Figure 10-9 shows a comparison of the Stricker's Pond water surface elevation between existing and proposed conditions for the 10% and 1% chance event with no change to the Stricker's Pond outlet.

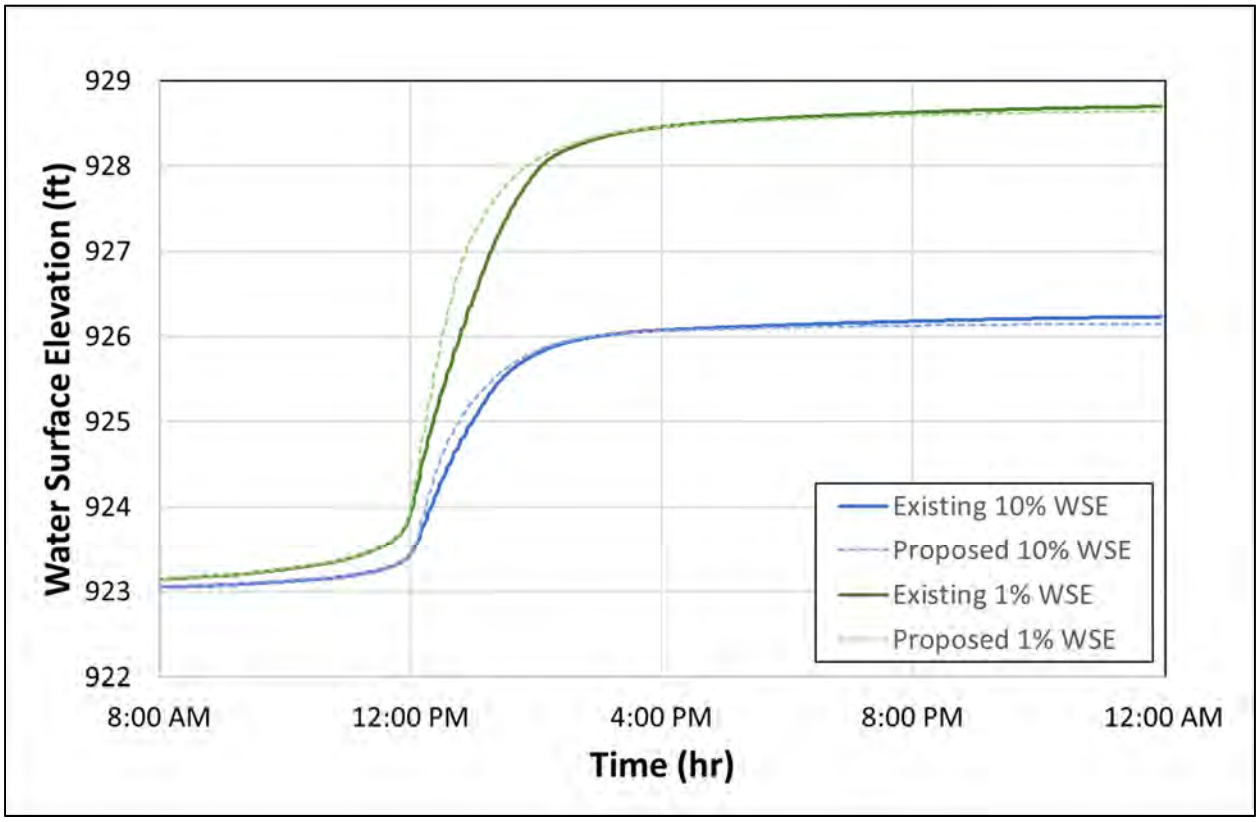


Figure 10-9. Stricker's Pond WSE – Existing and proposed conditions; without added Stricker's Pond Outlet

While model results show the existing conditions peak WSE is actually higher than the proposed conditions peak WSE, this is believed to be due to an anomaly in how the model is calculating flow

from the 2D surface into 1D storm sewer pipes. The total runoff volume generated in existing and proposed conditions are the same, so the overall peak WSE following the end of a rainfall event is expected to be similar.

However, BC did analyze improvements to the existing Stricker's Pond outfall to mitigate any potential increase in peak WSE from upstream improvements. During this analysis, BC reviewed installing a second parallel outfall draining the pond in approximately the same alignment.

The selected solution involves the installation of a second parallel outfall with a 24-inch diameter at the same invert elevation as the existing outfall. The additional outfall reduces the peak WSE in Stricker's Pond with the proposed upstream improvements to a lower peak WSE than in existing conditions and eliminates any worsening of flooding around the pond. Figure 10-10 below compares the Stricker's Pond water surface elevation. Table 10-4 compares the existing peak WSE in Stricker's Pond with the proposed conditions peak WSE with the parallel outfall in place for the various design storms considered as part of the analysis. Figure 10-11 shows the layout of the proposed outlet improvements.

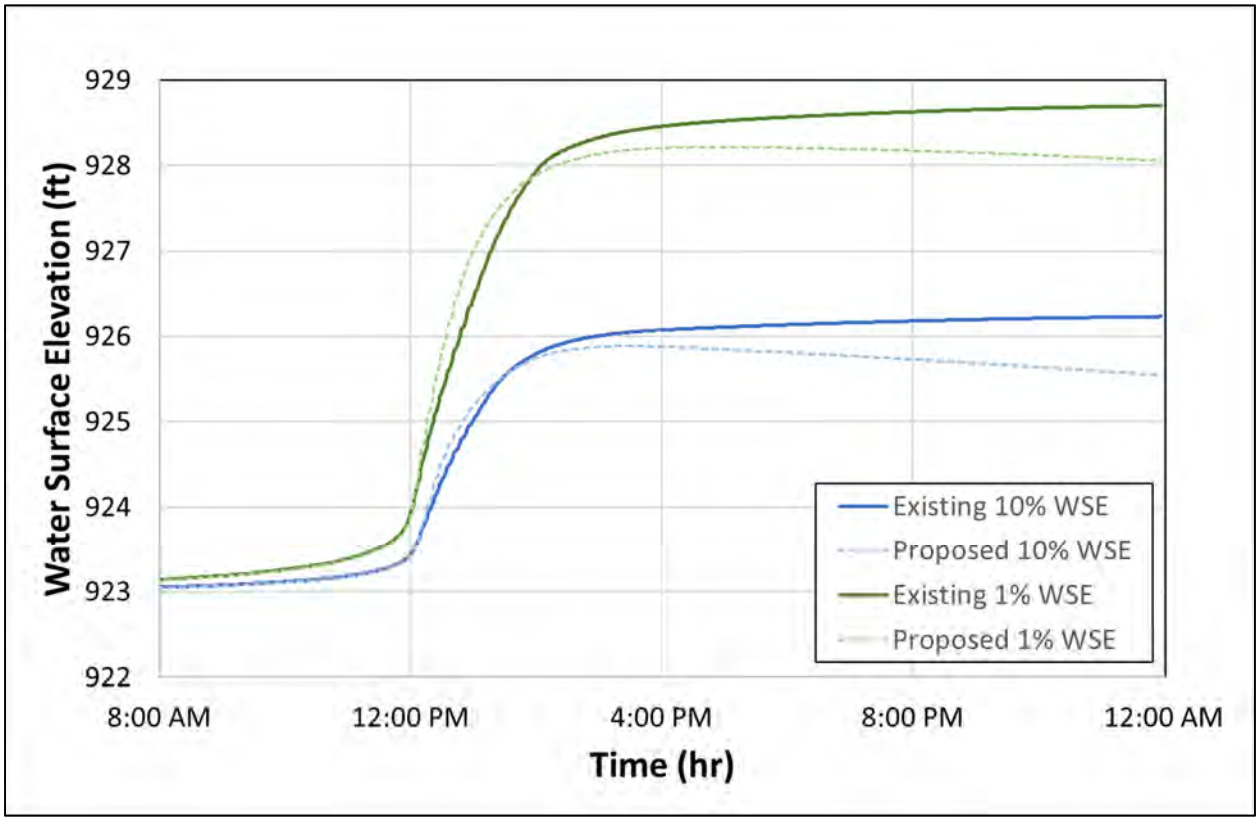


Figure 10-10. Stricker's Pond WSE – Existing and proposed conditions; with added Stricker's Pond Outlet

Table 10-4. Stricker's Pond Peak WSE Comparison
Stricker's/Mendota Watershed Study
City of Madison, WI

Design Storm	Existing Peak WSE in Stricker's Pond	Proposed Peak WSE in Stricker's Pond with Outfall Improvements
50% Chance	924.9	924.7

Table 10-4. Stricker's Pond Peak WSE Comparison
Stricker's/Mendota Watershed Study
City of Madison, WI

Design Storm	Existing Peak WSE in Stricker's Pond	Proposed Peak WSE in Stricker's Pond with Outfall Improvements
20% Chance	925.7	925.3
10% Chance	926.3	925.9
4% Chance	927.3	926.8
2% Chance	928.0	927.5
1% Chance	928.8	928.3
Pond Starting Water Surface Elevation = 923.5		

Associated Flood Reduction Benefits

The parallel Stricker's Pond outfall reduces the risk of flooding for properties adjacent to Stricker's Pond. The benefit is primarily within the City of Middleton as the majority of residences around the pond are within Middleton. The additional outlet could provide further benefit by giving expanded flexibility in managing pond water levels. The normal pond water level could be maintained at a lower elevation which would provide additional flood storage volume.

Project Constraints/Considerations

The Stricker's Pond outfall would be located entirely within the City of Middleton. Coordination between both the City of Madison and City of Middleton will be required to complete this project.

The WWI indicates wetlands may be present near the proposed outfall location. WDNR and USACE permitting may be needed prior to implementing this solution.

Additionally, the Stricker's Pond water level is regulated by a WDNR permit which dictates minimum and maximum pond water levels. It is believed that the additional outlet would be allowed under the permit as the outlet would provide flexibility to better manage the water level within those minimum and maximum levels. Furthermore, the pond starting water level has a significant impact on the peak water surface elevation that is observed within the pond during a storm event (See Section 11.4). Pond water levels are frequently above the maximum water level set by the WDNR permit. Maintaining the pond level at a lower elevation may reduce flood impacts associated with the pond.

Water Quality Benefits

There are no expected water quality benefits to this solution.

Additional Notes/Information

This project will increase the peak flows and peak WSE in Tiedeman Pond during intense rainfall events. A separate project detailed in Section 10.9 discusses potential mitigation measures at Tiedeman Pond.

10.9 Tiedeman Pond Outfall

Note: This is a preliminary solution located primarily in the City of Middleton. Any improvements to the Tiedeman Pond outfall will require coordination between the cities of Madison and Middleton.

This potential concept was developed by the City of Madison as a possible measure that could be implemented to offset the potential for increased peak WSE's in Stricker's Pond.

Detailed Project Description

Tiedeman Pond is a large kettle pond located entirely in the City of Middleton and it has no natural outlet. Under existing conditions, the pond water level is maintained primarily by evaporation, infiltration, and a pump station operated by the City of Middleton. Note: The outlet pump station is currently being reconstructed by the City of Middleton. This study did not account for any pumping as part of the analysis.

As described in Section 10.8, the City of Madison storm sewer improvements upstream of Stricker's Pond are not expected to increase peak WSEs in that pond. Additionally, without any improvements to the Stricker's Pond outfall to Tiedeman Pond, there is no measurable impact on the water surface elevation in Tiedeman Pond as shown in Figure 10-12 below.

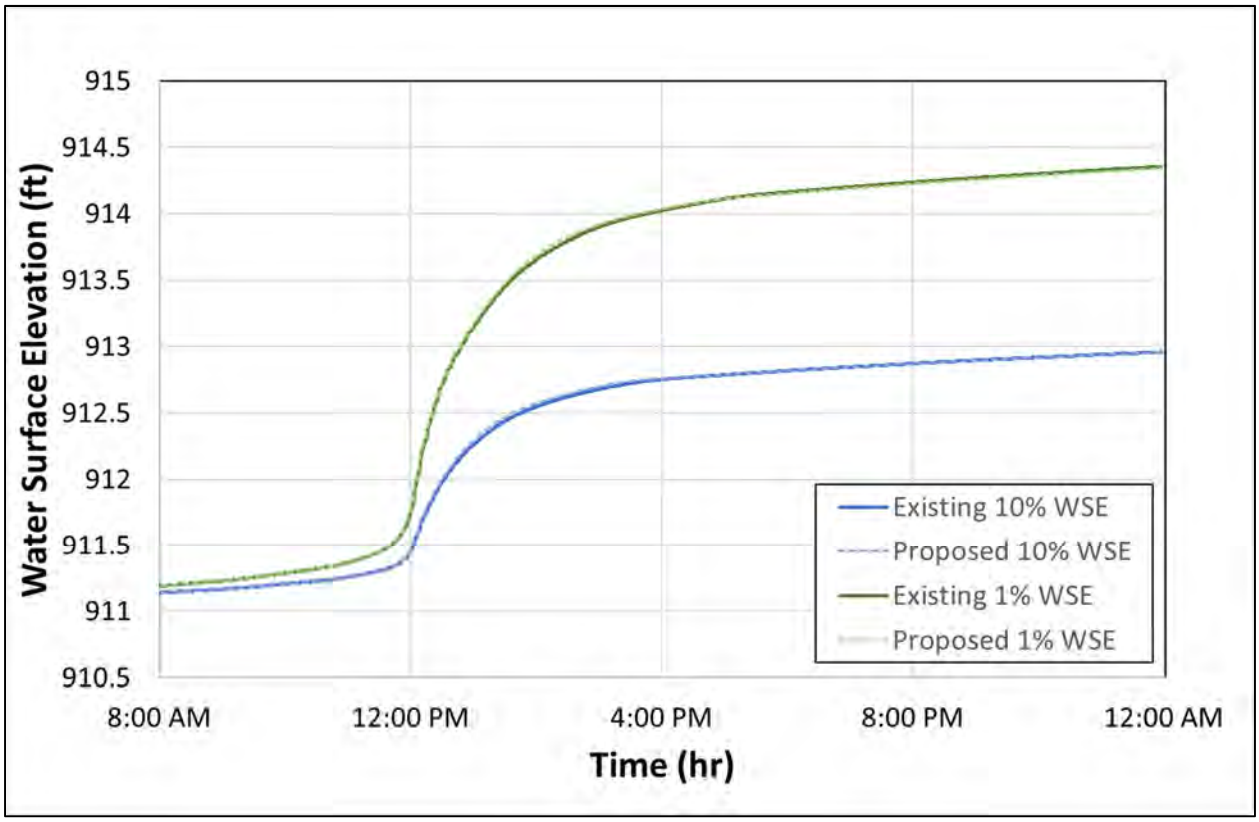


Figure 10-12. Tiedeman Pond WSE – Existing and proposed conditions; No new Stricker's or Tiedeman Outlet

As discussed in Section 10.8, a second parallel outlet draining Stricker's Pond to Tiedeman Pond is also considered. This will reduce the proposed peak WSE in Stricker's Pond to mitigate any perceived impacts from upstream improvements. However, the secondary outfall will increase flows to Tiedeman Pond and increase the peak WSE in this location as shown in Figure 10-13.

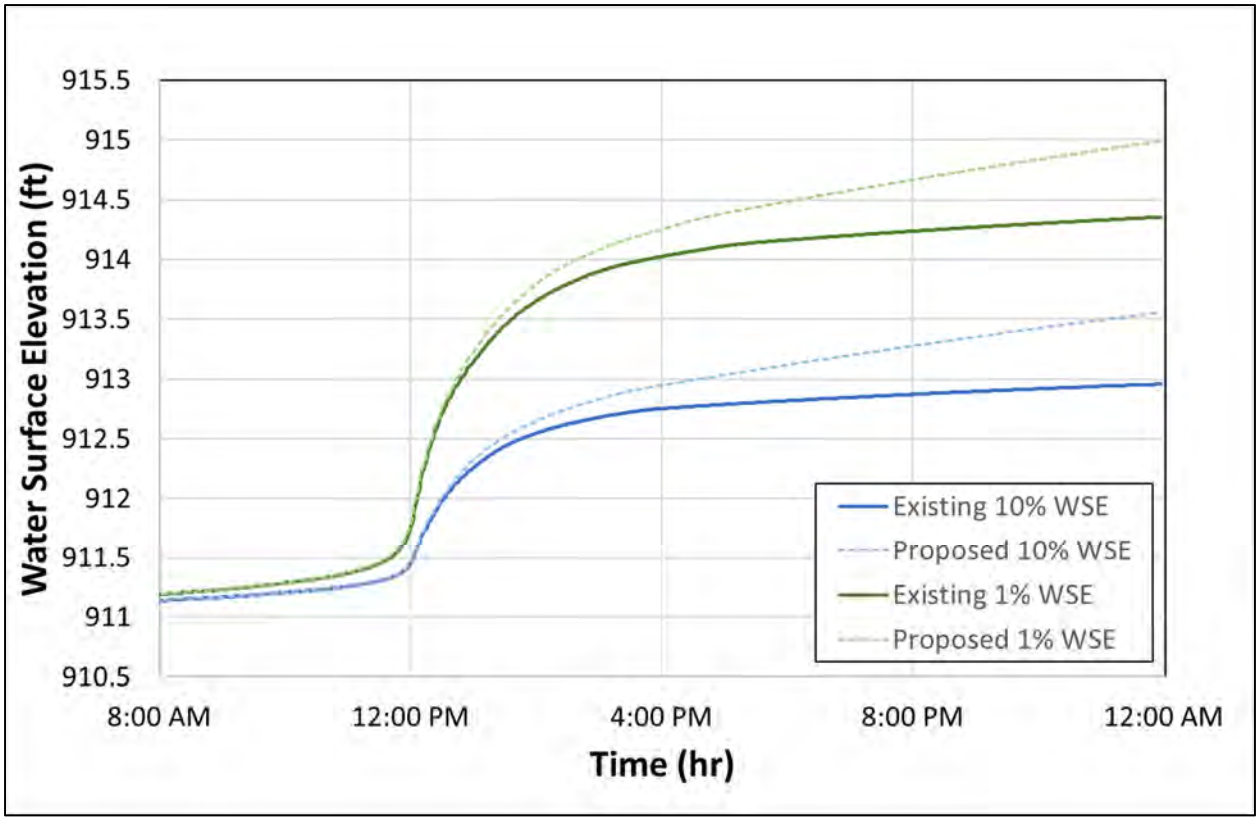


Figure 10-13. Tiedeman Pond WSE – Existing and proposed conditions; New parallel Stricker's Outlet; No new Tiedeman Outlet

To reduce peak WSEs in Tiedeman Pond, BC has analyzed several potential Tiedeman Pond outlets that would connect Tiedeman Pond to the Lake Mendota watershed in the City of Madison via a gravity-drained storm sewer. The proposed outfall would be located on the east end of Tiedeman Pond and would cross Park Street north of Woodgate Road. The outfall then follows the railroad to the southeast where it would daylight at a location in the City of Madison. BC analyzed three different slopes for the proposed pipe, each of which results in a different outfall location. The three locations are:

- Northwest of Skyview Pond in Skyview Park
- In Skyview Pond
- Across the railroad from Skyview Park in the Grassman Pond area

Each alternative can reduce the proposed peak WSE in Tiedeman Pond to a lower level than in existing conditions. For this analysis, the outfall pipe that discharges into Skyview Pond was included. The impacts to the Tiedeman Pond WSE are shown in Figure 10-14 below. Table 10-5 below compares the existing and proposed peak WSE in Tiedeman Pond.

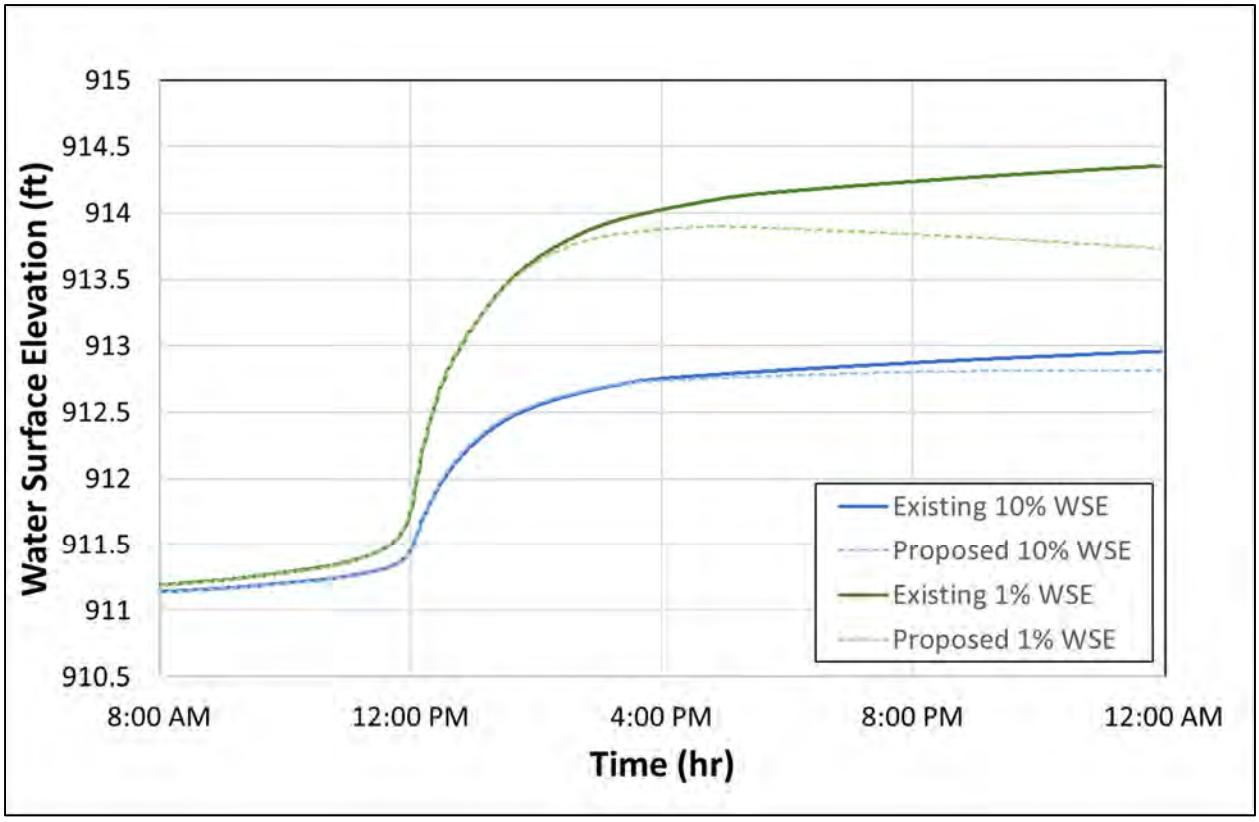


Figure 10-14. Tiedeman Pond WSE – Existing and proposed conditions – New parallel Stricker's Outfall; New Tiedeman Outlet

Table 10-5. Tiedeman Pond Peak WSE Comparison
Stricker's/Mendota Watershed Study
City of Madison, WI

Design Storm	Existing Peak WSE in Tiedeman Pond	Proposed Peak WSE in Tiedeman Pond
10% Chance	912.95	912.80
1% Chance	914.30	913.99

Associated Flood Reduction Benefits

The gravity outfall reduces the risk of flooding for properties adjacent to Tiedeman Pond within the City of Middleton.

Project Constraints/Considerations

The Tiedeman Pond outfall will be located primarily within the City of Middleton. Coordination between both the City of Madison and City of Middleton will be required to complete this project.

Most of the conceptual outfall alignment is in existing railroad right-of-way. Coordination between each municipality and the railroad will be needed during design and installation to avoid impacts to railroad operations.

During the analysis, it was noted that a gravity sewer draining Tiedeman Pond to the Lake Mendota watershed will pass underneath the natural watershed divide and may require pipes deeper than 20-feet below the ground surface. During the final design of this solution, pumping should be considered to reduce the required pipe depth. Additionally, detailed analysis of construction methodology (open-cut or trenchless) would also be needed to determine the most feasible and cost-effective approach.

Due to the conceptual nature of this project, and its location primarily within the City of Middleton, utility conflicts were not reviewed along the relief sewer route. Pumping, and the use of a force-main would be one option for resolving utility conflicts if needed.

As previously noted, the Tiedeman Pond pump station was not included as part of this analysis. This pump station does not impact flooding in the City of Madison and was not pertinent to the purpose of this study. However, the pump station may impact the potential gravity outlet sewer. Future implementation may wish to consider the pumping and how it impacts the level of service provided.

Water Quality Benefits

There are no expected water quality benefits to this solution.

Additional Notes/Information

This project will increase the peak flows and peak WSE in Skyview Pond, Grassman Pond, and the Lake Mendota Greenway. These impacts have been accounted for in the selected solutions related to these locations.

Section 11

Evaluation of Model Results with Selected Solutions Implemented

The XPSWMM™ model that included all of the selected solutions ("Proposed Conditions") was executed for each of the design storms. Table L-1 in Appendix L summarizes the peak water surface elevation and the duration of flooding at selected locations throughout the Stricker's/Mendota watershed. Figure 4-6 provides the location of each of the reporting locations in Table L-1. The "Maximum Water Depth" with the selected solutions implemented maps for each modeled event are found on Figures 11-1—11-7 (rain events from the 50% chance to the 0.2% chance events).

11.1 Comparison to City Flood Control Goals with Selected Solutions

The proposed conditions flooding results were compared to the City's flood control goals to quantify the performance of the selected solutions in the Stricker's/Mendota watershed. The performance of the system relative to greenway crossings, pipe capacity, inlet capacity, and street flooding were considered.

11.1.1 Greenway Crossings

At locations where a greenway crosses under a street the City's goal is to safely pass the 1% chance event without overtopping the street. The crossing was determined to be overtopped if the elevation at the upstream side of the culvert is above the street crossing elevation. Within the Stricker's/Mendota watershed there are three greenway crossings. The existing and proposed conditions performance, whether the street is overtopped, at these locations is summarized in Table 11-1.

Table 11-1. Greenway Crossing Performance
Stricker's/Mendota Watershed Study
City of Madison, WI

Location	Existing 1% Chance Event Performance	Proposed 1%Chance Event Performance
Old Middleton Road	No Overtopping	No Overtopping
University Avenue	No Overtopping	No Overtopping
Camelot Drive	Overtopped	No Overtopping

11.1.2 Pipe Capacity

The City's goal is to eliminate surcharging from the storm sewer system onto city streets for up to the 10% chance event. The pipe capacity was determined to be exceeded if the peak water surface elevation at the upstream end of the pipe was above the ground surface elevation. Under existing

conditions there are 58 percent of the pipes and 59 percent of the pipe length that do not meet the pipe capacity goal (See Section 6.2.1.2).

Within the proposed conditions XPSWMM™ model, there are a total of 232 pipes, of which, 15 are surcharged at the upstream end during the 10% chance event. This equates to 6.5 percent of the pipes not meeting the pipe capacity goal. The 232 pipes result in a total pipe length of 38,200-feet, of which 1,620-feet are surcharged during the 10% chance event. This equates to 4.2 percent of the pipe length not meeting the capacity goal.

11.1.3 Inlet Capacity

For inlet capacity, the flood mitigation goal is to allow no more than 0.5-feet of stormwater ponding above storm sewer inlets or rim elevations at inlet restricted low-points for the 10% chance event. As part of this study, the existing inlet capacity was evaluated at the subwatershed level (see Section 4.4.3 for additional detail). As part of the proposed solutions, it is assumed that inlet capacity improvements are incorporated such that the inlet capacity is not the limiting factor, and thus this goal would be met in all locations. Further detailed analysis is required to determine the exact number, type, and location of inlets required to be implemented.

11.1.4 Street Flooding

Within streets, the City's goal is to maintain drivability of municipal streets for the 4% chance event. Drivability is defined as having no more than 0.2-feet of flooding at the center of the street. Within the watershed there are a total of 17.7 miles of streets. Under existing conditions, 5.0 miles (28 percent) of the streets do not meet the street flooding goal.

With the selected solutions implemented, the length of street that do not meet the street flooding goal is reduced to 0.6 miles (3.4 percent).

11.1.5 Structure Flooding

The City's goal is to eliminate structure flooding during the 1% chance event. Structure flooding is defined as having 0.5-feet or more water within 5-feet of a building. Under existing conditions, structure flooding is identified for all storm events considered (50% chance through 0.2% chance events). During the 1% chance event in existing conditions there are 91 structures impacted by flooding. In proposed conditions, there are 15 structures impacted by flooding. It is believed that the majority of structures that are flagged to be impacted under proposed conditions are a result of nuances of the XPSWMM™ model. The locations where structure flooding was identified under the selected solutions were evaluated in further detail. The analysis conducted is described in Section 12.1.

11.2 Improvements to Known Flooding in Watershed from Selected Solutions

In Section 1-3, known flooding areas in the watershed, based on City staff information, were identified. The areas that were identified are shown on Figure 1-4. Additionally, focus group meetings were held in various areas of the watershed that were impacted by flooding. The location of each focus group meeting is shown on Figure 7-1. The locations of the focus groups corresponded with areas of known flooding that were reported by City staff.

The selected solutions were generally targeted at meeting the City's flood control goals throughout the Stricker's/Mendota watershed. Known flooding locations were considered as part of the development of solutions. The following text summarizes how known flooding locations, identified by City staff, are impacted by selected solutions.

1. **Longmeadow Road, approximately 400-feet west of Gammon Road**
   a. **Solutions that Benefit Area:** The Longmeadow Relief sewer reduces flood impact in this location by reducing the amount of flow in the existing storm sewer.
   b. **Flood Reductions Observed:** With the selected solution in place, there is no road flooding up to the 4% chance event and no impacted structures up to the 1% chance event.
2. **Westfield Road, approximately 575-feet east of Tramore Trail**
   a. **Solutions that Benefit Area:** Local storm sewer improvements reduce the impact of flooding at this location.
   b. **Flood Reductions Observed:** The selected solution eliminates all road flooding in the 4% chance event and prevents any structure flooding in the 1% chance event.
3. **Intersection of Gammon Road and Harvest Hill Road**
   a. **Solutions that Benefit Area:** This intersection benefits from the Longmeadow Relief Sewer solution.
   b. **Flood Reductions Observed:** In this location, all street flooding is eliminated for the 10% chance event, street flooding above 0.2-feet at the centerline is eliminated for the 4% chance event, and there are no impacted structures in the 1% chance event.
4. **Intersection of Gammon Road and Old Sauk Road**
   a. **Solutions that Benefit Area:** This intersection benefits from local storm sewer improvements in Gammon Road and the Longmeadow Relief Sewer.
   b. **Flood Reductions Observed:** As a result of the selected solutions, there is no road flooding under the 10% chance event and ponding is limited to less than 0.2-feet at the centerline during the 4% chance event. While one structure is shown to have greater than 6-inches of ponding within 5-feet of the building in the model in the 1% chance event, it is believed that water will be contained within the right-of-way. The limitations of the 2D grid may be allowing water to escape the right-of-way (See Section 12.1).
5. **Longmeadow Road, south of Stricker's Pond Forebay:**
   a. **Solutions that Benefit Area:** Flooding in this location is improved through local storm sewer improvements.
   b. **Flood Reductions Observed:** Flooding in this area is largely driven by the WSE in Stricker's Forebay. However, improvements to local storm sewer does help eliminate structure flooding here. The model shows ponded water in excess of the design goals under the 10% and 4% chance events in this location, but no structures are impacted in the 1% chance event.
6. **Hickory Hollow Condominiums**
   a. **Solutions that Benefit Area:** The upstream Lake Mendota Greenway improvements and the culvert improvements at University Avenue reduce flooding in this location.
   b. **Flood Reductions Observed:** Implementation of the selected solutions for the Lake Mendota greenway and the crossing at University Avenue reduce the peak water surface elevation at the Hickory Hollow condominiums to below the nearest structure elevation under the 1% chance event. It should be noted that the condo elevations were determined from available LIDAR data. A more detailed survey should be completed during design.
7. **Northwest end of Julia Street**
   a. **Solutions that Benefit Area:** The improvements to the Lake Mendota Greenway and the culvert crossings at University Avenue and Camelot Drive help reduce flooding in this location. There is some overland flow that is expected in the 10%, 4% and 1% chance events

that originates from the intersection of Baker Avenue and Julia Street, where there is an undeveloped road cross-section (no curb and gutter). However, this is largely contained within the right-of-way and in green space northeast of Julia Street and it persists for a short amount of time. Impacts to structures during intense rainfall events should be minimal. Because the storm sewer in Julia Street was constructed within the last few years, additional modifications in this area were not considered.

b. **Flood Reductions Observed:** Flooding near the Lake Mendota Greenway on the northwest end of Julia Street is reduced but not eliminated with the selected solutions in place. However, the ponding that is observed in proposed conditions originates further upstream in Julia Street from the new storm sewer and is less severe than in existing conditions.

8. **Northwest ends of Blanchard Street and Taychopera Road**
   a. **Solutions that Benefit Area:** The downstream Lake Mendota Greenway and Camelot Drive culvert improvements reduce flood impacts to this location.
   b. **Flood Reductions Observed:** The proposed conditions model indicates flooding in this area is completely eliminated through the 1% chance event due to the improved flow capacity and available storage in the greenway and the increase in culvert flow capacity at Camelot Drive.
9. **Tiedeman Pond**
   a. **Solutions that Benefit Area:** The proposed outlet sewer connecting Tiedeman Pond to the Lake Mendota watershed reduces flooding in the Tiedeman Pond area.
   b. **Flood Reductions Observed:** The peak WSE in Tiedeman Pond is reduced by up to 0.3 feet in the 1% chance event with the proposed outlet in place, which reduces nearby flood impacts. Additionally, the water level in Tiedeman Pond drops more rapidly than in existing conditions.

11.3 Discussion of Long Duration, Back-to-Back Model Results

As with the existing conditions, an additional design storm model run was conducted to represent the extreme condition of "back-to-back" 1% chance events occurring (See Section 6.3). The XPSWMM™ model with the selected solutions was executed for this back-to-back storm. The modeled results of the maximum water depth map for this event is shown on Figure 11-8 and tabular results are shown in Table L-1. Under the selected solutions scenario, the flooding depth and extents during the back-to-back storm event scenario is reduced. The largest reductions in flooding are observed in upstream areas where the conveyance capacity (i.e., new or enlarged storm sewers) is improved as a result of the selected solutions.

11.4 Stricker's Pond Level Sensitivity Analysis

The proposed City of Madison storm sewers that discharge into Stricker's Pond can be impacted by the water level of the pipe. In proposed conditions, there are five inlet sewers draining to the forebay, each of which can be partially submerged depending on the forebay/pond water level. To gain further understanding of the impact of the initial Stricker's Pond water level on the proposed system, a pond sensitivity analysis was completed for the selected solutions. A similar analysis was completed for existing conditions as described in Section 4.7.

As explained in the prior pond sensitivity analysis, the water level in Stricker's Pond fluctuates with rainfall events. The same pond water levels identified for the prior analysis were utilized as part of this additional evaluation (See Table 4-7).

To complete the analysis, the Stricker's/Mendota proposed conditions XPSWMM™ model was executed for each of the starting water surface elevations listed in Table 4-7 and analyzed for the

10%, 4% and 1% chance events. The resultant water levels in the system were then compared at the same five points as in the existing conditions analysis. The comparison points were selected based on their proximity to the pond. The results of the analysis are displayed in Figure 11-9. The pond starting water surface elevation has a large impact on the peak WSE in Stricker's Pond and has a moderate impact on the peak WSE in nearby pipes. However, the more upstream locations analyzed saw no noticeable impact from the starting WSE. This is consistent with the results observed in the existing system.

Section 12

Areas Flood Control Goals are Not Met

In most of the Stricker's/Mendota watershed, the City's flood control goals are met. In limited locations there are cases where the goals are not met. Further consideration of areas not meeting the 1% chance event structure flooding goal is provided in this section. Additionally, an analysis was conducted to determine the added infrastructure improvements that would be required to prevent structure flooding for the 0.2% chance event.

12.1 1% Chance Event

As noted in Section 11.1.5, there are 15 structures that were identified as flooded under the selected solutions scenario. It is believed that, for the majority of these structures, the identification that they are flooded is due to specific topographic conditions within the XPSWMM™ model. Each of these locations were evaluated in greater detail to determine the nature of the flooding and the additional capacity needed to eliminate the flooding.

To attempt to quantify the additional drainage system capacity that would be required to prevent flooding the following methodology was followed. Within the XPSWMM™ model, a new node was added to collect runoff from near the flooded structure. This node was connected to a hypothetical pipe that was given a free outfall, meaning that any runoff collected by the node was discharged directly from the model. The added pipes were given a 5-foot diameter and a 1% slope to allow free passage and discharge of runoff. This was a theoretical analysis and not representative of the exact size of improvements needed. The volume and peak runoff rate discharged through the outfall was measured to quantify the extent of additional capacity needed to resolve flooding.

The model was then executed for the 1% chance event. Based on the review of the structures impacted by flooding, the following observations were made.

- Eleven of the impacted structures are associated with local storm sewer improvements. In general, these locations are associated with a small amount of runoff. The maximum volume discharged through the added outfall is 0.9 acre-feet.
  - The majority of these flooding locations are triggered by limitations of the XPSWMM™ 2D model. The results were observed to show that shallow overland flow becomes trapped against a building and results in triggering the flooding criteria. The 2D model uses a 10-foot grid system to simulate overland flow. The grid size is reflective of a watershed study of this nature. However, it does not have the ability to capture, and simulate, all of the nuances within an urban area. For instance, the detailed grading surrounding a building may not be captured by the grid, or the 6-inch curb depth of a road might not be fully captured.
  - In some locations there may be private storm sewer present that is not incorporated into the model. The private storm sewer may prevent flooding if accounted for in the model.
  - Refinement of the model during subsequent planning, design and implementation phases for solutions can verify pipe sizing and confirm whether structures are flooded or not. Refining the model could include revising topographic data (such as supplementing LiDAR

data with survey data), decreasing the grid size is specific locations of interest, splitting subwatersheds, and/or adding additional storm sewer such as inlets, inlet leads, smaller storm sewer, or private storm sewer. Additionally, further structure elevation data (such as first floor or low opening elevations) could be obtained to verify where the structure would be flooded.

  - A final possibility in these locations is that the storm sewer improvements could be refined, and sizes potentially increased to provide a greater level of flood protection.

- Two impacted structures are adjacent to the Longmeadow Relief sewer. One structure is located near the outfall to Stricker's Forebay and another is located near the intersection of Longmeadow Road and Gammon Road. The flooding at the structure near Stricker's Forebay is due to slightly insufficient capacity in the combined relief sewer and existing outfall to fully contain the 1% chance event. The City has indicated that the final relief sewer alignment may follow Longmeadow Road to the forebay rather than be installed next to the existing outfall. If this is the case, a detailed analysis of the new alignment may allow for a larger outfall pipe that eliminates flooding in this location. The flooding at the structure near Longmeadow Road and Gammon Road occurs in an adjacent parking area low point with no outlet. It is possible there are private storm sewers in this location that may mitigate flood impacts to this structure.
- Two impacted structures are Hickory Hollow Drive condominiums adjacent to the Lake Mendota greenway. Based on available topographic LiDAR data, the elevation of the structure nearest the greenway near University Avenue is 871.5'. Model results indicate the peak WSE in this area will be below this critical elevation for the 1% chance event. However, the slope next to the structure is steep and the depth of ponding within 5 feet of the structures exceeds 6 inches. It is not clear whether the structure is impacted or if there is simply insufficient model resolution in this area. During final design, a more detailed survey should be conducted in this area and the model should be refined to verify whether the structures will be impacted.
- There are three structures located upstream of where storm sewer in Pebble Beach Drive discharges into the City of Middleton. The existing storm sewer in Pebble Beach Drive is the same size as the downstream Middleton sewer. While improvements to City of Madison storm sewer could reduce or eliminate these impacts, these improvements should only be considered in conjunction with Middleton storm sewer improvements to prevent simply moving flooding further downstream. Because this study did not include City of Middleton storm sewer improvements, City of Madison improvements in this area were not considered.

12.2 0.2% Chance Event

Under existing conditions, there are 143 structures within the Stricker's/Mendota Watershed impacted by flooding in the 0.2% chance event. With the implementation of the selected solutions, the number is reduced to 43 structures impacted. The study considered the level of effort needed to prevent structure impacts from the 0.2% chance event. To consider this evaluation the sizes of the selected solutions were modified to prevent structure flooding during this storm event. The selected solutions XPSWMM™ model was utilized as the starting point for the 0.2% chance event improvement scenario. The model was updated to reflect the increased infrastructure size required to prevent structure flooding for the 0.2% chance event. Below is a summary of the changes to the selected solutions.

- Throughout the watershed, the sizes of local storm sewer improvements were increased. This included increases to storm sewers that were included as part of the selected improvements and enlargements of additional sewer that were previously not identified for improvement. The

enlargement of storm sewers was conceptual in nature. Generally, the storm sewer was evaluated as a box culvert or elliptical pipe.

- Both the Longmeadow Relief Sewer and the existing parallel sewer were upsized. In the selected solution, the existing storm sewer from Longmeadow Road to the Stricker's Forebay is left unchanged, however, the volume of flow required to meet the 0.2% chance event requires modifications to this sewer as well.
- The new culverts crossing University Avenue and Camelot Drive were also upsized. Additional 0.2% chance event improvements upstream result in even more flow through the Lake Mendota greenway sections. To accommodate this flow, additional flow capacity at culvert crossings is needed.

Figure 12-1 provides a graphical depiction of the improvements included as part of this scenario. Table M-1 in Appendix M provides the pipe size increases included in the 0.2% chance event enhancement scenario. This table identifies the existing pipe size and peak flow rate, the pipe size and peak flow rate in the selected scenario, and the pipe size and peak flow rate in the enhanced scenario. The analysis was completed to assist in determining whether additional capacity could reasonably be added to provide a higher level of protection. The pipe sizes were not optimized, and flooding may be "over solved" in some areas. The pipe sizes along with the flow rates included in the table provide insight into the relative increase needed to provide flood protection for the 0.2% chance event.

Section 13

Cost Estimating

During the course of this study, planning level cost estimates were prepared for each of the stand-alone solutions described in Section 10. The following sections describe the methodology used for estimating costs. Cost estimates were not prepared for local storm sewer or inlet capacity improvements. In general, these improvements will be implemented in conjunction with street resurfacing projects. The costs associated with these storm sewer improvements will be developed by the City as they are scheduled for implementation in the City's five-year CIP.

To prepare the cost estimates, estimated quantities were developed for the project. The City of Madison provided average units costs for typical bid items included as part of storm water improvement projects. The standard unit costs were adjusted by BC based on specific project conditions that may result in higher, or lower, that average unit costs. Initial cost estimates were provided to the City for review and comment on unit costs prior to finalizing the estimates.

The total estimated cost for each of the stand-alone projects is provided in Table 13-1. Detailed breakdowns of the cost estimates for each project are included in Appendix N.

Table 13-1. Stand-Alone Project Cost Estimates
Stricker's/Mendota Watershed Study
City of Madison, WI

Project	Estimated Cost
Longmeadow Relief Sewer	$2.4 million
Upstream Lake Mendota Greenway & University Avenue Culvert	$1.7 million
Downstream Lake Mendota Greenway & Camelot Drive Culvert	$1.5 million
Stricker's Pond Outlet	$500,000
Tiedeman Pond Outlet	$8 million

Section 14

Implementation Sequence

14.1 Technical Implementation Needs

Implementation of individual selected solutions in the watershed can impact other parts of the watershed. For instance, implementing a conveyance improvement project could have a negative impact on a downstream area by increasing peak flows to the downstream area. Within the Stricker's/Mendota watershed there is some flexibility with implementing the various selected solutions. The following guidelines for implementation are provided.

1. Storm sewer improvements, including local storm sewers and the Longmeadow relief sewers, should generally be implemented from downstream to upstream to prevent increased downstream flooding. However, these improvements will typically be implemented with road reconstruction projects. A variety of other factors contribute to the scheduling road reconstruction projects. These factors may dictate that projects be implemented outside of the preferred sequence. As part of this approach, the specific improvements can be reviewed as part of the design process to determine if any temporary measures, such as bulkheads or restriction plates, are needed to offset downstream concerns.
2. The Longmeadow Relief sewer should be implemented prior to local storm sewer improvements that are connected to the relief sewer.
3. The modeling completed shows the Stricker's Pond WSE is not increased as a result of the upstream storm sewer improvements. Thus, it appears those storm sewer improvements (Longmeadow Relief Sewer and local sewers) could be constructed at any point in the implementation sequence. The City may wish to further evaluate and consider the potential for impacts in Stricker's Pond water surface elevation prior to implementing large storm sewer improvements, such as the Longmeadow relief sewer.
4. The Mendota-Grassman greenway improvements should occur starting at the downstream end and progressing upstream.
5. The Mendota-Grassman greenway improvements would preferably be implemented prior to upstream storm sewer improvements. However, implementation of storm sewer improvements upstream of Skyview Pond will have limited impact in changes to peak flows into the greenway. Other minor improvements closer to the greenway may also be insignificant. These improvements could be considered on a case-by-case basis.
6. The Mendota-Grassman greenway improvements should be implemented prior to construction of the Tiedeman Pond outlet sewer.
7. Improvements to the Stricker's Pond outlet and the Tiedeman Pond outlet within the City of Middleton are included as part of the selected solutions. The implementation of these measures should be coordinated with the City of Middleton.

14.2 Citywide Implementation Prioritization

The City is conducting similar watershed studies for all the watersheds in the City. All watersheds are expected to have numerous recommendations resulting from the studies. The City is developing a process to rank and prioritize the order in which the solutions might be implemented if and when

funding and public support are obtained. Information on this process will be shared by the City when it is available.

Section 15

Limitations

This document was prepared solely for city of Madison (City) in accordance with professional standards at the time the services were performed and in accordance with the contract between the City and Brown and Caldwell (BC) dated March 25, 2019. This document is governed by the specific scope of work authorized by the City; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

Further, BC makes no warranties, express or implied, with respect to this document, except for those, if any, contained in the agreement pursuant to which the document was prepared. All data, drawings, documents, or information contained this report have been prepared exclusively for the person or entity to whom it was addressed and may not be relied upon by any other person or entity without the prior written consent of BC unless otherwise provided by the Agreement pursuant to which these services were provided.

Section 16

References

Section 3.2.1 describes the specific files and data sources used in the development of the XPSWMM™ model. Below is a list of additional sources of information consulted or referenced during this study.

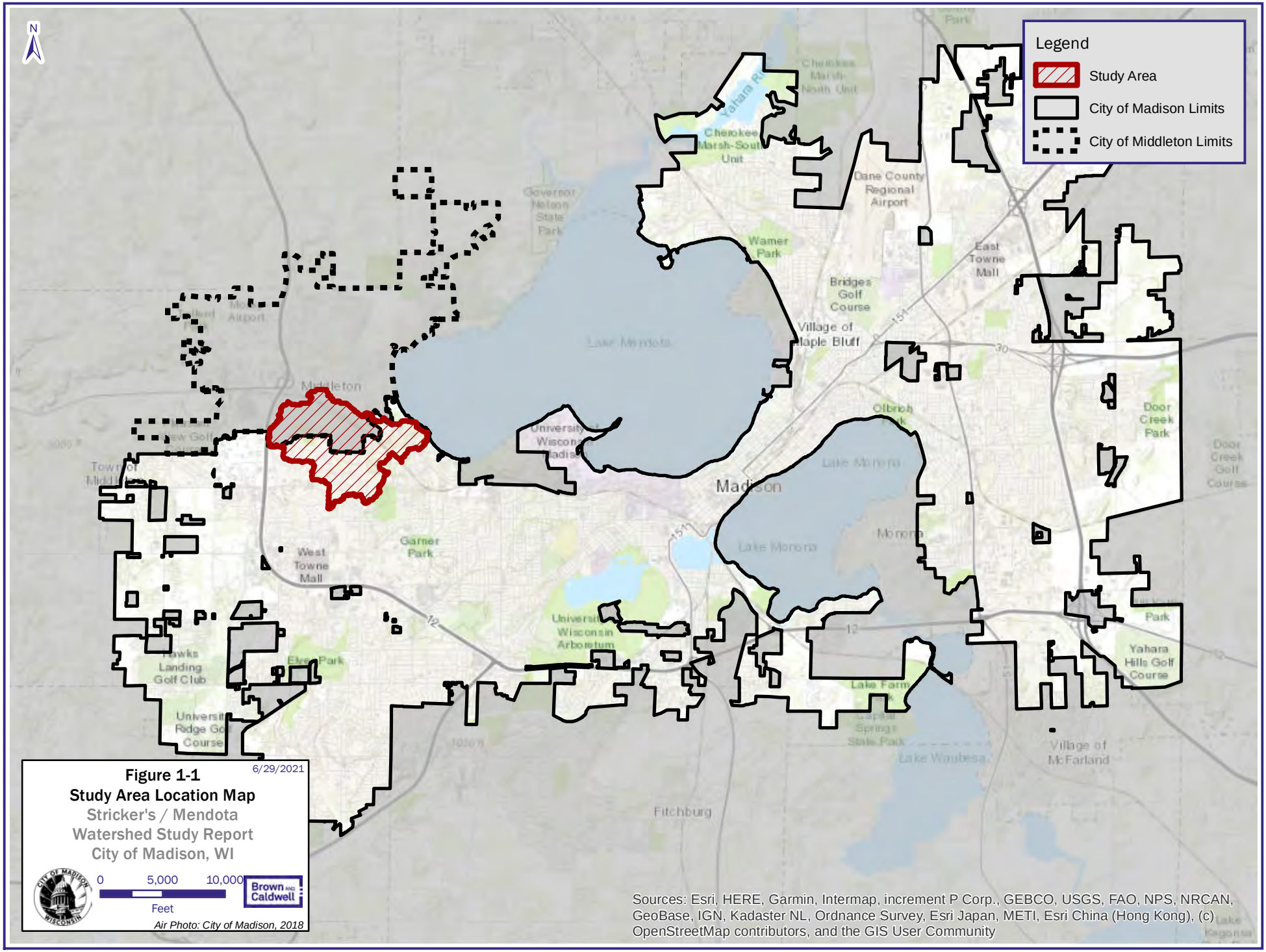
Dane County Land & Water Resources Department. Lake Levels and Information. https://lwrd.countyofdane.com/Lake-Levels

University of Wisconsin-Madison. Nelson Institute for Environmental Studies. 2016 Water Resources Management Practicum Report. *Making Stricker's Pond a Better Resource for Middleton and Madison Residents*, 2016

University of Wisconsin-Madison. Wisconsin Geological Geologic and Natural History Survey. Soil Survey of Dane County, Wisconsin, 1917. https://wgnhs.wisc.edu/pubs/000057/

Wisconsin Department of Natural Resources. Surface Water Data Viewer. https://dnr.wi.gov/topic/surfacewater/swdv/

Figures



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N

Legend

City of Madison Limits

Stricker's / Mendota Watershed

Drainage Area

Lake Mendota

Stricker's Pond

Tiedeman Pond

Tiedeman Pond

Stricker's Pond

Lake Mendota

12

14

N GAMMON RD

UNIVERSITY AVE

OLD SAUK RD

JUNCTION RD

6/29/2021

Figure 1-2
Watershed Map
Stricker's / Mendota
Watershed Study Report
City of Madison, WI

0 500 1,000
Feet

Air Photo: City of Madison, 2018

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N

Legend

- Flood Location Report
- Street Flooding Report
- City of Madison Limits
- Stricker's / Mendota Watershed

Tiedeman Pond

Stricker's Pond

Lake Mendota

12

14

N GAMMON RD

UNIVERSITY AVE

OLD SAUK RD

JUNCTION RD

6/29/2021

Figure 1-3
Flood Report Data
Stricker's / Mendota
Watershed Study Report
City of Madison, WI

0 500 1,000
Feet

Brown AND Caldwell

Air Photo: City of Madison, 2018

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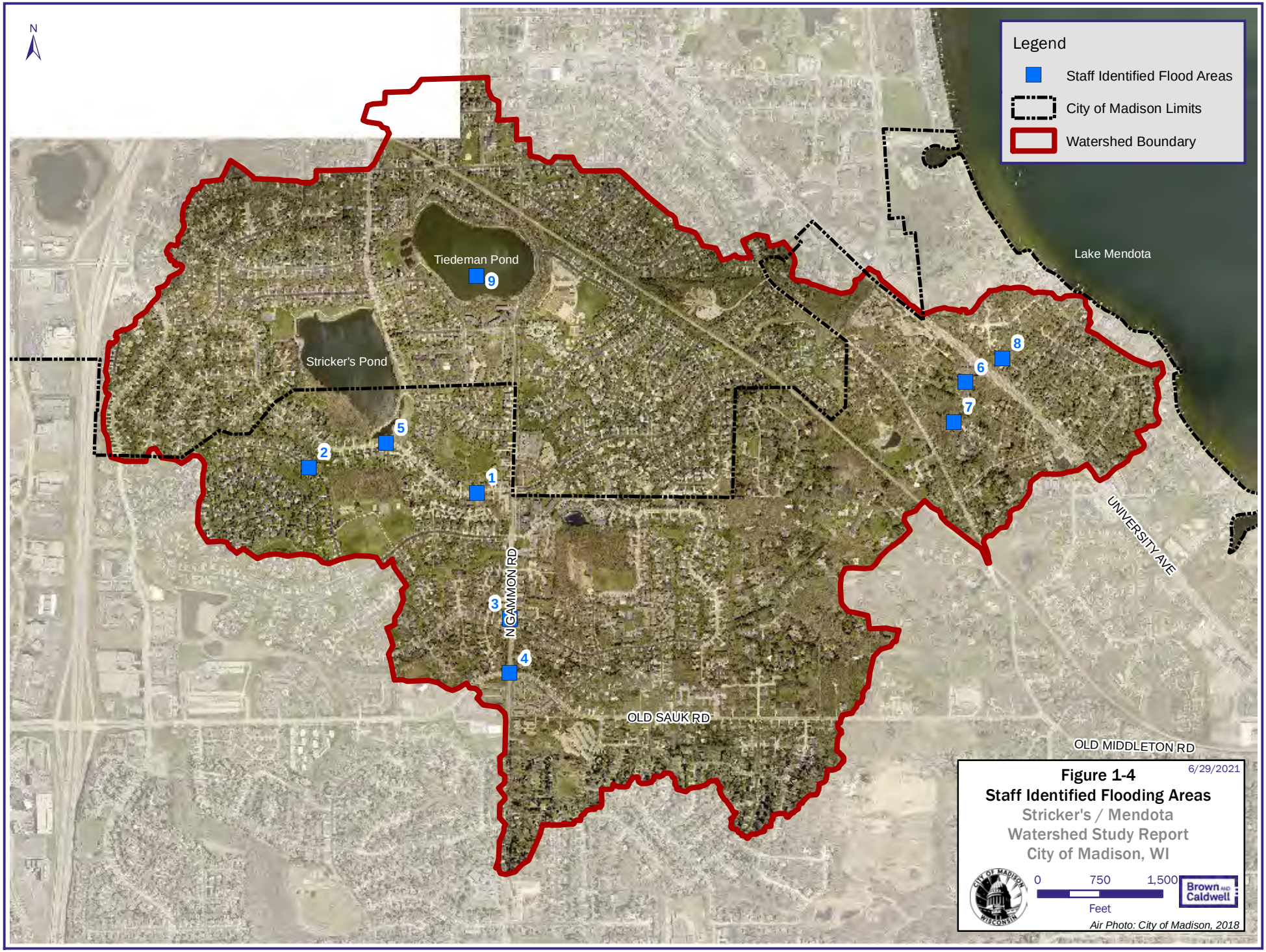

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N
Tiedeman Pond
Stricker's Pond
Lake Mendota
12
14
N GAMMON RD
OLD SAUK RD
UNIVERSITY AVE
OLD MIDDLETON RD
Legend
Wetland Point (Wisconsin Wetland Inventory)
City of Madison Limits
Open Water (WDNR)
Wetlands (Wisconsin Wetland Inventory)
Streams (WDNR)
Watershed Boundary
Figure 2-1
Natural Waterbodies
Stricker's / Mendota
Watershed Study Report
City of Madison, WI
6/29/2021
0
750
1,500
Feet
Brown AND Caldwell
Air Photo: City of Madison, 2018
Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\ExCondReportFigures\Fig2-1-WDNRwaterbodies.mxd

N

Legend

City of Madison Limits

Stricker's / Mendota Watershed

Drainage System

Storm Sewer

Open Channel

Tiedeman Pond

Stricker's Pond

Lake Mendota

12

14

N GAMMON RD

UNIVERSITY AVE

OLD SAUK RD

JUNCTION RD

6/29/2021

Figure 2-2

Existing Drainage System

Stricker's / Mendota Watershed Study Report

City of Madison, WI

0 500 1,000

Feet

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\ExCondReportFigures\Fig2-2-DrainageSystem.mxd

N

Tiedeman Pond

Stricker's Pond

Lake Mendota

12

14

N GAMMON RD

UNIVERSITY AVE

OLD SAUK RD

Legend

City of Madison Limits

Stricker's / Mendota Watershed

Land Use

Residential

Institutional

Commercial

Industrial

Open Space / Parks

Streets

Water

6/29/2021

Figure 2-3
Land Use
Stricker's / Mendota
Watershed Study Report
City of Madison, WI

0 500 1,000
Feet

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\ExCondReportFigures\Fig2-3-LandUse.mxd

N

Tiedeman Pond

Stricker's Pond

Lake Mendota

12

14

N GAMMON RD

UNIVERSITY AVE

OLD SAUK RD

Legend

City of Madison Limits

Stricker's / Mendota Watershed

Impervious

Single Family Parcel (% Impervious Provided)

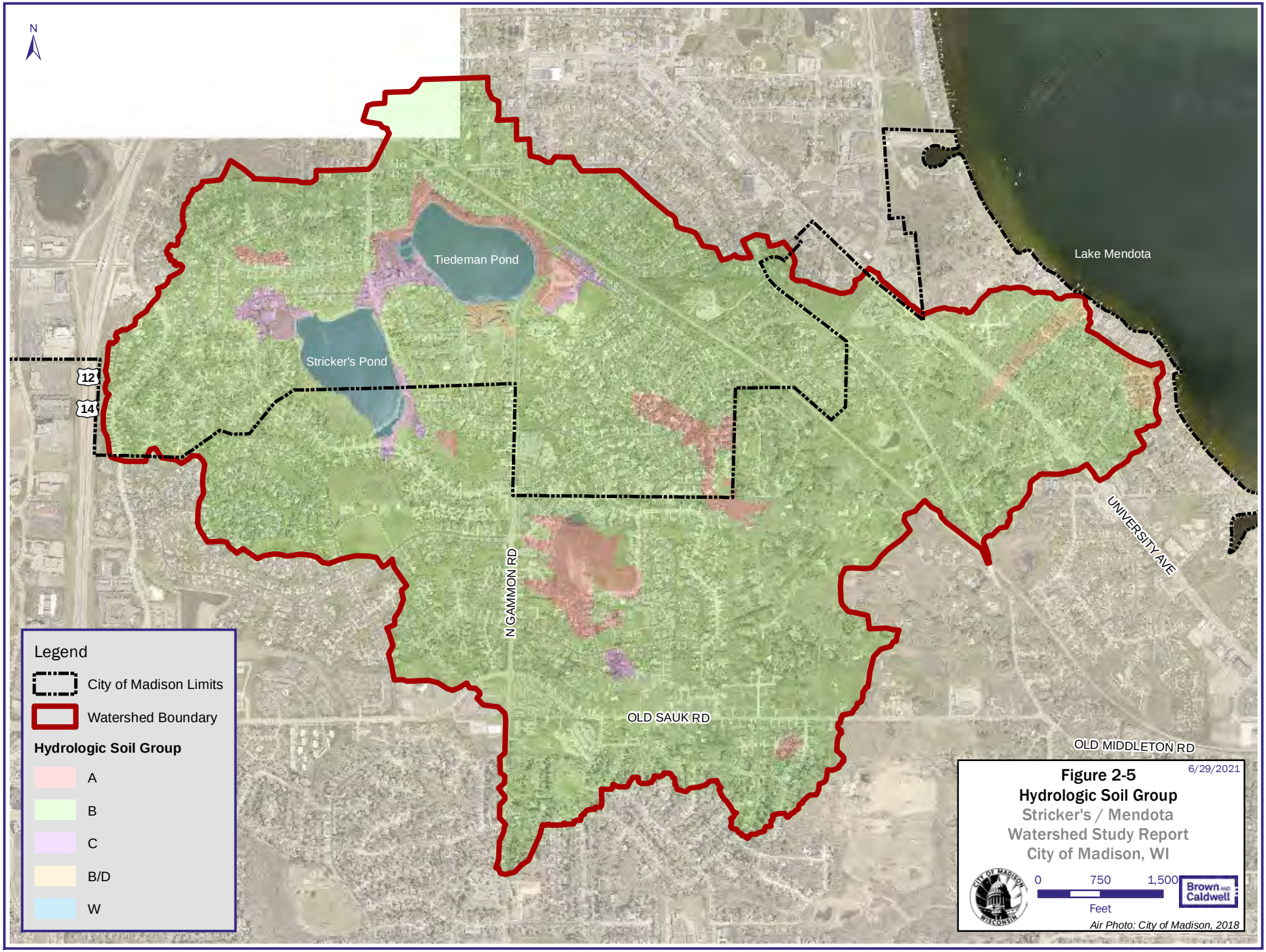
6/29/2021

Figure 2-4
Impervious Area Data
Stricker's / Mendota
Watershed Study Report
City of Madison, WI

0 500 1,000
Feet

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\ExCondReportFigures\Fig2-4-Impervious.mxd



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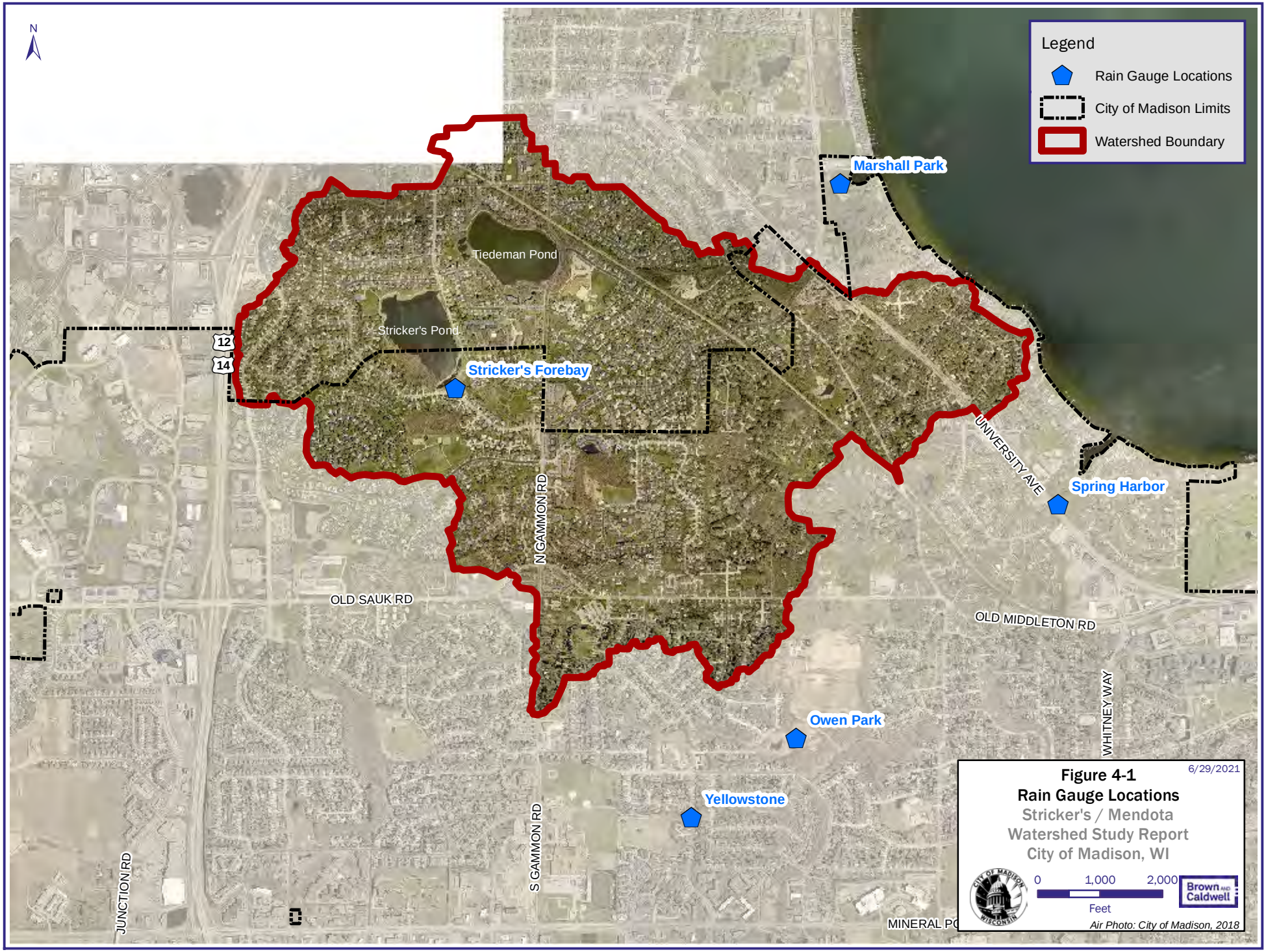

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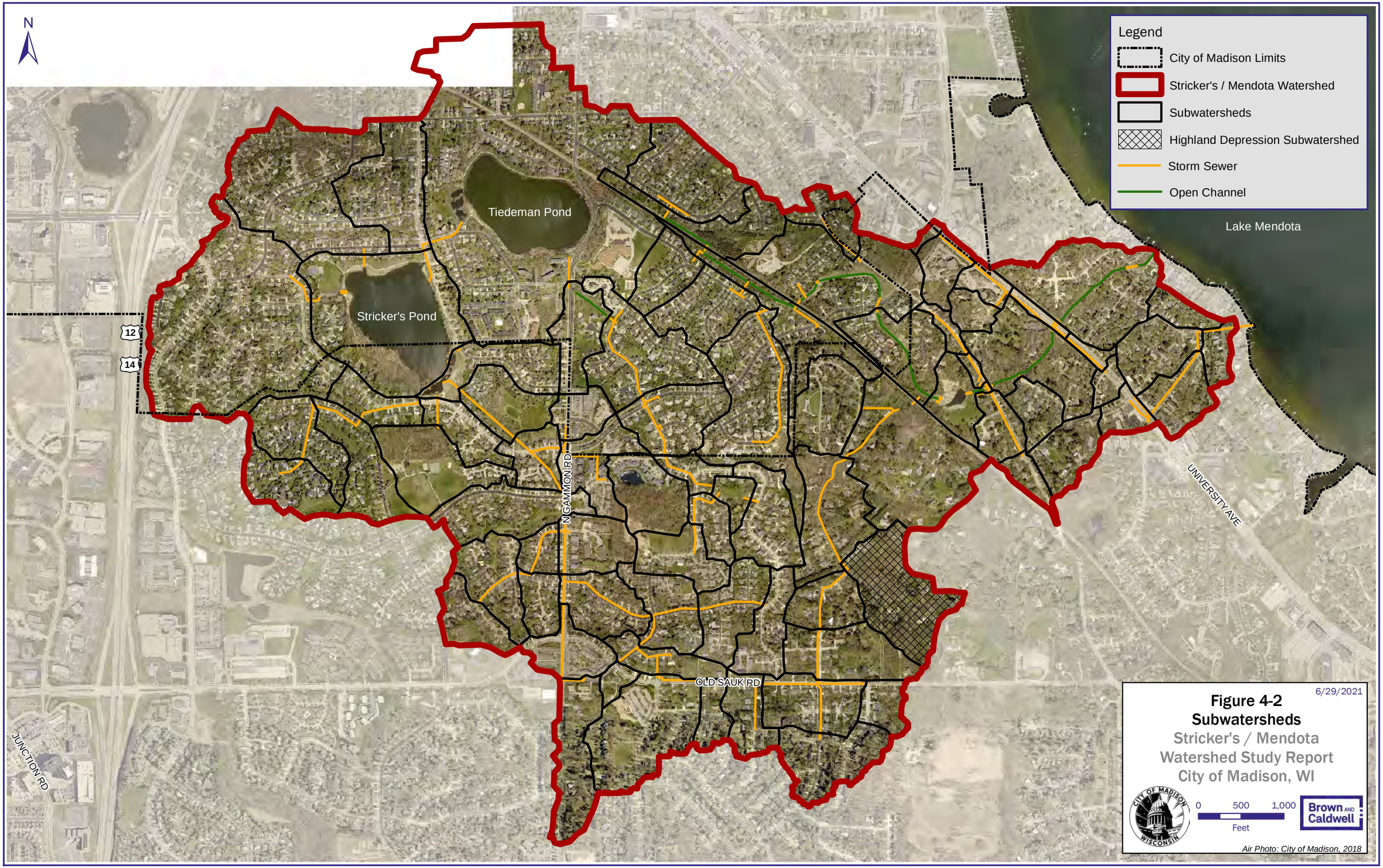
N
Legend
City of Madison Limits
Stricker's / Mendota Watershed
Subwatersheds
Highland Depression Subwatershed
Storm Sewer
Open Channel
Tiedeman Pond
Stricker's Pond
Lake Mendota
12
14
N GAMMON RD
UNIVERSITY AVE
OLD SAUK RD
JUNCTION RD
6/29/2021
Figure 4-2
Subwatersheds
Stricker's / Mendota
Watershed Study Report
City of Madison, WI
0
500
1,000
Feet
Brown AND Caldwell
Air Photo: City of Madison, 2018
Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\ExCondReportFigures\Fig4-2-Subwatersheds.mxd

N

Legend
- Storm Sewer
- Open Channels
- Modeled Ponds
- City of Madison Limits
- Stricker's / Mendota Watershed

Tiedeman Pond
Stricker's Pond
Stonefield Middleton
Old Middleton Road North
Grassman
Old Middleton Road South
Skyview
Lake Mendota
Ponwood Circle
Stonefield Madison
12
14
N GAMMON RD
OLD SAUK RD
UNIVERSITY AVE
JUNCTION RD

6/29/2021

Figure 4-3
Modeled Ponds
Stricker's / Mendota Watershed Study Report
City of Madison, WI

0 500 1,000
Feet

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\ExCondReportFigures\Fig4-3-Ponds.mxd

N

Tiedeman Pond

Stricker's Pond

Lake Mendota

12

14

N GAMMON RD

UNIVERSITY AVE

OLD SAUK RD

Legend

2D Land Use

- Impervious
- Open / Park
- Commercial
- Pervious
- Prairie
- Right of Way
- Residential
- Water
- Wooded
- City of Madison Limits
- Stricker's / Mendota Watershed

6/29/2021

Figure 4-4
2D Land Use
Stricker's / Mendota
Watershed Study Report
City of Madison, WI

0 500 1,000
Feet

Air Photo: City of Madison, 2018

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N

Legend

- Results Reporting Locations
- City of Madison Limits
- Stricker's / Mendota Watershed
- Storm Sewer
- Open Channel

Lake Mendota

N GAMMON RD

UNIVERSITY AVE

OLD SAUK RD

JUNCTION RD

6/29/2021

Figure 4-5
Results Reporting Locations
Stricker's / Mendota
Watershed Study Report
City of Madison, WI

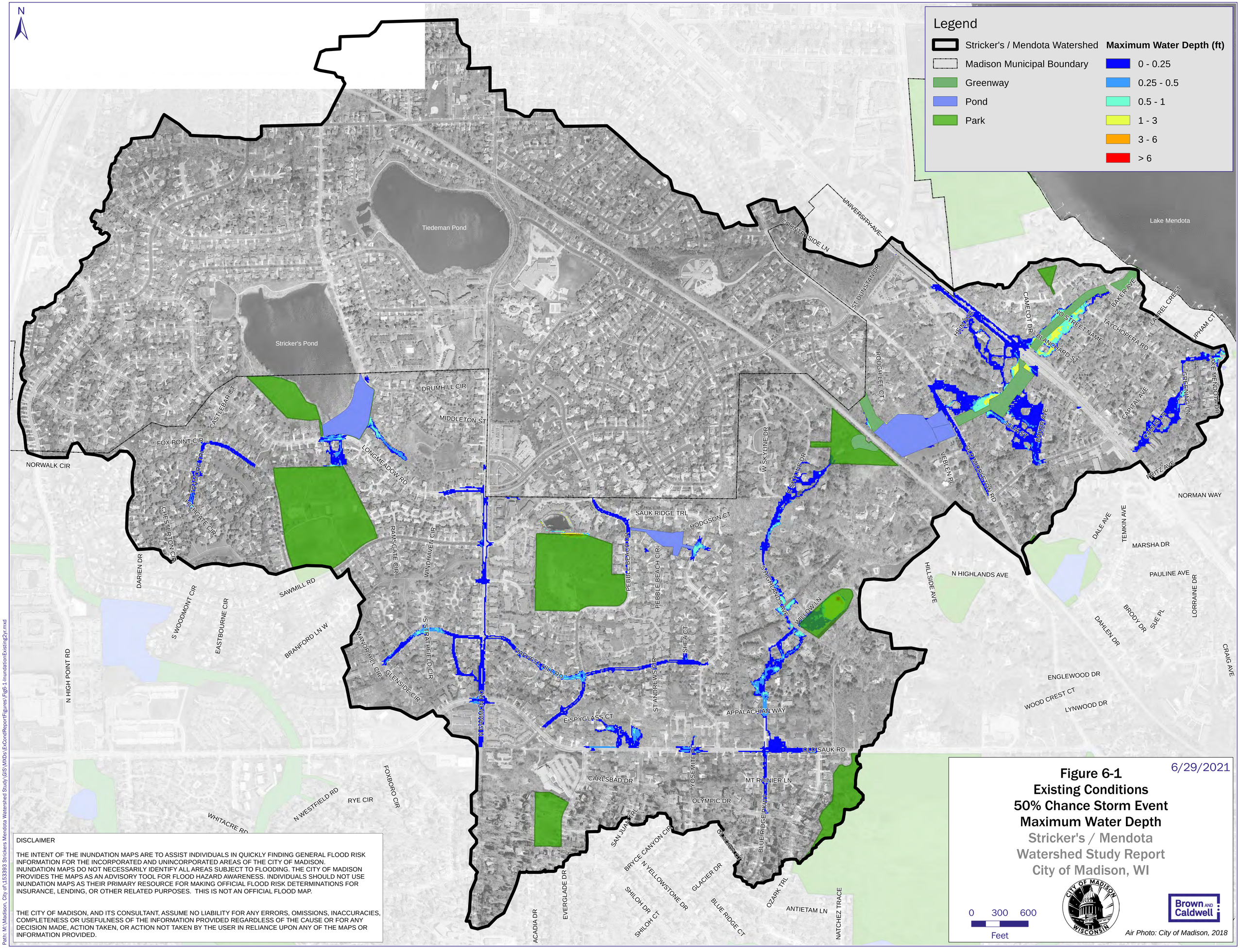
0 500 1,000
Feet

Brown AND Caldwell

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\ExCondReportFigures\Fig4-5-ReportingLocations.mxd


N
Strickers Pond
Starting WSE | Peak WSE 10-yr Event | Peak WSE 25-yr Event | Peak WSE 100-yr Event
920.5 | 924.15 | 925.26 | 927.03
923.0 | 926.02 | 926.99 | 928.53
925.5 | 927.94 | 928.73 | 929.67
STRICKERS_POND
Legend
Comparison Points
Storm Sewer Nodes
Storm Sewer
City of Madison Limits
Stricker's / Mendota Watershed
Node AS2646-001
Ground Elev. = 934.2
Starting WSE | Peak WSE 10-yr Event | Peak WSE 25-yr Event | Peak WSE 100-yr Event
920.5 | 935.45 | 935.70 | 936.19
923.0 | 935.45 | 935.70 | 936.20
925.5 | 935.45 | 935.77 | 936.28
IN2546-003
AS2646-001
ME04-A-0014-H-000
Node IN2546-003
Ground Elev. = 927.5
Starting WSE | Peak WSE 10-yr Event | Peak WSE 25-yr Event | Peak WSE 100-yr Event
920.5 | 927.75 | 928.17 | 928.50
923.0 | 927.78 | 928.20 | 928.53
925.5 | 927.97 | 928.73 | 929.66
Node AS2646-018
Ground Elev. = 956.7
Starting WSE | Peak WSE 10-yr Event | Peak WSE 25-yr Event | Peak WSE 100-yr Event
920.5 | 953.25 | 954.75 | 956.14
923.0 | 953.25 | 954.75 | 956.14
925.5 | 953.25 | 954.76 | 956.14
AS2646-018
N GAMMON RD
Node ME04-A-0014-H-000
Ground Elev. = 953.2
Starting WSE | Peak WSE 10-yr Event | Peak WSE 25-yr Event | Peak WSE 100-yr Event
920.5 | 953.84 | 954.58 | 955.16
923.0 | 953.84 | 954.58 | 955.16
925.5 | 953.84 | 954.59 | 955.16
6/29/2021
Figure 4-6
Pond Sensitivity Analysis
Stricker's / Mendota
Watershed Study Report
City of Madison, WI
0 125 250
Feet
Brown AND Caldwell
Air Photo: City of Madison, 2018
Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\ExCondReportFigures\Fig 4-6-PondSensitivity.mxd



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6/29/2021

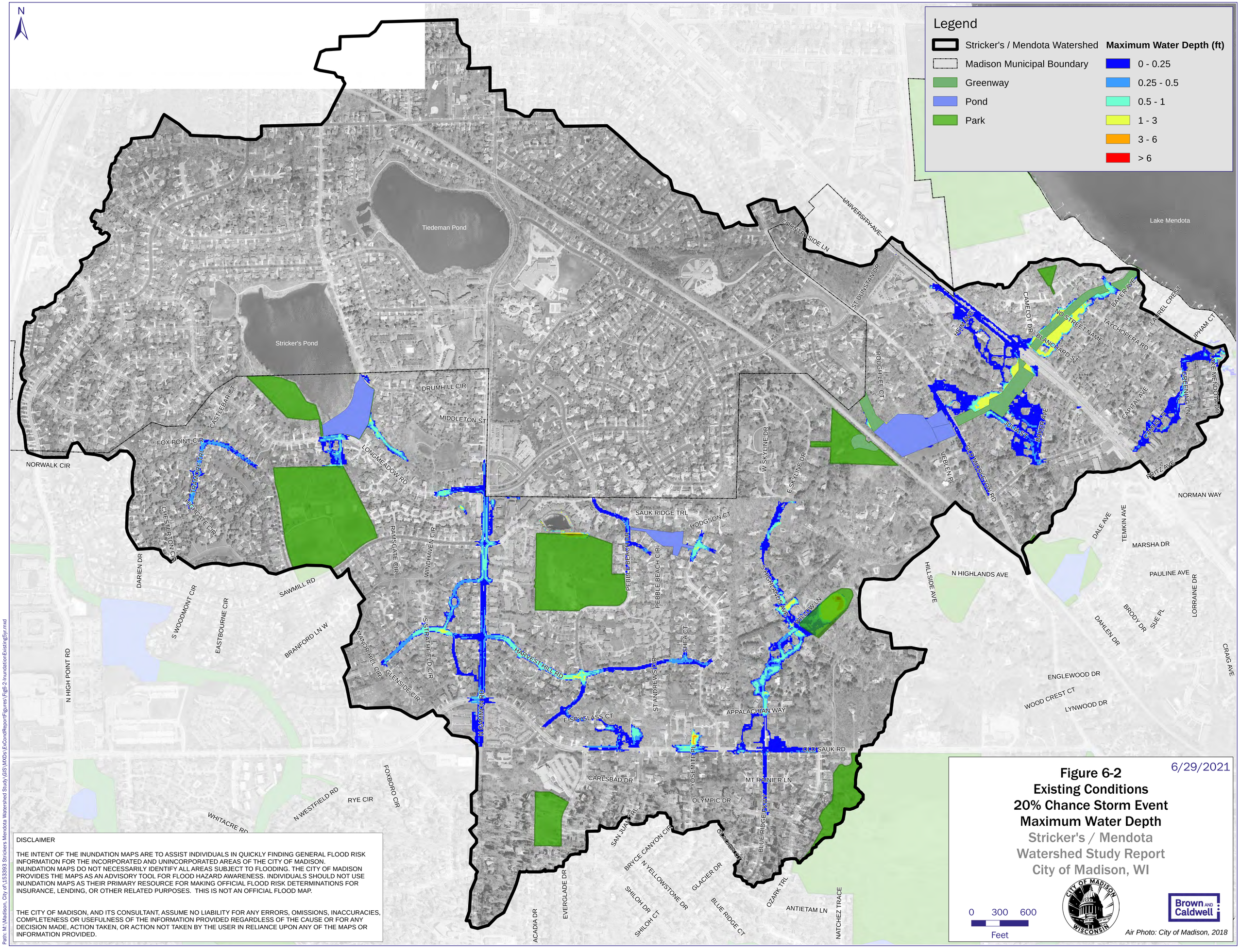
Figure 6-1
Existing Conditions
50% Chance Storm Event
Maximum Water Depth
Stricker's / Mendota
Watershed Study Report
City of Madison, WI

0 300 600
Feet

Brown AND Caldwell

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\ExCondReportFigures\Fig6-1-InundationExisting2yr.mxd



6/29/2021

Figure 6-2
Existing Conditions
20% Chance Storm Event
Maximum Water Depth
Stricker's / Mendota
Watershed Study Report
City of Madison, WI

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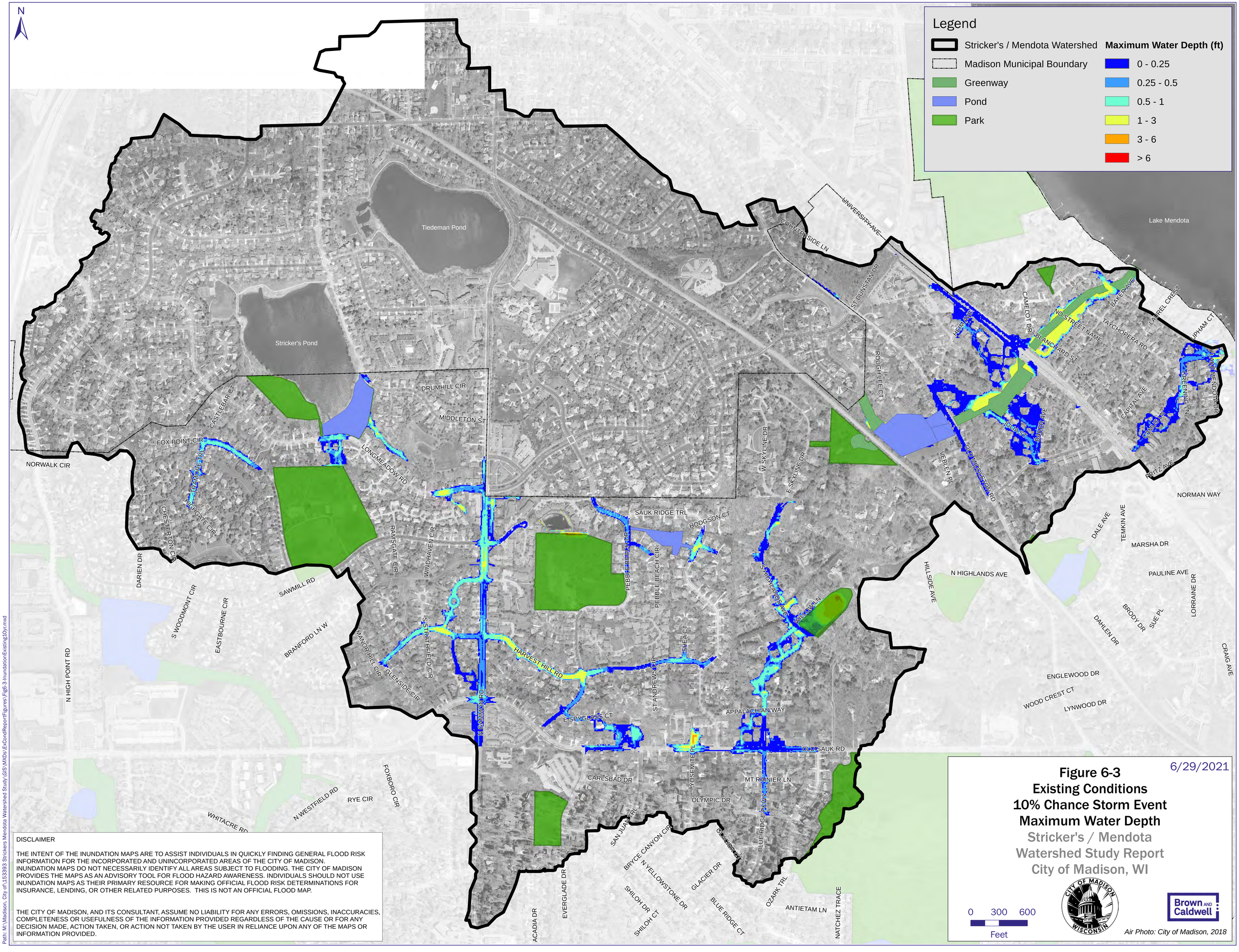

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6/29/2021

Figure 6-3
Existing Conditions
10% Chance Storm Event
Maximum Water Depth
Stricker's / Mendota
Watershed Study Report
City of Madison, WI

0 300 600
Feet

Brown AND Caldwell

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\ExCondReportFigures\Fig6-3-InundationExisting10yr.mxd

N

Legend

- Stricker's / Mendota Watershed
- Madison Municipal Boundary
- Greenway
- Pond
- Park

Maximum Water Depth (ft)

- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 3
- 3 - 6
- > 6

Tiedeman Pond
Stricker's Pond
Lake Mendota
UNIVERSITY AVE
COUNTRYSIDE LN
ST DUNSTAN DR
ROUGH LEE CT
HEIM AVE
CAMELOT DR
BLANCHARD ST
NO STREET NAME
TAYCHOPERA RD
BAKER AVE
LAUREL CREST
UPHAM CT
LAKE MENDOTA DR
GREENING LN
CAMUS LN
CAPITAL AVE
JULIA ST
BAKER AVE
OLD MIDDLETON RD
VEBLEN PL
FRITZ AVE
NORMAN WAY
DALE AVE
TEMKIN AVE
MARSHA DR
PAULINE AVE
LORRAINE DR
HILLSIDE AVE
N HIGHLANDS AVE
DAHLEN DR
BRODY DR
SUE PL
CRAIG AVE
ENGLEWOOD DR
WOOD CREST CT
LYNWOOD DR
DRUMHILL CIR
MIDDLETON ST
CASTLEBAR CT
FOX POINT CIR
LONGMEADOW RD
TRAMORE TRL
HIGHGATE CIR
NORWALK CIR
CHESTERTON CIR
DARIEN DR
SAWMILL RD
S WOODMONT CIR
EASTBOURNE CIR
BRANFORD LN W
N HIGH POINT RD
RAMSGATE CIR
WINDHAVEN CIR
S STRATHFIELD CIR
MANOR HILL CIR
GLENSIDE CIR
SAUK RIDGE TRL
HODGSON CT
PEBBLE BEACH DR
PEBBLE BEACH CIR
HARVEST HILL RD
N SAMMON RD
SHEA CT
ST ANDREWS CIR
E SPYGLASS CT
APPALACHIAN WAY
OLD SAUK RD
W SKYLINE DR
E SKYLINE DR
S HIGHLANDS AVE
WILLOW LN
CARLSBAD DR
YOSEMITE PL
MT RAINIER LN
OLYMPIC DR
BLUE RIDGE PKWY
SAN JUAN TRL
BRYCE CANYON CIR
N YELLOWSTONE DR
GLACIER DR
SHILOH DR
SHILOH CT
BLUE RIDGE CT
OZARK TRL
ANTIETAM LN
NATCHEZ TRACE
EVERGLADE DR
ACADIA DR
FOXBORO CIR
RYE CIR
N WESTFIELD RD
WHITACRE RD

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11/2/2021

Figure 6-4
Existing Conditions
4% Chance Storm Event
Maximum Water Depth
Stricker's / Mendota Watershed Study Report
City of Madison, WI

0 300 600
Feet

CITY OF MADISON WISCONSIN

Brown AND Caldwell

Air Photo: City of Madison, 2018

Path: V:\153393_Strickers_Mendota_Watershed_Study\GIS\MXDs\PrCondFigures\Fig6-4-InundationExisting25yr.mxd

N

Legend

- Stricker's / Mendota Watershed
- Madison Municipal Boundary
- Greenway
- Pond
- Park

Maximum Water Depth (ft)

- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 3
- 3 - 6
- > 6

Tiedeman Pond
Stricker's Pond
Lake Mendota
UNIVERSITY AVE
COUNTRYSIDE LN
ST DUNSTAN DR
ROUGH LEE CT
HEIM AVE
CAMELOT DR
BLANCHARD ST
NO STREET NAME
TAYCHOPERA RD
BAKER AVE
LAUREL CREST
UPHAM CT
LAKE MENDOTA DR
GREENING LN
CAMUS LN
CAPITAL AVE
JULIA ST
BAKER AVE
CROSS MIDDLETON RD
VEBLEN PL
RITZ AVE
NORMAN WAY
DALE AVE
TEMKIN AVE
MARSHA DR
PAULINE AVE
LORRAINE DR
HILLSIDE AVE
N HIGHLANDS AVE
DAHLEN DR
BRODY DR
SUE PL
CRAIG AVE
ENGLEWOOD DR
WOOD CREST CT
LYNWOOD DR
DRUMHILL CIR
MIDDLETON ST
CASTLEBAR CT
FOX POINT CIR
NORWALK CIR
LONGMEADOW RD
TRAMORE TRL
HIGHGATE CIR
CHESTERTON CIR
DARIEN DR
SAWMILL RD
S WOODMONT CIR
EASTBOURNE CIR
BRANFORD LN W
N HIGH POINT RD
RAMSGATE CIR
WINDHAVEN CIR
S STRATHFIELD CIR
MANOR HILL CIR
GLENSIDE CIR
HARVEST HILL RD
N GAMMON RD
SAUK RIDGE TRL
HODGSON CT
PEBBLE BEACH DR
PEBBLE BEACH CIR
SHEA CT
ST ANDREWS CIR
E SPYGLASS CT
W SKYLINE DR
E SKYLINE DR
SHORELAND AVE
WILLOW LN
APPALACHIAN WAY
OLD SAUK RD
YOSEMITE PL
CARLSBAD DR
MT RAINIER LN
OLYMPIC DR
BLUE RIDGE PKWY
SAN JUAN TRL
BRYCE CANYON CIR
N YELLOWSTONE DR
SHILOH DR
SHILOH CT
GLACIER DR
BLUE RIDGE CT
OZARK TRL
ANTIETAM LN
NATCHEZ TRACE
EVERGLADE DR
ACADIA DR
FOXBORO CIR
RYE CIR
N WESTFIELD RD
WHITACRE RD

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6/29/2021

Figure 6-5
Existing Conditions
2% Chance Storm Event
Maximum Water Depth
Stricker's / Mendota Watershed Study Report
City of Madison, WI

0 300 600
Feet

Brown AND Caldwell

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\ExCondReportFigures\Fig6-5-InundationExisting50yr.mxd

N

Legend

- Stricker's / Mendota Watershed
- Madison Municipal Boundary
- Greenway
- Pond
- Park

Maximum Water Depth (ft)

- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 3
- 3 - 6
- > 6

Tiedeman Pond
Stricker's Pond
Lake Mendota
UNIVERSITY AVE
COUNTRYSIDE LN
ST DUNSTAN DR
HEIM AVE
CAMELOT DR
BLANCHARD ST
NO STREET NAME
TAYCHOPERA RD
BAKER AVE
LAUREL CREST
UPHAM CT
ROUGH LEE CT
CAPITAL AVE
JULIA ST
BAKER AVE
GREENING LN
LAKE MENDOTA DR
CAMUS LN
OLD MIDDLETON RD
VEBLEN PL
FRITZ AVE
NORMAN WAY
W SKYLINE DR
E SKYLINE DR
DRUMHILL CIR
MIDDLETON ST
CASTLEBAR CT
FOX POINT CIR
NORWALK CIR
TRAMORE TRL
HIGHGATE CIR
CHESTERTON CIR
LONGMEADOW RD
RAMSGATE CIR
WINDHAVEN CIR
SAUK RIDGE TRL
HODGSON CT
PEBBLE BEACH DR
PEBBLE BEACH CIR
SHEA CT
STHIGHLANDS AVE
WILLOW LN
DARIEN DR
SAWMILL RD
S WOODMONT CIR
EASTBOURNE CIR
BRANFORD LN W
S STRATHFIELD CIR
MANOR HILL CIR
GLENSIDE CIR
HARVEST HILL RD
N GAMMON RD
N HIGH POINT RD
ST ANDREWS CIR
E SPYGLASS CT
APPALACHIAN WAY
OLD SAUK RD
YOSEMITE PL
CARLSBAD DR
MT RAINIER LN
OLYMPIC DR
BLUE RIDGE PKWY
N WESTFIELD RD
RYE CIR
FOXBORO CIR
WHITACRE RD
SAN JUAN TRL
BRYCE CANYON CIR
N YELLOWSTONE DR
SHILOH DR
SHILOH CT
GLACIER DR
BLUE RIDGE CT
OZARK TRL
ANTIETAM LN
NATCHEZ TRACE
EVERGLADE DR
ACADIA DR
HILLSIDE AVE
N HIGHLANDS AVE
DALE AVE
TEMKIN AVE
MARSHA DR
PAULINE AVE
LORRAINE DR
BRODY DR
SUE PL
DAHLEN DR
CRAIG AVE
ENGLEWOOD DR
WOOD CREST CT
LYNWOOD DR

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6/29/2021

Figure 6-6
Existing Conditions
1% Chance Storm Event
Maximum Water Depth
Stricker's / Mendota Watershed Study Report
City of Madison, WI

0 300 600
Feet

Air Photo: City of Madison, 2018

Brown AND Caldwell

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\ExCondReportFigures\Fig6-6 InundationExisting100yr.mxd

N

Legend

- Stricker's / Mendota Watershed
- Madison Municipal Boundary
- Greenway
- Pond
- Park

Maximum Water Depth (ft)

- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 3
- 3 - 6
- > 6

Tiedeman Pond

Stricker's Pond

Lake Mendota

UNIVERSITY AVE
COUNTRYSIDE LN
ST DUNSTAN DR
ROUGH LEE CT
HEIM AVE
CAMELOT DR
BLANCHARD ST
NO STREET NAME
TAYCHOPERA RD
BAKER AVE
LAUREL CREST
UPHAM CT
LAKE MENDOTA DR
GREENING LN
CAPITAL AVE
CAMUS LN
JULIA ST
BAKER AVE
OLD MIDDLETON RD
VEBLEN PL
FRITZ AVE
NORMAN WAY
DALE AVE
TEMKIN AVE
MARSHA DR
PAULINE AVE
LORRAINE DR
HILLSIDE AVE
N HIGHLANDS AVE
DAHLEN DR
BRODY DR
SUE PL
CRAIG AVE
ENGLEWOOD DR
WOOD CREST CT
LYNWOOD DR

DRUMHILL CIR
MIDDLETON ST
CASTLEBAR CT
FOX POINT CIR
NORWALK CIR
LONGMEADOW RD
TRAMORE TR
HIGHGATE CIR
CHESTERTON CIR
DARIEN DR
RAMSGATE CIR
WINDHAVEN CIR
SAWMILL RD
S WOODMONT CIR
EASTBOURNE CIR
BRANFORD LN W
N HIGH POINT RD
MANOR HILL CIR
GLENSIDE CIR
S STRATFIELD CIR
HARVEST HILL RD
N GAMMON RD
E SPYGLASS CT
SAUK RIDGE TRL
HODGSON CT
PEBBLE BEACH DR
PEBBLE BEACH CIR
ST ANDREWS CIR
SHEFACT
W SKYLINE DR
E SKYLINE DR
SHIGHLANDS AVE
WILLOW LN
APPALACHIAN WAY
OLD SAUK RD
YOSEMITE PL
CARLSBAD DR
MT RAINIER LN
OLYMPIC DR
BLUE RIDGE PKWY
SAN JUAN TRL
BRYCE CANYON CIR
N YELLOWSTONE DR
SHILOH DR
SHILOH CT
GLACIER DR
BLUE RIDGE CT
OZARK TRL
ANTIETAM LN
NATCHEZ TRACE
EVERGLADE DR
ACADIA DR
FOXBORO CIR
RYE CIR
N WESTFIELD RD
WHITACRE RD

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6/29/2021

Figure 6-7
Existing Conditions
0.2% Chance Storm Event
Maximum Water Depth
Stricker's / Mendota Watershed Study Report
City of Madison, WI

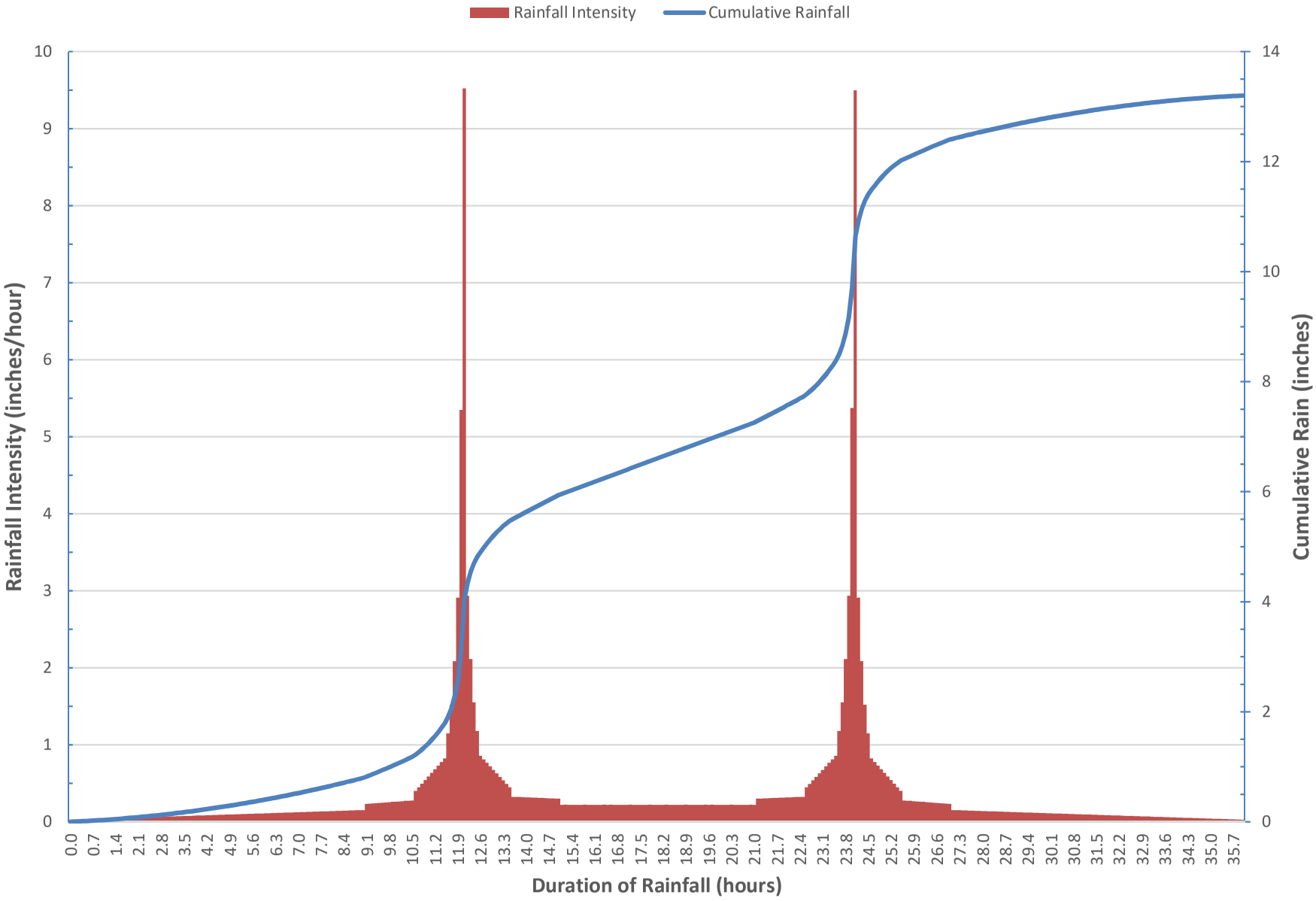
0 300 600
Feet

Air Photo: City of Madison, 2018

Brown AND Caldwell

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\ExCondReportFigures\Fig6-7 InundationExisting500yr.mxd

Fig. 6-8: Back to Back 100-year Rainfall Distribution



N

Legend

- Stricker's / Mendota Watershed
- Madison Municipal Boundary
- Greenway
- Pond
- Park

Maximum Water Depth (ft)

- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 3
- 3 - 6
- > 6

Tiedeman Pond
Stricker's Pond
Lake Mendota
UNIVERSITY AVE
COUNTRYSIDE LN
ST DUNSTAN DR
ROUGH LEE CT
HEIM AVE
CAMELOT DR
BLANCHARD ST
NO STREET NAME
TAYCHOPERA RD
BAKER AVE
LAUREL CREST
UPHAM CT
LAKE MENDOTA DR
GREENING LN
CAPITAL AVE
CAMUS LN
BAKER AVE
JULIA ST
OLD MIDDLETON RD
VEBLEN PL
RITZ AVE
NORMAN WAY
DALE AVE
TEMKIN AVE
MARSHA DR
PAULINE AVE
LORRAINE DR
BRODY DR
SUE PL
DAHLEN DR
CRAIG AVE
ENGLEWOOD DR
WOOD CREST CT
LYNWOOD DR
N HIGHLANDS AVE
HILLSIDE AVE
DRUMHILL CIR
MIDDLETON ST
CASTLEBAR CT
FOX POINT CIR
NORWALK CIR
TRAMORE TRL
LONGMEADOW RD
HIGHGATE CIR
CHESTERTON CIR
DARIEN DR
RAMSGATE CIR
WINDHAVEN CIR
SAUK RIDGE TRL
HODGSON CT
PEBBLE BEACH DR
PEBBLE BEACH CIR
W SKYLINE DR
E SKYLINE DR
S HIGHLANDS AVE
WILLOW LN
SHEA CT
ST ANDREWS CIR
SAWMILL RD
S WOODMONT CIR
EASTBOURNE CIR
BRANFORD LN W
S STRATHFIELD CIR
MANOR HILL CIR
GLENSIDE CIR
HARVEST HILL RD
N GAMMON RD
E SPYGLASS CIR
N HIGH POINT RD
APPALACHIAN WAY
OLD SAUK RD
YOSEMITE PL
CARLSBAD DR
MT RAINIER LN
OLYMPIC DR
FOXBORO CIR
RYE CIR
N WESTFIELD RD
WHITACRE RD
SAN JUAN TRL
BRYCE CANYON CIR
GRAND CANYON CIR
BLUE RIDGE PKWY
N YELLOWSTONE DR
GLACIER DR
SHILOH DR
SHILOH CT
BLUE RIDGE CT
OZARK TRL
ANTIETAM LN
NATCHEZ TRACE
EVERGLADE DR
ACADIA DR

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6/29/2021

Figure 6-9
Existing Conditions - Long Duration Storm
Consecutive 1% Chance Storm Events
Maximum Water Depth
Stricker's / Mendota
Watershed Study Report
City of Madison, WI

0 300 600
Feet

CITY OF MADISON WISCONSIN

Brown AND Caldwell

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\ExCondReportFigures\Fig6-9-InundationExistingBack10Back100y.mxd

N

Legend

City of Madison Limits

Stricker's / Mendota Watershed

Modeled Ponds

Modeled Storm Structures in Madison

Modeled Greenways in Madison

Modeled Storm Sewer in Madison

10% Chance Storm Event

Capacity Exceeded

Capacity Available

Lake Mendota

12

14

N GAMMON RD

UNIVERSITY AVE

OLD SAUK RD

JUNCTION RD

Figure 6-10
Existing Conditions
10% Chance Storm Event
Storm Sewer Capacity

Stricker's / Mendota
Watershed Study Report
City of Madison, WI

6/30/2021

0 500 1,000
Feet

Brown AND Caldwell

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\ExCondReportFigures\Fig6-10-ExistingConditions10yrStormSewerCapacity.mxd

N

Legend

City of Madison Limits

Stricker's Mendota Watershed

Stricker's Mendota Subcatchments

10-yr Storm Event

Composite Inlet Peak Water Depth

< 0.5'

> 0.5'

Lake Mendota

12

14

Figure 6-11
Existing Conditions
10% Chance Storm Event
Inlet Capacity Limitations

Stricker's / Mendota
Watershed Study Report
City of Madison, WI

6/29/2021

0 500 1,000
Feet

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\ExCondReportFigures\Fig6-11-ExistingConditions10yrStreetInundation.mxd

N

Legend

City of Madison Limits

Strickers Mendota Watershed

4% Chance Storm Event

Street Flood Risk

<0.2' Inundation

>0.2' Inundation

Maximum Water Depth (ft)

4% Chance Storm Event

0 - 0.25

0.25 - 0.5

0.5 - 1

1 - 3

3 - 6

> 6

Lake Mendota

COUNTRYSIDE LN
OLD MIDDLETON RD
QUETICO DR
UNIVERSITY AVE
CAMELOT DR
LAKE MENDOTA DR
TAYCHOPERA RD
BAKER AVE
HICKORY DR
LAUREL CREST
CAPITAL AVE
CAMUS LN
GREENING LN
FRITZ AVE
HEIM AVE
ROUGH LEE CT
E SKYLINE DR
W SKYLINE DR
JULIA ST
VEBLEN PL
N HIGHLANDS AVE
NORMAN WAY
UNIVERSITY AVE
12
14
DRUMHILL CIR
BACK BAY CIR
MIDDLETON ST
FOX POINT CIR
TRAMORE TRL
LONGMEADOW RD
N GAMMON RD
DARIEN DR
CHESTERTON CIR
N WESTFIELD RD
SAWMILL RD
PONDWOOD CIR
SAUK RIDGE TRL
PEBBLE BEACH CIR
SCHLOUGH CT
RAMSGATE CIR
ANDOVER CIR
FISKDALE CIR
HAVERHILL CIR
HARVEST HILL RD
PINEHURST CIR
GLENSIDE CIR
FIRESTONE CT
ST ANDREWS CIR
SHEACT
WILLOW LN
S HIGHLANDS AVE
PEBBLE BEACH DR
APPALACHIAN WAY
OLD SAUK RD
MT RAINIER LN
OZARK TRL
OLYMPIC DR
EVERGLADE DR
ISLE ROYAL DR
SAN JUAN TRL
BLUE RIDGE PKWY

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Figure 6-12
Existing Conditions
4% Chance Storm Event
Street Inundation
Stricker's / Mendota
Watershed Study Report
City of Madison, WI

0 500 1,000
Feet

Brown AND Caldwell

Air Photo: City of Madison, 2018

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N

Legend

City of Madison Limits

Stricker's / Mendota Watershed

Focus Group Areas

Baker Ave / Lake Mendota

Hickory Hollow

Julia St / Baker Ave

Longmeadow / Backbay Cir

Lake Mendota

Tiedeman Pond

Stricker's Pond

12

14

N GAMMON RD

UNIVERSITY AVE

OLD SAUK RD

JUNCTION RD

6/29/2021

Figure 7-1

Focus Group Areas

Stricker's / Mendota Watershed Study Report

City of Madison, WI

0 500 1,000

Feet

Brown AND Caldwell

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\ExCondReportFigures\Fig7-1-FocusGroupAreas.mxd

N

Legend

- Storm Sewer Improvements
- New Storm Sewer
- Abandon Ex. Storm Sewer
- Existing Storm Sewer
- Greenway Improvements
- Longmeadow Relief Sewer
- Stricker's / Mendota Watershed
- Madison Municipal Boundary

Stricker's Pond Outfall

Tiedeman Pond

Tiedeman Pond Outfall

Downstream Mendota-Grassman Greenway

Camelot Drive Culvert

Stricker's Pond

Longmeadow Relief Sewer

University Avenue Culvert

Upstream Mendota-Grassman Greenway

Lake Mendota

N GAMMON RD

OLD SAUK RD

UNIVERSITY AVE

6/25/2021

Figure 9-1
Selected Solutions Summary
Stricker's/Mendota Watershed Study Report
City of Madison, WI

0 500 1,000
Feet

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\PrCondReportFigures\Fig9-1SelectedSolutions.mxd

N

Tiedeman Pond

Stricker's Pond

LONGMEADOW RD

SAWMILL RD

OLD SAUK RD

NWESTFIELD RD

N GAMMON RD

BLUE RIDGE PKWY

OLD MIDDLETON RD

CAPITAL AVE

LAKE MENDOTA DR

UNIVERSITY AVE

N ROSA RD

Legend

- Madison Municipal Boundary
- Stricker's / Mendota Watershed
- Storm Sewer Improvements
- Existing Storm Sewer

Figure 10-1
Local Storm Sewer Improvements
Stricker's/Mendota Watershed Study Report
City of Madison, WI

6/25/2021

0 350 700
Feet

Brown AND Caldwell

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\PrCondReportFigures\Fig10-1-LocalStormSewerImprovements.mxd

N

Tiedeman Pond

Stricker's Pond

Legend

- Madison Municipal Boundary
- Stricker's / Mendota Watershed
- Subcatchment
- Inlet Capacity Improvement Areas
- Existing Storm Sewer

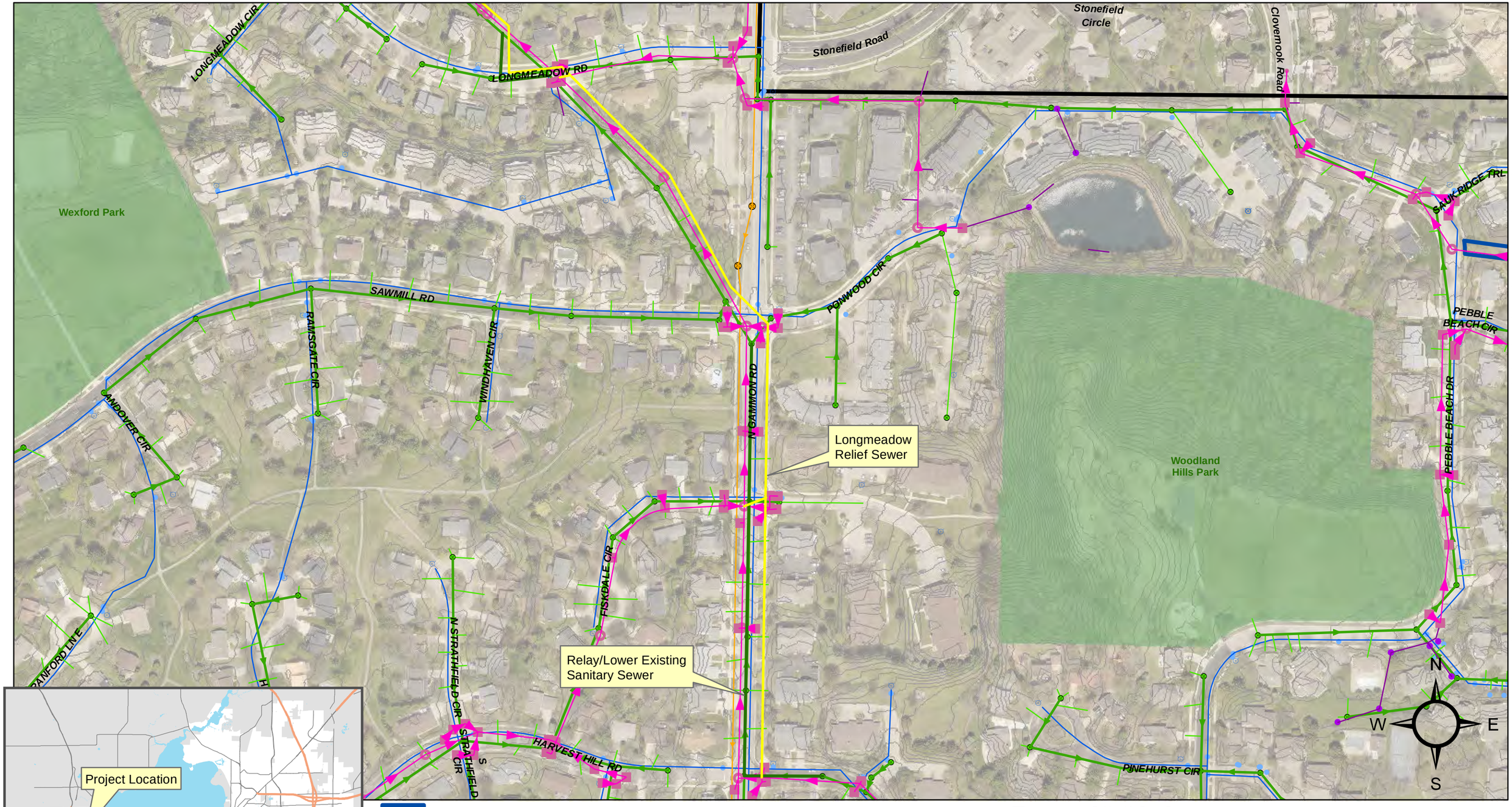
Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\PrCondReportFigures\Fig10-2-InletCapacityImprovements.mxd

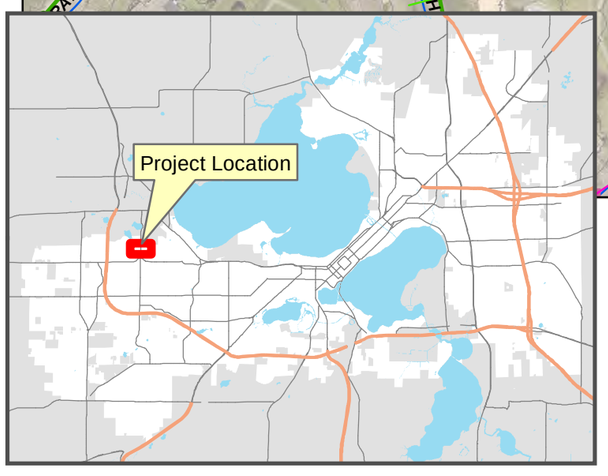
Figure 10-2
Inlet Capacity Improvement Subwatersheds
Stricker's/Mendota Watershed Study Report
City of Madison, WI

6/22/2021

0 350 700
Feet

Air Photo: City of Madison, 2018





Pond
Storm Pipe
Other Storm Structure
Access Structures
Inlet
Private Stormwater Pipes--Approx
Private Stormwater Structures--A...
Sanitary Mains
SAS
Sanitary Laterals
MMSD Mains
MMSD SAS
Water Main
Water Valve
Water Hydrant
Municipal Limits
Parks
Longmeadow Relief Sewer
Proposed Sanitary Modification

Figure 10-3A: Longmeadow Relief Sewer

ADDITIONAL NOTES THAT IMPACT PROJECT IMPLEMENTATION
-Sanitary sewer at intersection of Gammon Road and Harvest Hill Road needs to be lowered.
-Storm and sanitary sewer at Longmeadow Road crossing may need to jog to the west.
-Storm sewer crosses water utility at several locations. Water main may need to be lowered.
-WDNR NOI permit required. Chapter 30 permit may be needed.

CITY OF MADISON ENGINEERING

Date: 6/30/2021

0 100 200 Feet

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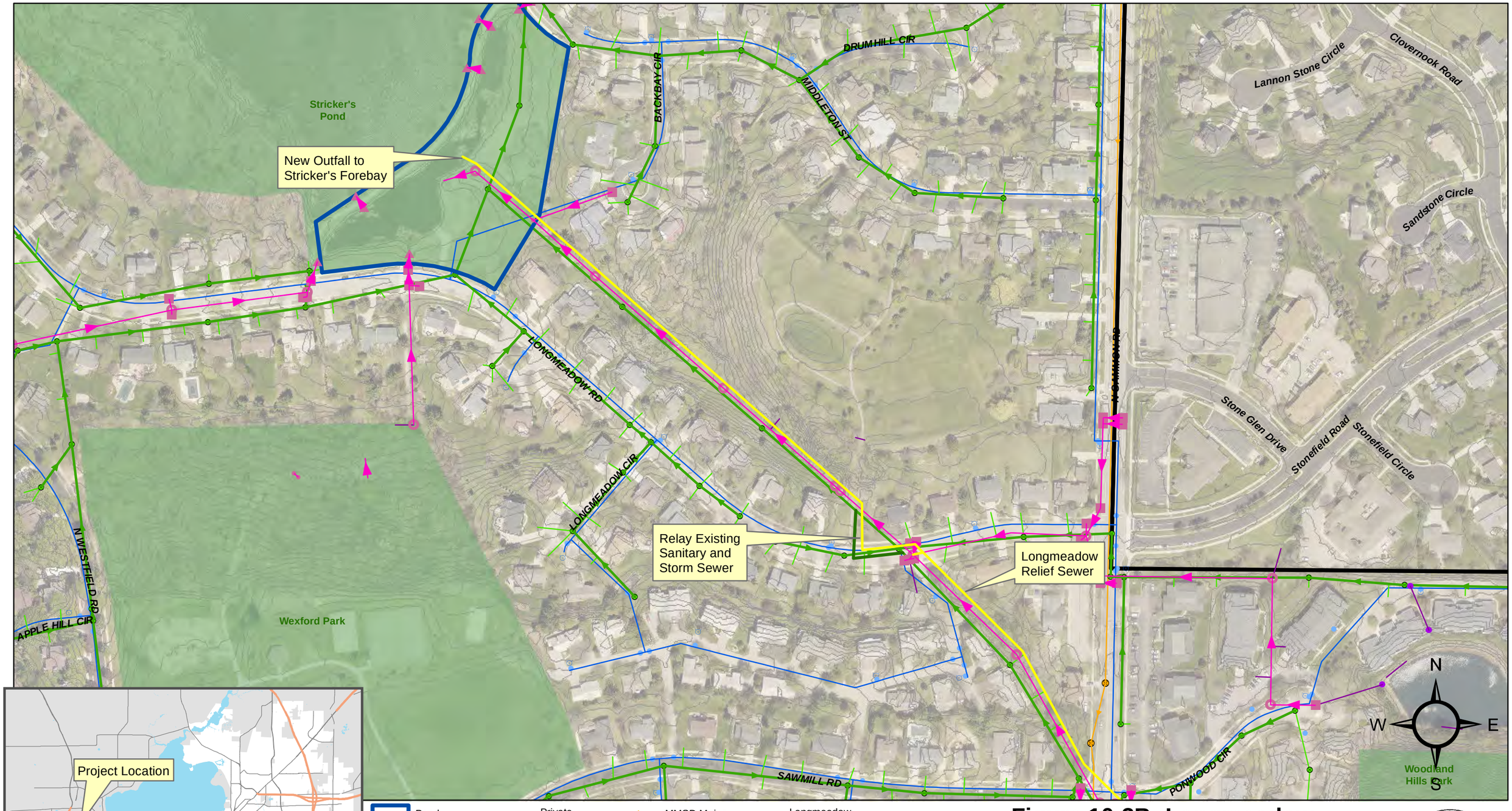

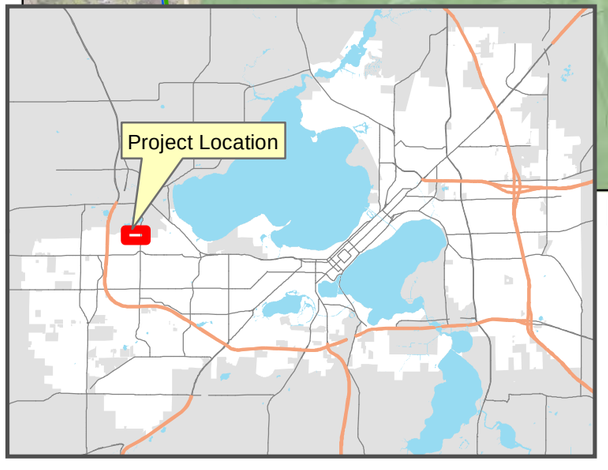

Pond
Storm Pipe
Other Storm Structure
Access Structures
Apron
Inlet
Private Stormwater Pipes--Approx
Private Stormwater Structures--A...
Sanitary Mains
SAS
Sanitary Laterals
MMSD Mains
MMSD SAS
Water Main
Water Valve
Water Hydrant
Municipal Limits
Parks
Longmeadow Relief Sewer
Proposed Sanitary Modification

Figure 10-3B: Longmeadow Relief Sewer

ADDITIONAL NOTES THAT IMPACT PROJECT IMPLEMENTATION
-Sanitary sewer at intersection of Gammon Road and Harvest Hill Road needs to be lowered.
-Storm and sanitary sewer at Longmeadow Road crossing may need to jog to the west.
-Storm sewer crosses water utility at several locations. Water main may need to be lowered.
-WDNR NOI permit required. Chapter 30 permit may be needed.

CITY OF MADISON ENGINEERING

Date: 6/30/2021

0 100 200 Feet

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University Avenue
Culvert Improvements
See Figure 10-6

Grading outside existing
greenway anticipated.
Property acquisition likely
required.

Increase Channel Slope
Reduce Channel Roughness
Re-grade Channel to Improve Flow Capacity

Grading outside existing
greenway anticipated.
Property acquisition likely
required.

HEIM AVE
BLANCHARD ST
UNIVERSITY AVE
HICKORY DR
OLD MIDDLETON RD
JULIA ST
JULIA CIR
BAKER AVE

Project Location

Greenway
Pond
Storm Pipe
Other Storm Structure
Access Structures
Apron
Inlet
Other
Private Stormwater Pipes--Approx
Sanitary Mains
SAS
Sanitary Laterals
MMSD Mains
MMSD SAS
Water Main
Water Valve
Water Hydrant
Proposed Grading Contour
Estimated Project Boundary

N
W
E
S

Figure 10-5: Upstream Mendota-Grassman Greenway Improvements

ADDITIONAL NOTES THAT IMPACT PROJECT IMPLEMENTATION
-Grading may be required on private property.
-Significant tree removal needed.
-WDNR/USACE wetland/waterway and NOI permitting will be required.

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0 50 100 Feet

Date: 6/30/2021

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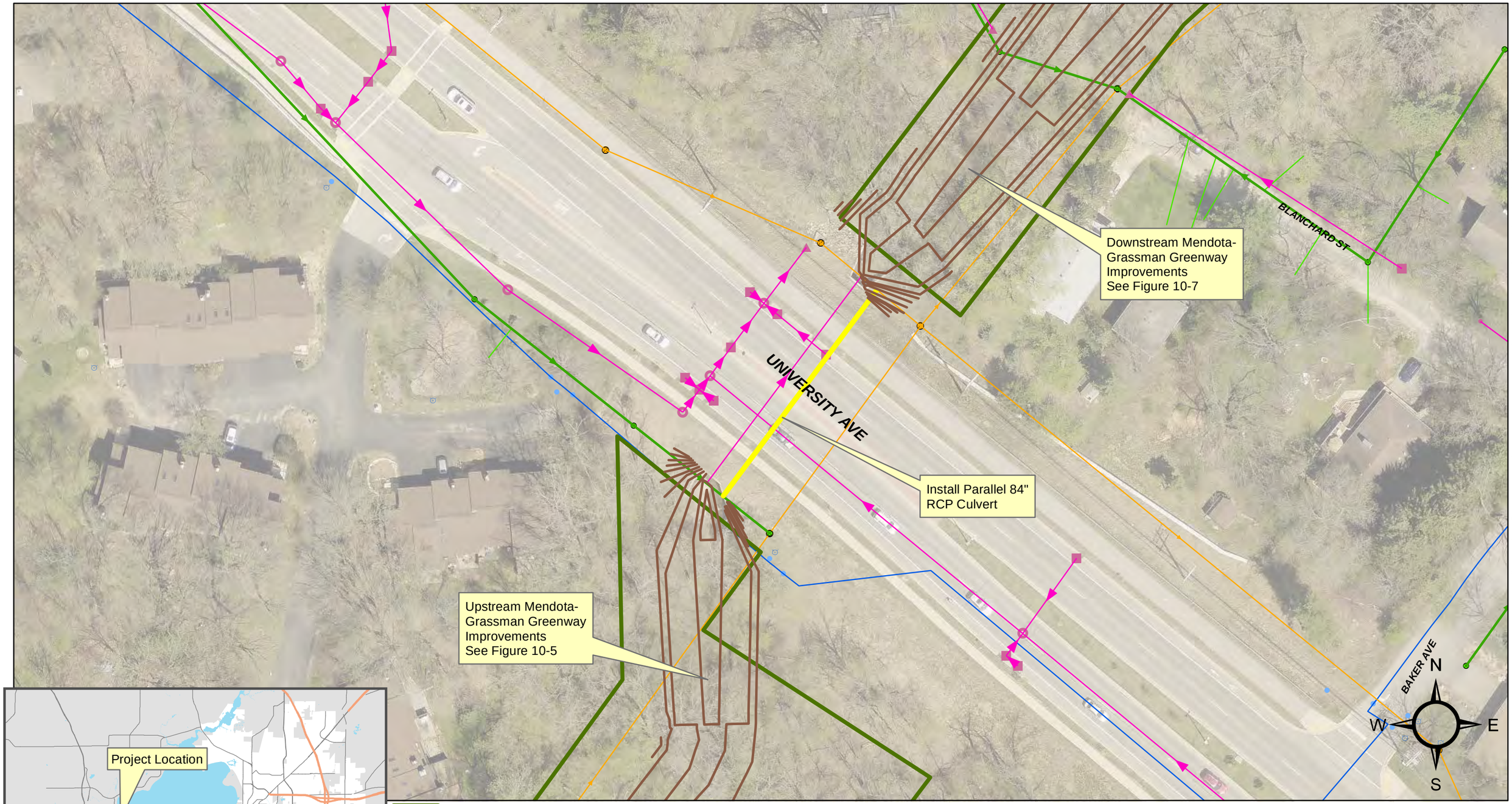

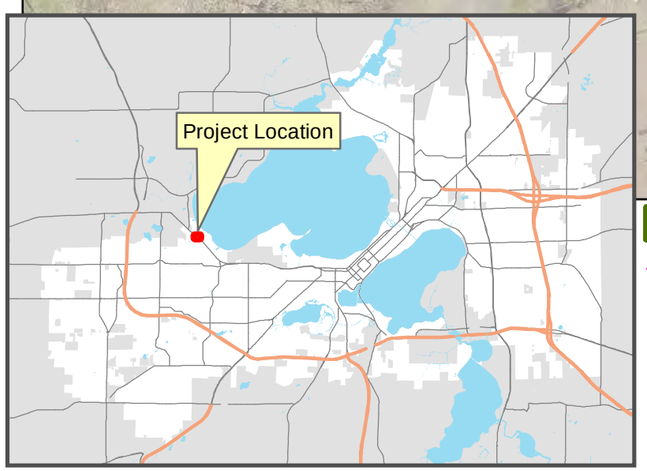

Greenway
Storm Pipe
Other Storm Structure
Access Structures
Apron
Inlet
Sanitary Mains
SAS
Sanitary Laterals
MMSD Mains
MMSD SAS
Water Main
Water Valve
Water Hydrant
Proposed Grading Contour
Proposed 84" Culvert

Figure 10-6: University Avenue Culvert Improvements

ADDITIONAL NOTES THAT IMPACT PROJECT IMPLEMENTATION
-University Avenue is a County Highway. Coordination with Dane County and Dane County permitting will be required.
-Several utilities in the University Avenue corridor will need to be considered in final design.

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0 25 50 Feet

Date: 6/25/2021

User Name: djoachim Document Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\PrCondReportFigures\Fig10-6-UniversityAveCulvert.mxd

Camelot Open Space

CAMELOT DR

Increase Channel Slope
Reduce Channel Roughness
Re-grade Channel to Improve Flow Capacity

Camelot Drive Culvert Improvements See Figure 10-8

Grading outside existing greenway anticipated. Property acquisition likely required.

LAKE MENDOTA DR

BAKER AVE

TAYCHOPERA RD

UNIVERSITY AVE

BLANCHARD ST

University Avenue Culvert Improvements See Figure 10-6

LAUREL CREST

HICKORY DR

N
W
E
S

Project Location

Greenway
Storm Pipe
Other Storm Structure
Access Structures
Apron
Inlet
Sanitary Mains
SAS
Sanitary Laterals
MMSD Mains
MMSD SAS
Water Main
Water Valve
Water Hydrant
Parks
Proposed Grading Contour
Estimated Project Boundary

Figure 10-7: Downstream Mendota-Grassman Greenway Improvements

ADDITIONAL NOTES THAT IMPACT PROJECT IMPLEMENTATION
-Grading may be required on private property.
-Significant tree removal needed.
-WDNR/USACE wetland/waterway and NOI permitting will be required.

CITY OF MADISON ENGINEERING

0 50 100
Feet
Date: 6/30/2021

User Name: djoachim Document Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\PrCondReportFigures\Fig10-7-DownstreamGreenway.mxd

CAMELOT DR

BAKER AVE

LAKE MENDOTA DR

Replace Existing Culverts
with 2 - 4x8 Box Culverts

Downstream Mendota-
Grassman Greenway
Improvements
See Figure 10-7

Project Location

Greenway
Storm Pipe
Other Storm Structure
Inlet
Sanitary Mains
SAS
Sanitary Laterals
MMSD Mains
MMSD SAS
Water Main
Water Valve
Water Hydrant
Municipal Limits
Proposed Grading Contour
Proposed Culvert Improvements

N
W
E
S

Figure 10-8: Camelot Drive Culvert Improvements

ADDITIONAL NOTES THAT IMPACT PROJECT IMPLEMENTATION
-Grading may be required on private property.
-Camelot Drive is the only road accessing area to the west. Construction of culvert improvements must be staged to allow continuous access.

CITY OF MADISON ENGINEERING

0 25 50
Feet

Date: 6/25/2021

User Name: djoachim Document Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\PrCondReportFigures\Fig10-8-CamelotDriveCulverts2.mxd

N

Legend

- Madison Municipal Boundary
- Stricker's / Mendota Watershed
- Stricker's Pond Outfall
- Existing Storm Sewer

Stricker's Pond Proposed Outfall

Existing Stricker's Pond Outfall

Tiedeman Pond

Stricker's Pond

City of Middleton

City of Madison

DRUMHILL CIR

BACKBAY CIR

LEBAR CT

Figure 10-11
Stricker's Pond Outfall Improvements
Stricker's/Mendota Watershed Study Report
City of Madison, WI

6/25/2021

0 150 300
Feet

Brown AND Caldwell

Air Photo: City of Madison, 2018

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N

Legend

- Madison Municipal Boundary
- Stricker's / Mendota Watershed
- Tiedeman Pond Outfall
- Existing Storm Sewer

Tiedeman Pond

Tiedeman Pond
Proposed Outfall

City of Middleton

City of Madison

UNIVERSITY AVE

ST DUNSTAN DR

QUETICO DR

HEIM AVE

OLD MIDDLETON RD

MIDDLETON ST

N GAMMON RD

LONGMEADOW RD

W SKYLINE DR

E SKYLINE DR

Skyview
Pond

N HIGHLANDS AVE

Figure 10-15
Tiedeman Pond
Outfall Improvements
Stricker's/Mendota
Watershed Study Report
City of Madison, WI

6/25/2021

0 150 300
Feet

Brown AND Caldwell

Air Photo: City of Madison, 2018

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N

Legend

- Stricker's / Mendota Watershed
- Madison Municipal Boundary
- Greenway
- Pond
- Park

Maximum Water Depth (ft)

- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 3
- 3 - 6
- > 6

Tiedeman Pond
Stricker's Pond
Lake Mendota
UNIVERSITY AVE
COUNTRYSIDE LN
ST DUNSTAN DR
HEIM AVE
CAMELOT DR
BLANCHARD ST
NO STREET NAME
TAYCHOPERA RD
BAKER AVE
LAUREL CREST
UPHAM CT
LAKE MENDOTA DR
GREENING LN
CAMUS LN
CAPITAL AVE
JULIA ST
BAKER AVE
OLD MIDDLETON RD
VEBLEN PL
FRITZ AVE
NORMAN WAY
DALE AVE
TEMKIN AVE
MARSHA DR
PAULINE AVE
LORRAINE DR
HILLSIDE AVE
N HIGHLANDS AVE
DAHLEN DR
BRODY DR
SUE PL
CRAIG AVE
ENGLEWOOD DR
WOOD CREST CT
LYNWOOD DR
ROUGH LEE CT
W SKYLINE DR
E SKYLINE DR
DRUMHILL CIR
MIDDLETON ST
CASTLEBAR CT
FOX POINT CIR
NORWALK CIR
LONGMEADOW RD
TRAMORE TRL
HIGHGATE CIR
CHESTERTON CIR
DARIEN DR
SAWMILL RD
S WOODMONT CIR
EASTBOURNE CIR
BRANFORD LN W
N HIGH POINT RD
RAWSGATE CIR
WINDHAVEN CIR
S STRATHFIELD CIR
MANOR HILL CIR
GLENSIDE CIR
SAUK RIDGE TRL
HODGSON CT
PEBBLE BEACH DR
PEBBLE BEACH CIR
S HIGHLANDS AVE
WILLOW LN
SHEA CT
HARVEST HILL RD
ST ANDREWS CIR
N GAMMON RD
E SPYGLASS CT
APPALACHIAN WAY
OLD SAUK RD
CARLSBAD DR
YOSEMITE PL
MT RAINIER LN
OLYMPIC DR
BLUE RIDGE PKWY
SAN JUAN TRL
BRYCE CANYON CIR
N YELLOWSTONE DR
GLACIER DR
SHILOH DR
SHILOH CT
BLUE RIDGE CT
OZARK TRL
ANTIETAM LN
NATCHEZ TRACE
EVERGLADE DR
ACADIA DR
FOXBORO CIR
RYE CIR
N WESTFIELD RD
WHITACRE RD

DISCLAIMER

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6/29/2021

Figure 11-1
Proposed Conditions
50% Chance Storm Event
Maximum Water Depth
Stricker's / Mendota
Watershed Study Report
City of Madison, WI

0 300 600
Feet

CITY OF MADISON WISCONSIN

Brown AND Caldwell

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\PrCondReportFigures\Fig11-1-InundationProposed2yr.mxd

N

Legend

- Stricker's / Mendota Watershed
- Madison Municipal Boundary
- Greenway
- Pond
- Park

Maximum Water Depth (ft)

- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 3
- 3 - 6
- > 6

Tiedeman Pond

Stricker's Pond

Lake Mendota

UNIVERSITY AVE

COUNTRYSIDE LN

ST DUNSTAN DR

HEIM AVE

CAMELOT DR

BLANCHARD ST

NO STREET NAME

TAYCHOPERA RD

BAKER AVE

LAUREL CREST

UPHAM CT

LAKE MENDOTA DR

GREENING LN

CAMUS LN

CAPITAL AVE

JULIA ST

ROUGH LEE CT

VEBLEN PL

OLD MIDDLETON RD

RITZ AVE

NORMAN WAY

DALE AVE

TEMKIN AVE

MARSHA DR

PAULINE AVE

LORRAINE DR

HILLSIDE AVE

N HIGHLANDS AVE

DAHLEN DR

BRODY DR

SUE PL

CRAIG AVE

ENGLEWOOD DR

WOOD CREST CT

LYNWOOD DR

DRUMHILL CIR

MIDDLETON ST

CASTLEBAR CT

FOX POINT CIR

NORWALK CIR

LONGMEADOW RD

TRAMORE TRL

HIGHGATE CIR

CHESTERTON CIR

DARIEN DR

SAWMILL RD

S WOODMONT CIR

EASTBOURNE CIR

BRANFORD LN W

N HIGH POINT RD

RAWSGATE CIR

WINDHAVEN CIR

S STRATHFIELD CIR

MANOR HILL CIR

GLENSIDE CIR

HARVEST HILL RD

N GAMMON RD

E SPYGLASS CT

SAUK RIDGE TRL

HODGSON CT

PEBBLE BEACH DR

PEBBLE BEACH CIR

ST ANDREWS CIR

SHEA CT

S HIGHLANDS AVE

WILLOW LN

APPALACHIAN WAY

OLD SAUK RD

CARLSBAD DR

YOSEMITE PL

MT RAINIER LN

OLYMPIC DR

W SKYLINE DR

E SKYLINE DR

BLUE RIDGE PKWY

SAN JUAN TRL

BRYCE CANYON CIR

N YELLOWSTONE DR

GLACIER DR

SHILOH DR

SHILOH CT

BLUE RIDGE CT

OZARK TRL

ANTIETAM LN

NATCHEZ TRACE

ACADIA DR

EVERGLADE DR

FOXBORO CIR

RYE CIR

N WESTFIELD RD

WHITACRE RD

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6/29/2021

Figure 11-2
Proposed Conditions
20% Chance Storm Event
Maximum Water Depth
Stricker's / Mendota Watershed Study Report
City of Madison, WI

0 300 600
Feet

CITY OF MADISON WISCONSIN

Brown AND Caldwell

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\PrCondReportFigures\Fig11-2-InundationProposed5yr.mxd

N

Legend

- Stricker's / Mendota Watershed
- Madison Municipal Boundary
- Greenway
- Pond
- Park

Maximum Water Depth (ft)

- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 3
- 3 - 6
- > 6

Tiedeman Pond

Stricker's Pond

Lake Mendota

UNIVERSITY AVE

COUNTRYSIDE LN

ST DUNSTAN DR

HEIM AVE

CAMELOT DR

BLANCHARD ST

NO STREET NAME

TAYCHOPERA RD

BAKER AVE

LAUREL CREST

UPHAM CT

LAKE MENDOTA DR

GREENING LN

CAMUS LN

CAPITAL AVE

ROUGH LEE CT

JULIA ST

BAKER AVE

OLD MIDDLETON RD

VEBLEN PL

FRITZ AVE

NORMAN WAY

DRUMHILL CIR

MIDDLETON ST

CASTLEBAR CT

FOX POINT CIR

LONGMEADOW RD

TRAMORE TRL

HIGHGATE CIR

CHESTERTON CIR

NORWALK CIR

DARIEN DR

SAWMILL RD

S WOODMONT CIR

EASTBOURNE CIR

BRANFORD LN W

N HIGH POINT RD

RAWSGATE CIR

WINDHAVEN CIR

S STRATHFIELD CIR

MANOR HILL CIR

GLENSIDE CIR

SAUK RIDGE TRL

HODGSON CT

PEBBLE BEACH DR

PEBBLE BEACH CIR

W SKYLINE DR

E SKYLINE DR

S HIGHLANDS AVE

WILLOW LN

SHEA CT

ST ANDREWS CIR

HARVEST HILL RD

N GAMMON RD

E SPYGLASS CT

APPALACHIAN WAY

OLD SAUK RD

CARLSBAD DR

YOSEMITE PL

MT RAINIER LN

OLYMPIC DR

BLUE RIDGE PKWY

SAN JUAN TRL

BRYCE CANYON CIR

N YELLOWSTONE DR

GLACIER DR

SHILOH DR

SHILOH CT

BLUE RIDGE CT

OZARK TRL

ANTIETAM LN

NATCHEZ TRACE

ACADIA DR

EVERGLADE DR

FOXBORO CIR

RYE CIR

N WESTFIELD RD

WHITACRE RD

N HIGHLANDS AVE

HILLSIDE AVE

DALE AVE

TEMKIN AVE

MARSHA DR

PAULINE AVE

LORRAINE DR

DAHLEN DR

BRODY DR

SUE PL

CRAIG AVE

ENGLEWOOD DR

WOOD CREST CT

LYNWOOD DR

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6/29/2021

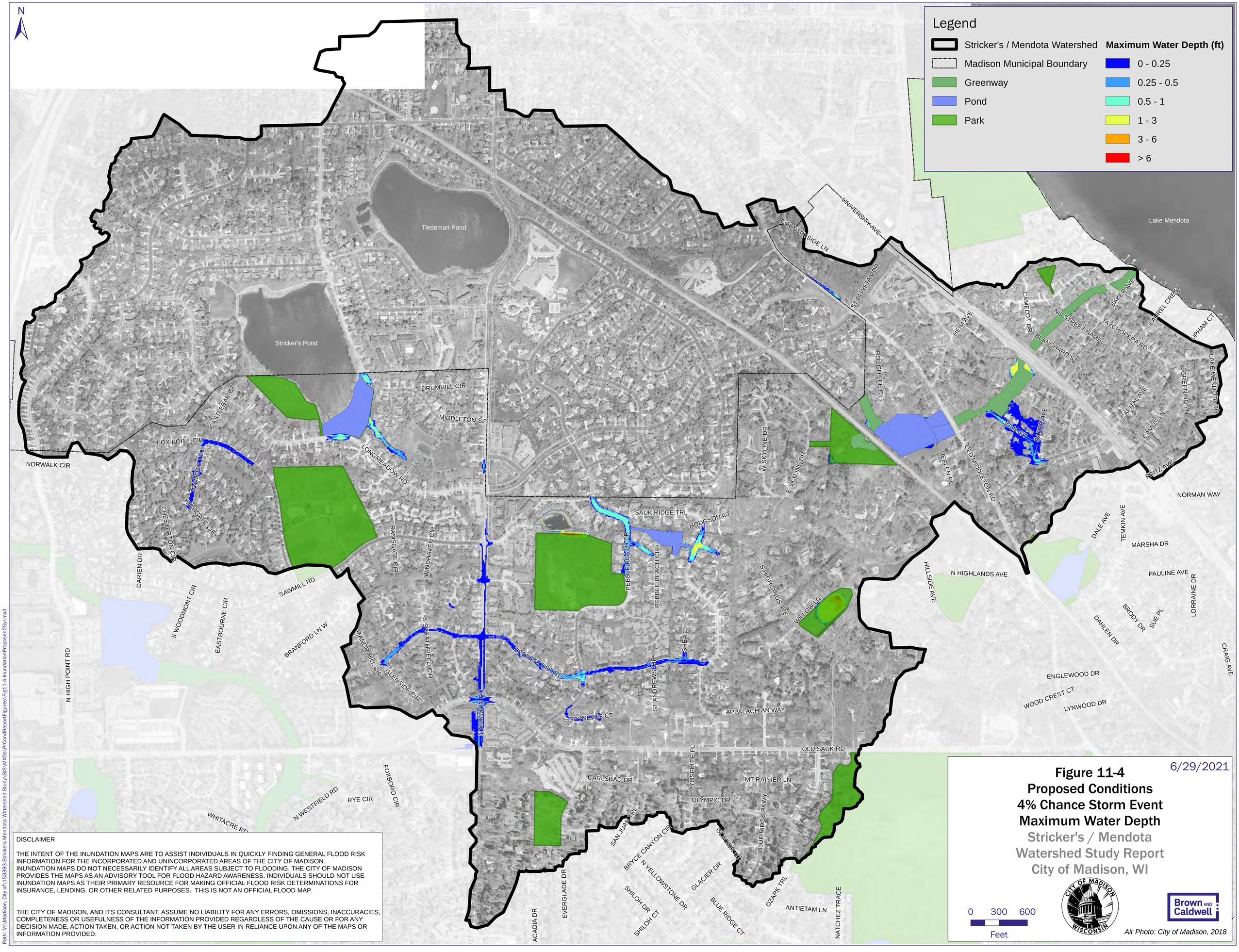
Figure 11-3
Proposed Conditions
10% Chance Storm Event
Maximum Water Depth
Stricker's / Mendota
Watershed Study Report
City of Madison, WI

0 300 600
Feet

Air Photo: City of Madison, 2018

Brown AND Caldwell

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\PrCondReportFigures\Fig11-3-InundationProposed10yr.mxd



6/29/2021

Figure 11-4
Proposed Conditions
4% Chance Storm Event
Maximum Water Depth
Stricker's / Mendota
Watershed Study Report
City of Madison, WI

Brown AND Caldwell

Air Photo: City of Madison, 2018

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N

Legend

- Stricker's / Mendota Watershed
- Madison Municipal Boundary
- Greenway
- Pond
- Park

Maximum Water Depth (ft)

- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 3
- 3 - 6
- > 6

Tiedeman Pond
Stricker's Pond
Lake Mendota
UNIVERSITY AVE
COUNTRYSIDE LN
ST DUNSTAN DR
HEIDI AVE
CAMELOT DR
BLANCHARD ST
NO STREET NAME
TAYCHOPERA RD
BAKER AVE
LAUREL CREST
UPHAM CT
ROUGH LEE CT
DRUMHILL CIR
MIDDLETON ST
CASTLEBAR CT
FOX POINT CIR
LONGMEADOW RD
NORWALK CIR
TRAMORE TRL
KNIGHTE CIR
CHESTERTON CIR
DARIEN DR
SAWMILL RD
S WOODMONT CIR
EASTBOURNE CIR
BRANFORD LN W
N HIGH POINT RD
RAMSGATE CIR
WINDHAVEN CIR
SAUK RIDGE TRL
HODGSON CT
PEBBLE BEACH DR
PEBBLE BEACH CIR
S STRATHFIELD CIR
MANOR HILL CIR
GLENSIDE CIR
HARVEST HILL RD
N GAMMON RD
SHEA CT
ST ANDREWS CIR
E SPYGLASS CT
APPALACHIAN WAY
OLD SAUK RD
W SKYLINE DR
E SKYLINE DR
VEBLEN PL
OLD MIDDLETON RD
JULIA ST
OAKVIEW AVE
CAPITAL AVE
CAMUS LN
GREENING LN
LAKE MENDOTA DR
RITZ AVE
NORMAN WAY
DALE AVE
TEMKIN AVE
MARSHA DR
PAULINE AVE
LORRAINE DR
HILLSIDE AVE
N HIGHLANDS AVE
S HIGHLANDS AVE
WILLOW LN
DAHLEN DR
BRODY DR
SUE PL
CRAIG AVE
ENGLEWOOD DR
WOOD CREST CT
LYNWOOD DR
FOXBORO CIR
N WESTFIELD RD
RYE CIR
WHITACRE RD
CARLSBAD DR
YOSEMITE PL
MT RAINIER LN
OLYMPIC DR
BLUE RIDGE PKWY
SAN JUAN TRL
BRYCE CANYON CIR
N YELLOWSTONE DR
GLACIER DR
SHILOH DR
SHILOH CT
BLUE RIDGE CT
OZARK TRL
ANTIETAM LN
NATCHEZ TRACE
EVERGLADE DR
ACADIA DR

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6/29/2021

Figure 11-5
Proposed Conditions
2% Chance Storm Event
Maximum Water Depth
Stricker's / Mendota Watershed Study Report
City of Madison, WI

0 300 600
Feet

CITY OF MADISON WISCONSIN

Brown AND Caldwell

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\PrCondReportFigures\Fig11-5-InundationProposed50yr.mxd

N

Legend

- Stricker's / Mendota Watershed
- Madison Municipal Boundary
- Greenway
- Pond
- Park

Maximum Water Depth (ft)

- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 3
- 3 - 6
- > 6

Tiedeman Pond

Stricker's Pond

Lake Mendota

UNIVERSITY AVE

COUNTRYSIDE LN

ST DUNSTAN DR

ROUGH LEE CT

HEIM AVE

CAMELOT DR

BLANCHARD ST

NO STREET NAME

TAYCHOPERA RD

BAKER AVE

LAUREL CREST

UPHAM CT

LAKE MENDOTA DR

GREENING LN

CAMUS LN

CAPITAL AVE

JULIA ST

BAKER AVE

OLD MIDDLETON RD

VEBLEN PL

E SKYLINE DR

W SKYLINE DR

RITZ AVE

NORMAN WAY

DALE AVE

TEMKIN AVE

MARSHA DR

PAULINE AVE

LORRAINE DR

HILLSIDE AVE

N HIGHLANDS AVE

DAHLEN DR

BRODY DR

SUE PL

CRAIG AVE

ENGLEWOOD DR

WOOD CREST CT

LYNWOOD DR

DRUMHILL CIR

MIDDLETON ST

CASTLEBAR CT

FOX POINT CIR

LONGMEADOW RD

NORWALK CIR

TRAMORE TRL

IVYGATE CIR

CHESTERTON CIR

DARIEN DR

SAWMILL RD

S WOODMONT CIR

EASTBOURNE CIR

BRANFORD LN W

N HIGH POINT RD

RAMSGATE CIR

WINDHAVEN CIR

SAUK RIDGE TRL

HODGSON CT

PEBBLE BEACH DR

PEBBLE BEACH CIR

S HIGHLANDS AVE

WILLOW LN

S STRATHFIELD CIR

MANOR HILL CIR

GLENSIDE CIR

HARVEST HILL RD

N GAMMON RD

SHEA CT

ST ANDREWS CIR

E SPYGLASS CT

APPALACHIAN WAY

OLD SAUK RD

YOSEMITE PL

CARLSBAD DR

MT RAINIER LN

OLYMPIC DR

BLUE RIDGE PKWY

FOXBORO CIR

RYE CIR

N WESTFIELD RD

WHITACRE RD

SAN JUAN TRL

BRYCE CANYON CIR

N YELLOWSTONE DR

GLACIER DR

SHILOH DR

SHILOH CT

BLUE RIDGE CT

OZARK TRL

ANTIETAM LN

NATCHEZ TRACE

EVERGLADE DR

ACADIA DR

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6/29/2021

Figure 11-6
Proposed Conditions
1% Chance Storm Event
Maximum Water Depth
Stricker's / Mendota
Watershed Study Report
City of Madison, WI

0 300 600
Feet

CITY OF MADISON WISCONSIN

Brown AND Caldwell

Air Photo: City of Madison, 2018

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N

Legend

- Stricker's / Mendota Watershed
- Madison Municipal Boundary
- Greenway
- Pond
- Park

Maximum Water Depth (ft)

- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 3
- 3 - 6
- > 6

Tiedeman Pond

Stricker's Pond

Lake Mendota

UNIVERSITY AVE

COUNTRYSIDE LN

ST DUNSTAN DR

ROUGH LEE CT

HEIM AVE

CAMELOT DR

BLANCHARD ST

NO STREET NAME

TAYCHOPERA RD

BAKER AVE

LAUREL CREST

UPHAM CT

LAKE MENDOTA DR

GREENING LN

CAMUS LN

CAPITAL AVE

JULIA ST

BAKER AVE

OLD MIDDLETON RD

VEBLEN PL

RITZ AVE

NORMAN WAY

DALE AVE

TEMKIN AVE

MARSHA DR

PAULINE AVE

LORRAINE DR

HILLSIDE AVE

N HIGHLANDS AVE

DAHLEN DR

BRODY DR

SUE PL

CRAIG AVE

ENGLEWOOD DR

WOOD CREST CT

LYNWOOD DR

W SKYLINE DR

E SKYLINE DR

DRUMHILL CIR

MIDDLETON ST

CASTLEBAR CT

FOX POINT CIR

NORWALK CIR

TRAMORE TRL

HIGHGATE CIR

CHESTERTON CIR

LONGMEADOW RD

RAMSGATE CIR

WINDHAVEN CIR

DARIEN DR

SAWMILL RD

S WOODMONT CIR

EASTBOURNE CIR

BRANFORD LN W

N HIGH POINT RD

MANOR HILL CIR

GLENSIDE CIR

S STRATHFIELD CIR

N GAMMON RD

HARVEST HILL RD

SAUK RIDGE TRL

HODGSON CT

PEBBLE BEACH DR

PEBBLE BEACH CIR

SHEA CT

ST ANDREWS CIR

S HIGHLANDS AVE

WILLOW LN

E SPYGLASS CT

APPALACHIAN WAY

OLD SAUK RD

YOSEMITE PL

CARLSBAD DR

MT RAINIER LN

OLYMPIC DR

BLUE RIDGE PKWY

FOXBORO CIR

RYE CIR

N WESTFIELD RD

WHITACRE RD

SAN JUAN TRL

BRYCE CANYON CIR

N YELLOWSTONE DR

SHILOH DR

SHILOH CT

GLACIER DR

BLUE RIDGE CT

OZARK TRL

ANTIETAM LN

NATCHEZ TRACE

EVERGLADE DR

ACADIA DR

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6/29/2021

Figure 11-7
Proposed Conditions
0.2% Chance Storm Event
Maximum Water Depth
Stricker's / Mendota Watershed Study Report
City of Madison, WI

0 300 600
Feet

CITY OF MADISON WISCONSIN

Brown AND Caldwell

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\PrCondReportFigures\Fig11-7InundationProposed500yr.mxd

N

Legend

- Stricker's / Mendota Watershed
- Madison Municipal Boundary
- Greenway
- Pond
- Park

Maximum Water Depth (ft)

- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 3
- 3 - 6
- > 6

Tiedeman Pond

Stricker's Pond

Lake Mendota

UNIVERSITY AVE

COUNTRYSIDE LN

ST DUNSTAN DR

HEIM AVE

CAMELOT DR

BLANCHARD ST

NO STREET NAME

TAYCHOPERA RD

BAKER AVE

LAUREL CREST

UPHAM CT

ROUGH LEE CT

W SKYLINE DR

E SKYLINE DR

VEBLEN PL

OLD MIDDLETON RD

JULIA ST

BAKER AVE

CAPITAL AVE

CAMUS LN

GREENING LN

LAKE MENDOTA DR

FRITZ AVE

NORMAN WAY

DALE AVE

TEMKIN AVE

MARSHA DR

PAULINE AVE

LORRAINE DR

HILLSIDE AVE

N HIGHLANDS AVE

DAHLEN DR

BRODY DR

SUE PL

CRAIG AVE

ENGLEWOOD DR

WOOD CREST CT

LYNWOOD DR

DRUMHILL CIR

MIDDLETON ST

CASTLEBAR CT

FOX POINT CIR

LONGMEADOW RD

TRAMORE TRL

HIGHGATE CIR

NORWALK CIR

CHESTERTON CIR

DARIEN DR

SAWMILL RD

S WOODMONT CIR

EASTBOURNE CIR

BRANFORD LN W

N HIGH POINT RD

RAMSGATE CIR

WINDHAVEN CIR

S STRATHFIELD CIR

MANOR HILL CIR

GLENSIDE CIR

N GAMMON RD

SAUK RIDGE TRL

HODGSON CT

PEBBLE BEACH DR

PEBBLE BEACH CIR

S HIGHLANDS AVE

WILLOW LN

HARVEST HILL RD

SHEA CT

ST ANDREWS CIR

E SPYGLASS CT

APPALACHIAN WAY

OLD SAUK RD

YOSEMITE PL

CARLSBAD DR

MT RAINIER LN

OLYMPIC DR

BLUE RIDGE PKWY

FOXBORO CIR

RYE CIR

N WESTFIELD RD

WHITACRE RD

SAN JUAN TRL

BRYCE CANYON CIR

N YELLOWSTONE DR

SHILOH DR

SHILOH CT

GLACIER DR

BLUE RIDGE CT

OZARK TRL

ANTIETAM LN

NATCHEZ TRACE

EVERGLADE DR

ACADIA DR

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6/29/2021

Figure 11-8
Proposed Conditions - Long Duration Storm
Consecutive 1% Chance Storm Events
Maximum Water Depth
Stricker's / Mendota
Watershed Study Report
City of Madison, WI

0 300 600
Feet

CITY OF MADISON WISCONSIN

Brown AND Caldwell

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\PrCondReportFigures\Fig11-8-InundationProposedBackToBack100yr.mxd

N

Strickers Pond			
Starting WSE	Peak WSE 10-yr Event	Peak WSE 25-yr Event	Peak WSE 100-yr Event
920.5	924.14	925.11	926.77
923	925.89	926.78	928.28
925.5	927.41	928.2	929.39

STRICKERS_POND

Legend

- Comparison Points
- Storm Sewer Nodes
- Proposed Improvements
- Existing Storm Sewer
- City of Madison Limits
- Stricker's / Mendota Watershed

Node AS2646-001			
Ground Elev. = 934.2			
Starting WSE	Peak WSE 10-yr Event	Peak WSE 25-yr Event	Peak WSE 100-yr Event
920.5	934.22	935.43	935.71
923	934.22	935.43	935.71
925.5	934.25	935.44	935.72

IN2546-003

AS2646-001

Node IN2546-003			
Ground Elev. = 927.5			
Starting WSE	Peak WSE 10-yr Event	Peak WSE 25-yr Event	Peak WSE 100-yr Event
920.5	928.03	928.28	928.54
923	928.03	928.29	928.54
925.5	928.06	928.31	929.39

Node AS2646-018			
Ground Elev. = 956.7			
Starting WSE	Peak WSE 10-yr Event	Peak WSE 25-yr Event	Peak WSE 100-yr Event
920.5	947.02	952.27	953.11
923	947.02	952.27	953.11
925.5	947.02	952.28	953.12

AS2646-018

ME04-A-0014-H-000

Node ME04-A-0014-H-000			
Ground Elev. = 953.2			
Starting WSE	Peak WSE 10-yr Event	Peak WSE 25-yr Event	Peak WSE 100-yr Event
920.5	949.13	949.41	949.78
923	949.13	949.41	949.78
925.5	949.13	949.41	949.78

N GAMMON RD

Figure 11-9 6/29/2021

Proposed Conditions

Pond Sensitivity Analysis

Stricker's / Mendota Watershed Study Report

City of Madison, WI

0 125 250

Feet

Brown AND Caldwell

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\PrCondReportFigures\Fig11-9-PondSensitivity.mxd

N

Tiedeman Pond

Stricker's Pond

Lake Mendota

Longmeadow
Relief Sewer
Enlargement

Camelot Drive
Culvert Enlargement

University Avenue
Culvert Enlargement

Legend

- Enhancements to Storm Sewer Improvements (0.2% Chance Storm)
- Storm Sewer Improvements
- Abandon Ex. Storm Sewer
- Existing Storm Sewer
- Greenway Improvements
- Stricker's / Mendota Watershed
- Madison Municipal Boundary

Figure 12-1
0.2% Chance Storm Enhancement Scenario
Stricker's/Mendota Watershed Study Report
City of Madison, WI

6/28/2021

0 400 800
Feet

Air Photo: City of Madison, 2018

Path: M:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\PrCondReportFigures\Fig12-1-500yrFloodImprovements.mxd

Appendix A: Modeling Guidance

MODELING GUIDANCE

Version 2019-12-06 (DRAFT)

Latest Draft to Round 1 and Round 2 Study Consultants

The City recognizes that an important aspect of modeling is professional judgement; and it will be up to the Consultant to appropriately define parameters, variables, and methodology. However, it is in the City's best interest to aim for relative uniformity amongst all City models. Therefore, the Consultant may be expected to justify, document, and in some instances, modify various model inputs and assumptions.

City of Madison Flood Mitigation Goals

1. No home or business will be flooded during the 100-year design storm.
2. Eliminate flooding from the storm sewer system for up to the 10-year design storm; all water shall be contained within the pipes and structures (exception: low points).
3. Allow no more than 0.5 feet of water above storm sewer inlet rim at inlet-restricted low points for up to the 10-year design storm.
4. Centerline of street to remain passable during 25-year design storm with no more than 0.2 feet of water at the centerline.
    a. Note that the Watershed Study modeling approach will not explicitly account for cross flow conditions where more gutter flow on one side of the street can overtop the crown.
5. Enclosed depressions to be served to the 100-year design storm (which can include safe overland flow within street, easements, greenways or other public lands).
6. Greenway crossings at streets to be served to the 100-year design storm.
7. Provide flooding solutions that do not negatively impact downstream properties.
8. For the purpose of the watershed studies "deficiencies" in the system shall be defined as existing infrastructure, drainage capacity or system limitations that fail to meet the goals stated in 1-7 above.

Guidance for Solutions

1. Watershed deficiencies will be reviewed, and solutions will be provided up to the 100-yr design storm.
2. In areas where flooding occurs in events exceeding the 100-year storm, those areas will not be prioritized for engineering solutions, but will be identified in existing conditions model for 500-year event storms.
3. Proposed solutions will be identified for only the publicly owned drainage system. Drainage issues that are private (water from the public infrastructure such as streets, greenways, ponds and/or easements is not the cause of the drainage issue) will not require modeling solutions but should be identified where possible in the existing conditions analysis so staff may work with property owners if necessary. (See Also Hydraulics section of Modeling Guidance for discussion on private system existing conditions modeling.)

DATA SOURCES:

In the report, document the file name and date for the following data sources:

- Land Use
- LiDAR
- Storm Sewer
- Culverts
- Greenways
- Planimetric Data
- Aerial Imagery

MODELING PARAMETERS:

Initial model parameters are the following items:

1. Model all storm sewer and culvert segments 18 inches in diameter (or equivalent) and larger, noting that the model will be required to identify all watershed deficiencies, including inlet capacity. Inclusion of smaller diameter pipes may be required to meet the goals of the model.
2. Street inlets are to be aggregated within the model to the 18-inch diameter (or equivalent) storm sewer level.
3. Incorporate existing storm water management facilities (public and private) into the model.
4. Subdivide provided outfall basins into smaller watersheds as needed in order to properly execute the model.
5. Coordinate System and Vertical Datum
    a. Horizontal Coordinate System: Wisconsin County Coordinate System – Dane Zone NAD83 (HARN).
    b. Vertical Datum: NAVD88 (pre 2007 adjustment) ft (City of Madison Datum + 845.6)
6. Naming convention
    a. Names are limited to 20 characters
    b. Subcatchments:
        i. Begin with Subcatchments naming convention provided by the City in the Outfall Basin feature class.
            1. Add a three-digit designator to the end of the name, beginning with 000
            2. As subcatchments are subdivided, increase the added designator by 1.
            3. Example: ME04-A-0014-H *(Provided by City)* → ME04-A-0014-H-MAD-C-000 *(For the original basin)* → ME04-A-0014-H-001 *(For first subdivision)*
        ii. Final outfall basin feature class file, including supporting files used to compute runoff timing and volume parameters shall be part of the deliverables provided to the City of Madison.
    c. Structures and Junctions:
        i. Node (Junction/Storage/Outfall) names for existing structures shall retain the asset identification provided by the City.
        ii. Proposed Structure names are to be determined by the Consultant but shall be given a “logical” name that reflects general location, function, or other.
        iii. For junctions that need to be added that are storm sewer tees as constructed, use the downstream manhole / structure with “_01” added in increasing order moving from downstream to upstream. For example, the first junction added for a tee upstream of MI3350-001 would be MI3350-001_01
    d. Pipes:
        i. Conduit names for existing pipes shall retain the asset identification provided by the City, except that:
            1. The first two letters (i.e AE, IN, etc) will be removed
            2. Leads with an asset ID that takes up all 20 characters can be shortened to the corresponding assigned ID. For example, 3350-032_3350-007_3350-001 can be changed to 3350-032_3350-001_01
        ii. Proposed Pipe names are to be determined by the Consultant but shall be named in a manner similar to the City pipe naming convention, which includes the upstream and downstream structure names.
    e. Channel/Street Flow Segments:
        i. Conduit names for drainage-ways shall be named in a manner that identifies the greenway segment it represents by Greenway Node Number and the distance from the upstream end. Example: GR7541-062_125 would represent a channel segment that begins 125 feet into the North Door Creek Greenway – Sprecher Road Section.
        ii. Conduit names for streets shall be named with “Rd_”[US_Node_Name]_[DS_Node_Name] and remove the first two letters in the node name similar to how pipes are named.
    f. Natural Channels:
        i. Natural channel transects shall be named with the same ID as the conduit name.

ii. Street models as natural channels shall be named in a manner that is easily identifiable for the street or street type it represents.
iii. A shapefile shall be created documenting where natural channel transects are cut.

g. Other SWMM Features (Weirs, orifices, etc)
   i. Other SWMM features shall have readily identifiable names corresponding to the type of feature they are trying to model. For example, an orifice for a detention pond should have an ID that is "<Detention Pond ID>_ORIF_01", keeping within a 20 character limit.

h. Ponds
   i.

7. Rainfall
   a. MSE4 24-hour Distribution and NOAA Atlas 14 Depths

Recurrence Interval (years)	Rainfall Depth (inches)
2	2.8
5	3.5
10	4.1
25	5.0
50	5.7
100	6.6
500	8.8

   b. Long-Duration Storm – Two 24-hour, 100-year MSE4 storm events with the time between peak rainfalls shorted from 24 hours to 12 hours.

8. Hydrology (SWMM Method with Horton Infiltration) (References: A, B, C)
   - Parameters listed are default parameters and may need to be adjusted based on calibration data.

   a. Subcatchment Detail for Street Drainage
      i. Contributing area to the existing storm sewer system that is to be modeled (Determined on a watershed by watershed basis)
      ii. Provides information that there is or is not an issue with upstream street flooding / storm sewer capacity that would be detailed out as part of a future street improvement design project.

   b. SWMM Routing Parameters (if calibration is not available to adjust parameters)
      i. Percent Impervious - Follow Step 1 (pages 1-3) of the "HowTo_CalculateCN" document.
      ii. DCIA – Reference WinSLAMM Standard Land Use DCIA Spreadsheet
      iii. Width – Estimated based on subcatchment shape. Estimation methodology shall be documented.
      A single width shall be calculated for the entire subcatchment. The single width with then be prorated based on sub area acreage for each sub area. DCIA will be prorated based on the area of the DCIA sub area compared to the total subcatchment area. The prorated width for the non-DCIA sub area and pervious sub area will be the same; it will be based on the sum of the non-DCIA plus the pervious area compared to the total subcatchment area.
      It is expected Width is one of the first calibration parameters for peak flow.
      iv. Slope – Computed manually or estimated based on LiDAR. Computation or estimation methodology shall be documented.
      v. Each subcatchment is to be split into area of (1) DCIA, (2) non-DCIA, and (3) pervious area. Within the model, the non-DCIA shall be routed to the pervious area.

   c. Horton Infiltration

i. For typical urban pervious area (Based on range of values for different soil types, moisture conditions, and vegetation conditions found in Reference A):

HSG Group[a]	Max Infil. Rate (in/hr)	Min Infil. Rate (in/hr)	Decay Rate (1/hr)	Dry Days[b]
A	4.0	1.0	4.0	3.1
B	2.0	0.5	4.0	4.4
C	1.0	0.2	4.0	7.0
D	0.5	0.1	4.0	9.9
Water	0	0	0	0

[a]For HSG listed as A/D, B/D, C/D, the default approach will be to assume the HSG associated with the lower infiltration rate (HSG D).
[b]Use equation 4-12, pg 99, SWMM Reference Manual Volume 1 – Hydrology (Revised), January 2016

ii. Impervious Manning's n – 0.016
iii. Pervious Manning's n – 0.20
iv. Depression Storage for Impervious – 0.05 inches
v. Depression Storage for Pervious – 0.15 inches
vi. Factors for adjusting
    1. Forest – Multiply max and min infiltration rates by 2.
    2. Farmland – Divide max and min infiltration rates by 2.
    3. Other land uses – see reference
vii. Area-weight the Horton Infiltration parameters for each subcatchment based on the area of each soil type within a subcatchment.
viii. It is understood the NRCS/SCS updates the soil mapping at various times. The project teams will identify a date the soils data will be downloaded and that will be the data used for the duration of the project.

Commented [BC1]: Add maximum infiltration volume in inches

9. 1D Hydraulics (References: A, B, D, E, F)
- Dynamic mode with constant / variable timestep sufficient to model system accurately.
- Conduit lengthening shall not be used unless prior approval from City on reason.
- Parameters are default parameters and may need to be adjusted based on calibration data.
- This list is not intended to be exhaustive.

a. System to be Modeled
    i. Public
        1. Standard: 18" Pipes and Larger
        2. Process for Exceptions: Provide justification for reason that a pipe 18" and larger does not need to be modeled.
        3. Process for requiring inclusion of pipes less than 18": Necessary when they are the only pipes draining parts of the street or drainage system. For example, a 15" pipe stubbing out to a greenway from the street or a long trunk-line that is less than 18".
    ii. Private
        1. Standard: Not included
        2. Process for requiring inclusion of private pipes:
            a. Stormwater management detention facilities
            b. When necessary to understand the functioning of the public system. For example, the West Towne Mall parking lot drainage system.
    iii. All greenways and major surface drainages
    iv. All stormwater detention facilities (public and private). Private systems may be simplified if serving a single site.
    v. Street surface drainage, but not necessary to the block level unless needed to understand major overflow routes
b. Loss Coefficients
    i. Entry

1. Culverts – Select Inlet Type based on the Help File or HEC-RAS Hydraulic Reference Manual
2. Storm Sewer (internal at MHs) = 0.1
3. Storm Drainage Structures (MH) at 45 degree bend = 0.25
4. Storm Drainage Structures (MH) at 90 degree bend = 0.5
5. For culverts and entrances to storm sewer from an open channel or pond, both the energy loss coefficient and the inlet control (culvert code) shall be used.

ii. Exit
1. Culverts –
   a. Exit closed conduit to open channel = 0.5
   b. Exit closed conduit to lake or pond = 1.0
2. Storm Sewer (internal at MHs) = 0.05
3. Storm Drainage Structures (MH) at 45 degree bend = 0.25
4. Storm Drainage Structures (MH) at 90 degree bend = 0.5

c. Coefficient of Discharge
   i. Weirs
      1. Sharp Crested – 3.0
      2. Roadway embankment – 2.6
      3. Flatter overflow – Use engineering judgment
   ii. Orifices
      1. 0.6
d. Manning's n
   i. Pipes
      1. Concrete Pipe: 0.013
      2. All other n values shall be chosen within generally acceptable ranges.
   ii. Channels
      1. Use Chow's Open Channel Hydraulics, Reference E
   iii. Bank Flow, including developed urban areas
      1. Use Chow's Open Channel Hydraulics, Reference E
e. Transect Placement and Modifiers
   i. Splitting long open channels
      1. Changes in cross section
      2. Significant changes in slope and roughness
      3. Overflow points
   ii. Segment Lengths
   iii. Channel Geometry
   iv. Provide shapefile where natural channel transects are selected along with XS Identifier
f. Tailwater Conditions:
   i. Lake Mendota: one foot over Summer Maximum – 851.10
   ii. Lake Wingra:
g. Inlet Clogging Factors
   i. Continuous Slopes
      1. Street slope < 1% - 25% Clogging
      2. Street slope >= 1% - No Clogging
   ii. Sags – 50% Clogging

10. 2D Data
    a. Surface Roughness – The average Manning's n may vary by land cover / land use. Referencing TR-55, the following roughness shall be used:
       i. Impervious areas - 0.1
       ii. Turf grass areas - 0.24
       iii. Wooded – 0.4
       iv. Prairie – 0.15
       v. Other – reference TR-55

There is not currently a city-wide impervious area layer. The consultant may choose to delineate the impervious area for the watershed.
Or, the existing data may be utilized. The following assumptions can be made using the existing land use data:

i. For non-residential parcels, impervious and pervious area is available, therefore, that shall be used.
ii. A percent impervious is available for residential parcels. Calculate a composite roughness using the percent impervious area. Remove roofs from the composite roughness calculation – reference the Dane County land use for residential roofs. (roofs will be entered as blocked obstructions)
iii. Average the roughness within the ROW based impervious and pervious area.

b. Blocked Obstructions – enter roofs as blocked obstructions
   i. Non-residential – use City impervious area data for roofs
   ii. Residential – use Dane County roof layer

11. Non-Modeling Data
    a. In the Notes field, include the sources of data

12. Scenarios
    a. Scenarios shall be set up as follows:
       a. 'Children' of the BASE scenario:
          i. EXISTING
             (grandchildren of BASE scenario, children of EXISTING)
             1. EXISTING_002_YR
             2. EXISTING_005_YR
             3. EXISTING_010_YR
             4. EXISTING_025_YR
             5. EXISTING_050_YR
             6. EXISTING_100_YR
             7. EXISTING_500_YR
             8. EXISTING_100YR_LONG_STORM
          ii. PROP_ALT1
             (grandchildren of BASE scenario, children of PROP_ALT1)
             1. PROP_ALT1_002_YR
             2. PROP_ALT1_005_YR
             3. PROP_ALT1_010_YR
             4. PROP_ALT1_025_YR
             5. PROP_ALT1_050_YR
             6. PROP_ALT1_100_YR
             7. PROP_ALT1_500_YR
             8. PROP_ALT1_100YR_LONG_STORM
          iii. PROP_ALT2
             (grandchildren of BASE scenario, children of PROP_ALT2)
             1. PROP_ALT2_002_YR
             2. PROP_ALT2_005_YR
             3. PROP_ALT2_010_YR
             4. PROP_ALT2_025_YR
             5. PROP_ALT2_050_YR
             6. PROP_ALT2_100_YR
             7. PROP_ALT2_500_YR
             8. PROP_ALT2_100YR_LONG_STORM
          iv. PROP_ALT3
             (grandchildren of BASE scenario, children of PROP_ALT3)

             1. PROP_ALT3_002_YR

Commented [BC2]: Do we know if the scenario manager works for XP-SWMM? Otherwise we can come up with a model naming convention and use global storms.

2. PROP_ALT3_005_YR
3. PROP_ALT3_010_YR
4. PROP_ALT3_025_YR
5. PROP_ALT3_050_YR
6. PROP_ALT3_100_YR
7. PROP_ALT3_500_YR
8. PROP_ALT3_100YR_LONG_STORM

b. Facility for children of the BASE scenario is defined via database queries. Facility for grandchildren of the BASE scenario are defined by inheritance.
c. Data sets for children of the BASE scenario should be BASE except where needed to define different datasets. Data sets for the grandchildren of the BASE scenario shall be defined by inheritance except for the raingage, which should be set as defined below.
    i. Data set naming convention should match the children of the BASE scenario. For example, if a different junction data set is needed for PROP_ALT2, the junction data set should be called "PROP_ALT2".
    ii. Data set naming convention for raingage sets should be based on the event used in the scenario naming convention, e.g. 002_YR, 005_YR…100YR_LONGSTORM.

REFERENCES

A. Help File
B. Storm Water Management Model version 5.1 User's Manual. (Available at: https://www.epa.gov/water-research/storm-water-management-model-swmm-version-51-users-manual)
C. SWMM reference manual volume I – hydrology (Available at: https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100NYRA.txt)
D. SWMM reference manual volume volume II – hydraulics (Available at: https://nepis.epa.gov/Exe/ZyPDF.cgi/P100S9AS.PDF?Dockey=P100S9AS.PDF)
E. Chow, Open Channel Hydraulics, 1959
F. HEC-RAS Hydraulic Reference Manual. (Available at: https://www.hec.usace.army.mil/software/hec-ras/documentation/HEC-RAS%205.0%20Reference%20Manual.pdf)

Appendix B: Hydrology Input Parameters

Table B-1 DCIA by Land Use Stricker's / Mendota Watershed Study Report, City of Madison, WI			
Land Use	Land Use Abbreviation	Area (acres)	DCIA Percentage
Subburban	SUBR	65.7	28.6%
High Density Residential No Alleys	HDRNA	3.3	66.8%
Duplex	DUPLEX	37.1	53.3%
Medium Density Residential No Alleys	MDRNA	560.7	45.8%
Multi-Family Residential	MFR	46.8	83.9%
Low Density Residential	LDR	137.3	41.4%
High Rise Residential	HRR	42.3	97.4%
Institutional	INST	18.7	93.0%
School	SCH	14.2	97.3%
Strip Commercial	STRIPCOM	14.4	98.1%
Light Industrial	LI	4.7	87.2%
Open Space	OPEN	33.0	100.0%
Park	PARK	137.3	64.5%
Street	STREET	237.5	100.0%
Type1 55000ADT S1 Street	Type1 55000ADT S1	10.2	39.7%
Water	WATER	47.8	100.0%
Total		1411	

Table B-2 Existing Sub-Watershed Hydrologic Parameters Stricker's / Mendota Watershed Study Report, City of Madison, WI							
Sub-Watershed Name	SWMM Node Name	Subcatchment Number	Area (acres)	Percent Impervious (%)	Base Width (ft)	Calib. Width (ft)	Slope
ME03-A-0011-N-MID-C-000	T13153	1	2.5	100	179	1314	0.063
ME03-A-0011-N-MID-C-000	T13153	2	1.8	100	1135	1314	0.063
ME03-A-0011-N-MID-C-000	T13153	3	14.0	0	1135	1314	0.063
ME03-A-0011-N-MID-C-001	STONEFIELD_MIDDLETON	1	7.5	100	360	1864	0.018
ME03-A-0011-N-MID-C-001	STONEFIELD_MIDDLETON	2	3.2	100	1504	1864	0.018
ME03-A-0011-N-MID-C-001	STONEFIELD_MIDDLETON	3	28.1	0	1504	1864	0.018
ME03-A-0011-N-MID-C-002	AS2944-013	1	1.5	100	170	922	0.005
ME03-A-0011-N-MID-C-002	AS2944-013	2	0.9	100	752	922	0.005
ME03-A-0011-N-MID-C-002	AS2944-013	3	5.8	0	752	922	0.005
ME03-A-0012-H-MID-C-001	T13118	1	3.1	100	142	724	0.015
ME03-A-0012-H-MID-C-001	T13118	2	2.3	100	582	724	0.015
ME03-A-0012-H-MID-C-001	T13118	3	10.6	0	582	724	0.015
ME03-A-0012-H-MID-C-002	T13110	1	2.4	100	135	624	0.013
ME03-A-0012-H-MID-C-002	T13110	2	1.2	100	489	624	0.013
ME03-A-0012-H-MID-C-002	T13110	3	7.7	0	489	624	0.013
ME03-A-0012-H-MID-C-003	T13135	1	2.3	100	112	932	0.009
ME03-A-0012-H-MID-C-003	T13135	2	1.6	100	820	932	0.009
ME03-A-0012-H-MID-C-003	T13135	3	15.2	0	820	932	0.009
ME03-A-0013-K-MID-C-000	T13106	1	3.6	100	152	678	0.018
ME03-A-0013-K-MID-C-000	T13106	2	1.7	100	526	678	0.018
ME03-A-0013-K-MID-C-000	T13106	3	10.7	0	526	678	0.018
ME03-A-0013-K-MID-C-001	T12451	1	5.0	100	201	983	0.012
ME03-A-0013-K-MID-C-001	T12451	2	3.2	100	782	983	0.012
ME03-A-0013-K-MID-C-001	T12451	3	16.2	0	782	983	0.012
ME03-A-0021-H-MAD-C-000	GR_2946-016	1	1.5	100	35	1012	0.060
ME03-A-0021-H-MAD-C-000	GR_2946-016	2	1.8	100	977	1012	0.060
ME03-A-0021-H-MAD-C-000	GR_2946-016	3	39.9	0	977	1012	0.060
ME03-A-0021-H-MAD-C-001	IN2946-014	1	1.8	100	56	551	0.033
ME03-A-0021-H-MAD-C-001	IN2946-014	2	1.6	100	495	551	0.033
ME03-A-0021-H-MAD-C-001	IN2946-014	3	14.2	0	495	551	0.033
ME03-A-0021-H-MAD-C-002	ME03-A-0021-H-002	1	1.3	100	69	1183	0.028

Table B-2 Existing Sub-Watershed Hydrologic Parameters Stricker's / Mendota Watershed Study Report, City of Madison, WI							
Sub-Watershed Name	SWMM Node Name	Subcatchment Number	Area (acres)	Percent Impervious (%)	Base Width (ft)	Calib. Width (ft)	Slope
ME03-A-0021-H-MAD-C-002	ME03-A-0021-H-002	2	1.5	100	1113	1183	0.028
ME03-A-0021-H-MAD-C-002	ME03-A-0021-H-002	3	20.1	0	1113	1183	0.028
ME03-A-0021-H-MAD-C-003	HIGHLANDDEPRESSION	1	1.0	100	34	844	0.025
ME03-A-0021-H-MAD-C-003	HIGHLANDDEPRESSION	2	1.1	100	810	844	0.025
ME03-A-0021-H-MAD-C-003	HIGHLANDDEPRESSION	3	23.8	0	810	844	0.025
ME03-A-0021-H-MAD-C-004	ME03-A-0021-H-004	1	0.6	100	30	569	0.035
ME03-A-0021-H-MAD-C-004	ME03-A-0021-H-004	2	0.8	100	539	569	0.035
ME03-A-0021-H-MAD-C-004	ME03-A-0021-H-004	3	9.7	0	539	569	0.035
ME03-A-0021-H-MAD-C-005	ME03-A-0021-H-005	1	1.2	100	48	758	0.028
ME03-A-0021-H-MAD-C-005	ME03-A-0021-H-005	2	1.3	100	710	758	0.028
ME03-A-0021-H-MAD-C-005	ME03-A-0021-H-005	3	16.5	0	710	758	0.028
ME03-A-0021-H-MAD-C-006	ME03-A-0021-H-006	1	2.9	100	175	1007	0.022
ME03-A-0021-H-MAD-C-006	ME03-A-0021-H-006	2	1.9	100	832	1007	0.022
ME03-A-0021-H-MAD-C-006	ME03-A-0021-H-006	3	11.7	0	832	1007	0.022
ME03-A-0021-H-MAD-C-007	ME03-A-0021-H-007	1	1.0	100	84	566	0.037
ME03-A-0021-H-MAD-C-007	ME03-A-0021-H-007	2	0.5	100	482	566	0.037
ME03-A-0021-H-MAD-C-007	ME03-A-0021-H-007	3	5.1	0	482	566	0.037
ME03-A-0021-H-MAD-C-008	ME03-A-0021-H-008	1	1.5	100	95	637	0.052
ME03-A-0021-H-MAD-C-008	ME03-A-0021-H-008	2	1.0	100	542	637	0.052
ME03-A-0021-H-MAD-C-008	ME03-A-0021-H-008	3	7.6	0	542	637	0.052
ME03-A-0021-H-MAD-C-009	ME03-A-0021-H-009	1	3.1	100	191	1105	0.021
ME03-A-0021-H-MAD-C-009	ME03-A-0021-H-009	2	2.1	100	914	1105	0.021
ME03-A-0021-H-MAD-C-009	ME03-A-0021-H-009	3	12.9	0	914	1105	0.021
ME03-A-0039-K-MAD-C-000	GR3244-003_02	1	4.3	100	264	2151	0.069
ME03-A-0039-K-MAD-C-000	GR3244-003_02	2	2.7	100	1887	2151	0.069
ME03-A-0039-K-MAD-C-000	GR3244-003_02	3	27.9	0	1887	2151	0.069
ME03-A-0039-K-MAD-C-001	HD3046-025_01	1	1.7	100	88	1293	0.046
ME03-A-0039-K-MAD-C-001	HD3046-025_01	2	1.5	100	1205	1293	0.046
ME03-A-0039-K-MAD-C-001	HD3046-025_01	3	22.3	0	1205	1293	0.046
ME03-A-0039-K-MAD-C-002	ME03-A-0039-K-002	1	0.5	100	30	132	0.024
ME03-A-0039-K-MAD-C-002	ME03-A-0039-K-002	2	0.8	100	102	132	0.024

Table B-2 Existing Sub-Watershed Hydrologic Parameters Stricker's / Mendota Watershed Study Report, City of Madison, WI							
Sub-Watershed Name	SWMM Node Name	Subcatchment Number	Area (acres)	Percent Impervious (%)	Base Width (ft)	Calib. Width (ft)	Slope
ME03-A-0039-K-MAD-C-002	ME03-A-0039-K-002	3	0.9	0	102	132	0.024
ME03-A-0039-K-MAD-C-003	ME03-A-0039-K-003	1	0.5	100	37	158	0.040
ME03-A-0039-K-MAD-C-003	ME03-A-0039-K-003	2	0.6	100	121	158	0.040
ME03-A-0039-K-MAD-C-003	ME03-A-0039-K-003	3	1.0	0	121	158	0.040
ME03-A-0039-K-MAD-C-004	ME03-A-0039-K-004	1	0.7	100	63	296	0.009
ME03-A-0039-K-MAD-C-004	ME03-A-0039-K-004	2	0.5	100	233	296	0.009
ME03-A-0039-K-MAD-C-004	ME03-A-0039-K-004	3	2.1	0	233	296	0.009
ME03-A-0039-K-MAD-C-005	ME03-A-0039-K-005	1	1.3	100	69	422	0.045
ME03-A-0039-K-MAD-C-005	ME03-A-0039-K-005	2	0.9	100	353	422	0.045
ME03-A-0039-K-MAD-C-005	ME03-A-0039-K-005	3	5.6	0	353	422	0.045
ME03-A-0039-K-MAD-C-006	ME03-A-0039-K-006	1	1.5	100	69	534	0.056
ME03-A-0039-K-MAD-C-006	ME03-A-0039-K-006	2	0.9	100	465	534	0.056
ME03-A-0039-K-MAD-C-006	ME03-A-0039-K-006	3	9.0	0	465	534	0.056
ME03-A-0039-K-MAD-C-007	ME03-A-0039-K-007	1	1.8	100	151	395	0.034
ME03-A-0039-K-MAD-C-007	ME03-A-0039-K-007	2	0.8	100	244	395	0.034
ME03-A-0039-K-MAD-C-007	ME03-A-0039-K-007	3	2.2	0	244	395	0.034
ME03-A-0039-K-MAD-C-008	ME03-A-0039-K-008	1	0.5	100	40	394	0.086
ME03-A-0039-K-MAD-C-008	ME03-A-0039-K-008	2	0.4	100	354	394	0.086
ME03-A-0039-K-MAD-C-008	ME03-A-0039-K-008	3	4.1	0	354	394	0.086

Appendix C: Hydraulic Input Parameters

N

Legend

- Madison Municipal Boundary
- Stricker's / Mendota Watershed
- Inactive Pond Area
- Inactive Overland Flow Area
- Inactive Building Area
- Hydraulic Node
- Runoff Node
- Storm Sewer
- Open Channel
- Weir
- Inlet Rating Curve

Tiedeman Pond
Stricker's Pond
Lake Mendota
UNIVERSITY AVE
COUNTRYSIDE LN
ST DUNSTAN DR
HEIM AVE
ROUGH LEE CT
CAMELOT DR
BLANCHARD ST
NO STREET NAME
TAYCHOPERA RD
BAKER AVE
LAUREL CREST
UPHAM CT
LAKE MENDOTA DR
GREENING LN
CAPITAL AVE
CAMUS LN
FRITZ AVE
NORMAN WAY
JULIA ST
BAKER AVE
OLD MIDDLETON RD
VEBLEN PL
E SKYLINE DR
W SKYLINE DR
DRUMHILL CIR
MIDDLETON ST
CASTLEBAR CT
FOX POINT CIR
LONGMEADOW RD
NORWALK CIR
IRAMORE TRL
HIGHGATE CIR
CHESTERTON CIR
DARIEN DR
SAUK RIDGE TRL
HODGSON CT
PEBBLE BEACH DR
PEBBLE BEACH CIR
S HIGHLANDS AVE
WILLOW LN
N HIGHLANDS AVE
HILLSIDE AVE
DALE AVE
TEMKIN AVE
MARSHA DR
PAULINE AVE
LORRAINE DR
DAHLEN DR
BRODY DR
SUE PL
CRAIG AVE
ENGLEWOOD DR
WOOD CREST CT
LYNWOOD DR
RAMSGATE CIR
WINDHAVEN DR
SAWMILL RD
S WOODMONT CIR
EASTBOURNE CIR
BRANFORD LN W
S STRATHFIELD CIR
MANOR HILL CIR
GLENSIDE CIR
HARVEST HILL RD
N GAMMON RD
N HIGH POINT RD
E SPYGLASS CT
ST ANDREWS CIR
SHEA CT
APPALACHIAN WAY
OLD SAUK RD
CARLSBAD DR
YOSEMITE PL
MT RAINIER LN
OLYMPIC DR
BLUE RIDGE PKWY
SAN JUAN TRL
BRYCE CANYON CIR
N YELLOWSTONE DR
GLACIER DR
SHILOH DR
SHILOH CT
BLUE RIDGE CT
OZARK TRL
ANTIETAM LN
NATCHEZ TRACE
ACADIA DR
EVERGLADE DR
FOXBORO CIR
RYE CIR
N WESTFIELD RD
WHITACRE RD
SAUK CREEK DR
FARMINGTON WAY
PINTAIL CIR
PLOVER CIR
ST LAWRENCE CIR

4/17/2020

Figure C-1
Existing Conditions
XPSWMM Model Layout
Stricker's / Mendota Watershed Study Report
City of Madison, WI

0 300 600
Feet

CITY OF MADISON WISCONSIN

Brown AND Caldwell

Air Photo: City of Madison, 2018

Path: P:\Madison, City of\153393 Strickers Mendota Watershed Study\GIS\MXDs\ExCondReportFigures\FigC-1-ModelLayout.mxd

Table C-1
Existing XPSWMM™ Model Link Inputs
Stricker's / Mendota Watershed Study Report, City of Madison, WI

Link Name	Conduit Name	Type	Upstream Node Name	Upstream Rim Elevation	Upstream Invert Elevation	Downstream Node Name	Downstream Rim Elevation	Downstream Invert Elevation	Length (feet)	Slope	Pipe Shape	Size (inches)	Manning's n
2446-007_2446-012	2446-007_2446-012	Storm Sewer	IN2446-007	961.37	957.22	AS2446-012	961.34	957.25	24.9	-0.1%	Circular	21"	0.013
2446-008_2446-011	2446-008_2446-011	Storm Sewer	IN2446-008	961.19	957.80	IN2446-011	957.51	953.23	256.0	1.8%	Circular	24"	0.013
2446-011_2546-009	2446-011_2546-009	Storm Sewer	IN2446-011	957.51	953.23	AS2546-009	953.48	948.26	297.3	1.7%	Circular	24"	0.013
2446-012_2446-008	2446-012_2446-008	Storm Sewer	AS2446-012	961.34	957.25	IN2446-008	961.19	957.80	8.0	-6.9%	Circular	21"	0.013
2446-013_2446-012	2446-013_2446-012	Storm Sewer	AS2446-013	963.04	957.75	AS2446-012	961.34	957.25	129.0	0.4%	Circular	15"	0.013
2446-014_2446-013	2446-014_2446-013	Storm Sewer	AS2446-014	966.75	962.00	AS2446-013	963.04	957.75	232.0	1.8%	Circular	15"	0.013
2446-020_2446-014	2446-020_2446-014	Storm Sewer	AS2446-020	969.44	964.00	AS2446-014	966.75	962.00	166.0	1.2%	Circular	15"	0.013
2446-021_2446-020	2446-021_2446-020	Storm Sewer	IN2446-021	971.41	967.69	AS2446-020	969.44	964.00	131.0	2.8%	Circular	15"	0.013
2447-003_2446-021	2447-003_2446-021	Storm Sewer	AS2447-003	972.30	967.94	IN2446-021	971.41	967.69	50.0	0.5%	Circular	15"	0.013
2447-006_2447-003	2447-006_2447-003	Storm Sewer	IN2447-006	972.97	969.50	AS2447-003	972.30	967.94	126.0	1.2%	Circular	15"	0.013
2447-007_2447-006	2447-007_2447-006	Storm Sewer	IN2447-007	973.17	969.63	IN2447-006	972.97	969.50	25.5	0.5%	Circular	15"	0.013
2447-008_2447-007	2447-008_2447-007	Storm Sewer	AS2447-008	974.10	970.22	IN2447-007	973.17	969.63	118.0	0.5%	Circular	15"	0.013
2545-001_BC_JCT_1	2545-001_BC_JCT_1	Storm Sewer	AS2545-001	929.74	923.10	PD_2046-021	930.00	923.10	73.1	0.0%	Circular	60"	0.013
2546-001_2546-002	2546-001_2546-002	Storm Sewer	AS2546-001	939.26	934.30	IN2546-002	927.62	923.83	302.8	3.5%	Circular	21"	0.013
2546-002_2546-003	2546-002_2546-003	Storm Sewer	IN2546-002	927.62	923.83	IN2546-003	927.47	923.71	33.3	0.4%	Special	24"x38"	0.013
2546-003_2546-005	2546-003_2546-005	Storm Sewer	IN2546-003	927.47	923.71	PD_2046-021	930.00	923.60	36.1	0.3%	Circular	30"	0.013
2546-008_2546-009	2546-008_2546-009	Storm Sewer	IN2546-008	953.45	949.74	AS2546-009	953.48	948.26	6.4	23.1%	Circular	18"	0.013
2546-009_2546-019	2546-009_2546-019	Storm Sewer	AS2546-009	953.48	948.26	IN2546-019	953.38	948.00	22.2	1.2%	Circular	18"	0.013
2546-010_2546-011	2546-010_2546-011	Storm Sewer	AS2546-010	947.11	942.91	AS2546-011	937.22	931.25	354.1	3.3%	Circular	30"	0.013
2546-011_2546-020	2546-011_2546-020	Storm Sewer	AS2546-011	937.22	931.25	AS2546-020	929.85	924.44	296.4	2.3%	Circular	36"	0.013
2546-019_2546-010	2546-019_2546-010	Storm Sewer	IN2546-019	953.38	948.00	AS2546-010	947.11	942.91	149.5	3.4%	Circular	30"	0.013
2546-020_2546-015	2546-020_2546-015	Storm Sewer	AS2546-020	929.85	924.44	PD_2046-021	930.00	924.10	69.7	0.5%	Circular	36"	0.013
2645-002_2545-002	2645-002_2545-002	Storm Sewer	IN2645-002	926.18	923.32	PD_2046-021	930.00	923.10	31.6	0.7%	Circular	18"	0.013
2646-001_BC_JCT_2	2646-001_BC_JCT_2	Storm Sewer	AS2646-001	934.23	926.56	BC_JCT_2	929.80	924.75	180.9	1.0%	Circular	48"	0.013
2646-003_2646-018	2646-003_2646-018	Storm Sewer	AS2646-003	960.17	951.88	AS2646-018	956.66	944.18	209.0	3.7%	Circular	48"	0.013
2646-004_2646-005	2646-004_2646-005	Storm Sewer	AS2646-004	955.32	943.63	AS2646-005	942.95	935.57	322.5	2.5%	Circular	48"	0.013
2646-005_2646-001	2646-005_2646-001	Storm Sewer	AS2646-005	942.95	935.57	AS2646-001	934.23	926.56	369.6	2.4%	Circular	48"	0.013
2646-006_2646-009	2646-006_2646-009	Storm Sewer	IN2646-006	966.66	955.98	AS2646-009	966.79	955.19	67.9	1.2%	Circular	21"	0.013
2646-009_2646-003	2646-009_2646-003	Storm Sewer	AS2646-009	966.79	955.19	AS2646-003	960.17	951.88	380.8	0.9%	Circular	42"	0.013
2646-010_2646-011	2646-010_2646-011	Storm Sewer	IN2646-010	965.57	962.70	IN2646-011	965.76	962.51	13.7	1.4%	Circular	18"	0.013
2646-011_2646-006	2646-011_2646-006	Storm Sewer	IN2646-011	965.76	961.51	IN2646-006	966.66	955.98	182.8	3.0%	Circular	21"	0.013
2646-015_2646-003	2646-015_2646-003	Storm Sewer	IN2646-015	959.86	956.85	AS2646-003	960.17	951.88	12.7	39.1%	Circular	18"	0.013
2646-018_2646-004	2646-018_2646-004	Storm Sewer	AS2646-018	956.66	944.18	AS2646-004	955.32	943.63	15.0	3.7%	Circular	48"	0.013
2647-001_2646-003	2647-001_2646-003	Storm Sewer	AS2647-001	966.51	959.70	AS2646-003	960.17	951.88	312.3	2.5%	Circular	48"	0.013
2647-002_2647-001	2647-002_2647-001	Storm Sewer	AS2647-002	974.22	963.02	AS2647-001	966.51	959.70	369.7	0.9%	Circular	48"	0.013
2647-003_2647-002	2647-003_2647-002	Storm Sewer	AS2647-003	975.56	969.66	AS2647-002	974.22	963.02	228.3	2.9%	Circular	48"	0.013
2647-004_2646-009	2647-004_2646-009	Storm Sewer	AS2647-004	970.21	955.85	AS2646-009	966.79	955.19	90.5	0.7%	Circular	42"	0.013
2648-001_2647-003	2648-001_2647-003	Storm Sewer	AS2648-001	979.03	971.60	AS2647-003	975.56	969.66	162.7	1.2%	Circular	48"	0.013
2648-002_2648-001	2648-002_2648-001	Storm Sewer	AS2648-002	993.02	987.36	AS2648-001	979.03	971.60	264.2	6.0%	Circular	42"	0.013
2648-003_2648-001	2648-003_2648-001	Storm Sewer	AS2648-003	978.34	974.60	AS2648-001	979.03	971.60	40.6	7.4%	Circular	30"	0.013
2648-005_2648-003	2648-005_2648-003	Storm Sewer	AS2648-005	981.47	977.45	AS2648-003	978.34	974.60	463.5	0.6%	Circular	30"	0.013
2648-006_2648-002	2648-006_2648-002	Storm Sewer	AS2648-006	998.44	992.43	AS2648-002	993.02	987.36	325.8	1.6%	Circular	42"	0.013
2648-007_2648-006	2648-007_2648-006	Storm Sewer	AS2648-007	1004.06	998.61	AS2648-006	998.44	992.43	276.5	2.2%	Circular	24"	0.013
2648-016_2648-017	2648-016_2648-017	Storm Sewer	IN2648-016	985.44	982.73	IN2648-017	985.37	982.69	7.9	0.5%	Circular	18"	0.013
2648-017_2648-024	2648-017_2648-024	Storm Sewer	IN2648-017	985.37	982.69	IN2648-024	985.18	982.52	8.3	2.0%	Circular	18"	0.013
2648-024_2648-005	2648-024_2648-005	Storm Sewer	IN2648-024	985.18	982.52	AS2648-005	981.47	977.45	250.4	2.0%	Circular	24"	0.013

Table C-1
Existing XPSWMM™ Model Link Inputs
Stricker's / Mendota Watershed Study Report, City of Madison, WI

Link Name	Conduit Name	Type	Upstream Node Name	Upstream Rim Elevation	Upstream Invert Elevation	Downstream Node Name	Downstream Rim Elevation	Downstream Invert Elevation	Length (feet)	Slope	Pipe Shape	Size (inches)	Manning's n
2648-030_BC_JCT_8	2648-030_BC_JCT_8	Storm Sewer	AS2648-030	987.86	983.74	BC_JCT_8	986.63	983.44	124.0	0.2%	Circular	18"	0.013
2649-001_2648-007	2649-001_2648-007	Storm Sewer	AS2649-001	1010.93	1003.30	AS2648-007	1004.06	998.61	329.3	1.4%	Circular	24"	0.013
2649-002_2649-001	2649-002_2649-001	Storm Sewer	AS2649-002	1012.02	1007.65	AS2649-001	1010.93	1003.30	105.0	4.1%	Circular	21"	0.013
2649-006_2649-002	2649-006_2649-002	Storm Sewer	AS2649-006	1026.26	1020.45	AS2649-002	1012.02	1007.65	440.7	2.9%	Circular	21"	0.013
2747-002_T13059MAD	2747-002_T13059MAD	Storm Sewer	IN2747-002	974.98	971.10	T13059MAD	974.73	970.40	105.6	0.7%	Circular	24"	0.013
2747-005_2647-004	2747-005_2647-004	Storm Sewer	AS2747-005	968.07	960.83	AS2647-004	970.21	955.85	378.6	1.3%	Circular	36"	0.013
2747-006_2747-005	2747-006_2747-005	Storm Sewer	AS2747-006	973.63	962.02	AS2747-005	968.07	960.83	274.3	0.4%	Circular	36"	0.013
2747-007_2747-006	2747-007_2747-006	Storm Sewer	IN2747-007	972.75	962.64	AS2747-006	973.63	962.02	97.6	0.6%	Circular	30"	0.013
2748-001_2748-004	2748-001_2748-004	Storm Sewer	AS2748-001	1000.80	995.33	AS2748-004	999.70	994.73	202.5	0.3%	Special	34"x53"	0.013
2748-004_2748-006	2748-004_2748-006	Storm Sewer	AS2748-004	999.70	994.73	AS2748-006	998.40	994.10	213.6	0.3%	Special	34"x53"	0.013
2748-006_2648-006	2748-006_2648-006	Storm Sewer	AS2748-006	998.40	994.10	AS2648-006	998.44	992.43	50.5	3.3%	Special	34"x53"	0.013
2749-002_2749-003	2749-002_2749-003	Storm Sewer	AS2749-002	1026.98	1021.33	IN2749-003	1026.07	1020.73	34.6	1.7%	Circular	18"	0.013
2749-003_2649-006	2749-003_2649-006	Storm Sewer	IN2749-003	1026.07	1020.73	AS2649-006	1026.26	1020.45	27.6	1.0%	Circular	18"	0.013
2749-004_2749-007	2749-004_2749-007	Storm Sewer	IN2749-004	1015.14	1011.35	AS2749-007	1012.77	1007.27	169.3	2.4%	Circular	18"	0.013
2749-005_2749-007	2749-005_2749-007	Storm Sewer	IN2749-005	1012.52	1007.30	AS2749-007	1012.77	1007.27	10.1	0.3%	Circular	30"	0.013
2749-007_2749-046	2749-007_2749-046	Storm Sewer	AS2749-007	1012.77	1007.27	CB2749-046	1009.96	1004.12	285.0	1.1%	Circular	36"	0.013
2749-009_2749-013	2749-009_2749-013	Storm Sewer	IN2749-009	1004.14	999.38	AS2749-013	1004.33	998.33	55.1	1.9%	Circular	36"	0.013
2749-013_2749-027	2749-013_2749-027	Storm Sewer	AS2749-013	1004.33	998.33	AS2749-027	1003.09	997.13	244.1	0.5%	Circular	42"	0.013
2749-017_2749-005	2749-017_2749-005	Storm Sewer	AS2749-017	1024.48	1013.52	IN2749-005	1012.52	1007.30	247.0	2.5%	Circular	30"	0.013
2749-018_2749-017	2749-018_2749-017	Storm Sewer	AS2749-018	1024.07	1015.43	AS2749-017	1024.48	1013.52	58.5	3.3%	Circular	30"	0.013
2749-024_2749-013	2749-024_2749-013	Storm Sewer	AS2749-024	1005.12	1000.20	AS2749-013	1004.33	998.33	174.9	1.1%	Circular	30"	0.013
2749-027_2749-033	2749-027_2749-033	Storm Sewer	AS2749-027	1003.09	997.13	AS2749-033	1002.04	996.07	199.6	0.5%	Circular	42"	0.013
2749-033_2748-001	2749-033_2748-001	Storm Sewer	AS2749-033	1002.04	996.07	AS2748-001	1000.80	995.33	254.9	0.3%	Special	34"x53"	0.013
2749-035_2749-018	2749-035_2749-018	Storm Sewer	IN2749-035	1022.69	1015.23	AS2749-018	1024.07	1015.43	27.5	-0.7%	Circular	36"	0.013
2749-042_BC_JCT_3	2749-042_BC_JCT_3	Storm Sewer	IN2749-042	1032.84	1029.19	BC_JCT_3	1033.20	1029.48	11.7	-2.5%	Circular	18"	0.013
2749-043_2749-042	2749-043_2749-042	Storm Sewer	IN2749-043	1032.51	1029.77	IN2749-042	1032.84	1029.19	52.6	1.1%	Circular	18"	0.013
2749-046_2749-009	2749-046_2749-009	Storm Sewer	CB2749-046	1009.96	1004.12	IN2749-009	1004.14	999.38	422.1	1.1%	Circular	36"	0.013
2749-047_2749-046	2749-047_2749-046	Storm Sewer	IN2749-047	1018.93	1013.12	CB2749-046	1009.96	1004.12	260.3	3.5%	Circular	18"	0.013
2847-001_2747-002	2847-001_2747-002	Storm Sewer	AS2847-001	976.56	972.16	IN2747-002	974.98	971.10	266.8	0.4%	Circular	24"	0.013
2847-006_2847-001	2847-006_2847-001	Storm Sewer	AS2847-006	977.50	973.01	AS2847-001	976.56	972.16	142.2	0.6%	Circular	24"	0.013
2847-007_2847-006	2847-007_2847-006	Storm Sewer	AE2847-007	978.61	975.60	AS2847-006	977.50	973.01	214.2	1.2%	Circular	24"	0.013
2847-009_2847-017	2847-009_2847-017	Storm Sewer	IN2847-009	981.35	978.00	AE2847-017	980.58	977.60	135.8	0.3%	Circular	24"	0.013
2847-012_2847-009	2847-012_2847-009	Storm Sewer	AS2847-012	981.49	978.01	IN2847-009	981.35	978.00	13.5	0.1%	Circular	24"	0.013
2847-013_2847-012	2847-013_2847-012	Storm Sewer	AS2847-013	982.25	978.51	AS2847-012	981.49	978.01	157.5	0.3%	Special	19"x30"	0.013
2847-014_2847-013	2847-014_2847-013	Storm Sewer	IN2847-014	983.43	980.10	AS2847-013	982.25	978.51	53.0	3.0%	Circular	18"	0.013
2847-018_2847-014	2847-018_2847-014	Storm Sewer	IN2847-018	996.78	993.00	IN2847-014	983.43	980.10	303.9	4.2%	Circular	18"	0.013
2848-001_2847-018	2848-001_2847-018	Storm Sewer	IN2848-001	1003.67	1000.10	IN2847-018	996.78	993.00	153.3	4.6%	Circular	15"	0.013
2848-002_2848-001	2848-002_2848-001	Storm Sewer	IN2848-002	1011.61	1008.09	IN2848-001	1003.67	1000.10	171.1	4.7%	Circular	15"	0.013
2848-004_2849-005	2848-004_2849-005	Storm Sewer	AS2848-004	1007.87	1002.18	AS2849-005	1006.99	1001.48	179.5	0.4%	Circular	48"	0.013
2848-006_2848-004	2848-006_2848-004	Storm Sewer	AS2848-006	1008.72	1003.95	AS2848-004	1007.87	1002.18	188.1	0.9%	Circular	24"	0.013
2848-007_2848-006	2848-007_2848-006	Storm Sewer	IN2848-007	1008.53	1004.75	AS2848-006	1008.72	1003.95	7.1	11.3%	Circular	18"	0.013
2848-009_2848-007	2848-009_2848-007	Storm Sewer	IN2848-009	1009.38	1006.20	IN2848-007	1008.53	1004.75	120.7	1.2%	Circular	18"	0.013
2848-011_2848-009	2848-011_2848-009	Storm Sewer	IN2848-011	1010.50	1007.44	IN2848-009	1009.38	1006.20	122.7	1.0%	Circular	18"	0.013
2848-012_2848-011	2848-012_2848-011	Storm Sewer	IN2848-012	1014.02	1010.44	IN2848-011	1010.50	1007.44	138.1	2.2%	Circular	18"	0.013
2849-001_2749-024	2849-001_2749-024	Storm Sewer	AS2849-001	1005.69	1000.18	AS2749-024	1005.12	1000.20	172.2	0.0%	Special	38"x60"	0.013
2849-005_2849-001	2849-005_2849-001	Storm Sewer	AS2849-005	1006.99	1001.48	AS2849-001	1005.69	1000.18	243.5	0.5%	Special	38"x60"	0.013

Table C-1
Existing XPSWMM™ Model Link Inputs
Stricker's / Mendota Watershed Study Report, City of Madison, WI

Link Name	Conduit Name	Type	Upstream Node Name	Upstream Rim Elevation	Upstream Invert Elevation	Downstream Node Name	Downstream Rim Elevation	Downstream Invert Elevation	Length (feet)	Slope	Pipe Shape	Size (inches)	Manning's n
2849-012_2749-035	2849-012_2749-035	Storm Sewer	IN2849-012	1021.17	1018.17	IN2749-035	1022.69	1016.72	291.2	0.5%	Circular	24"	0.013
2849-013_2849-012	2849-013_2849-012	Storm Sewer	IN2849-013	1022.19	1017.12	IN2849-012	1021.17	1018.22	179.4	-0.6%	Circular	18"	0.013
2850-003_2850-004	2850-003_2850-004	Storm Sewer	IN2850-003	1022.42	1017.05	IN2850-004	1022.19	1016.10	41.0	2.3%	Circular	15"	0.013
2850-004_2950-021	2850-004_2950-021	Storm Sewer	IN2850-004	1022.19	1016.10	IN2950-021	1022.37	1016.08	463.2	0.0%	Circular	24"	0.013
2850-005_2850-003	2850-005_2850-003	Storm Sewer	IN2850-005	1047.63	1018.20	IN2850-003	1022.42	1017.05	501.5	0.2%	Circular	15"	0.013
2850-010_2849-013	2850-010_2849-013	Storm Sewer	IN2850-010	1022.48	1018.76	IN2849-013	1022.19	1017.12	68.5	2.4%	Circular	18"	0.013
2850-015_2850-004	2850-015_2850-004	Storm Sewer	IN2850-015	1021.47	1019.40	IN2850-004	1022.19	1016.10	111.4	3.0%	Circular	18"	0.013
2944-013_2944-014	2944-013_2944-014	Storm Sewer	AS2944-013	923.11	919.00	AE2944-014	919.50	917.60	92.0	1.5%	Circular	18"	0.013
2946-003_2946-014	2946-003_2946-014	Storm Sewer	AS2946-003	912.59	908.70	IN2946-014	904.74	898.50	220.0	4.6%	Circular	36"	0.016
2946-004_2946-003	2946-004_2946-003	Storm Sewer	AS2946-004	928.75	924.70	AS2946-003	912.59	908.70	340.0	4.7%	Circular	36"	0.016
2946-005_2946-004	2946-005_2946-004	Storm Sewer	AS2946-005	944.01	940.15	AS2946-004	928.75	924.70	195.0	7.9%	Circular	36"	0.016
2946-014_2946-006	2946-014_2946-006	Storm Sewer	IN2946-014	904.74	898.50	GR_2946-016	916.50	896.50	60.0	3.3%	Circular	36"	0.016
2947-002_2947-003	2947-002_2947-003	Storm Sewer	AS2947-002	965.06	961.94	AS2947-003	966.07	956.56	32.0	16.8%	Circular	36"	0.024
2947-003_2947-004	2947-003_2947-004	Storm Sewer	AS2947-003	966.07	956.56	AS2947-004	950.81	946.11	260.1	4.0%	Circular	36"	0.024
2947-004_2946-005	2947-004_2946-005	Storm Sewer	AS2947-004	950.81	946.11	AS2946-005	944.01	940.15	67.0	8.9%	Circular	36"	0.013
2947-013_BC_JCT_6	2947-013_BC_JCT_6	Storm Sewer	IN2947-013	978.21	972.09	BC_JCT_6	977.37	970.30	31.0	5.8%	Circular	36"	0.024
2948-001_2948-002	2948-001_2948-002	Storm Sewer	AS2948-001	997.71	993.60	AS2948-002	995.86	991.20	396.0	0.6%	Circular	33"	0.013
2948-002_BC_JCT_4	2948-002_BC_JCT_4	Storm Sewer	AS2948-002	995.86	991.20	BC_JCT_4	988.49	982.07	396.0	2.3%	Circular	33"	0.013
2948-004_2948-001	2948-004_2948-001	Storm Sewer	AS2948-004	1002.95	997.20	AS2948-001	997.71	993.60	372.9	1.0%	Circular	30"	0.013
2948-005_2948-004	2948-005_2948-004	Storm Sewer	AS2948-005	1005.22	1000.36	AS2948-004	1002.95	997.20	217.1	1.5%	Circular	30"	0.013
2949-002_2949-012	2949-002_2949-012	Storm Sewer	AS2949-002	1015.30	1010.60	AS2949-012	1011.02	1006.99	210.6	1.7%	Circular	27"	0.013
2949-010_2948-005	2949-010_2948-005	Storm Sewer	IN2949-010	1009.66	1006.18	AS2948-005	1005.22	1000.36	282.0	2.1%	Circular	27"	0.013
2949-012_2949-010	2949-012_2949-010	Storm Sewer	AS2949-012	1011.02	1006.99	IN2949-010	1009.66	1006.18	46.6	1.7%	Circular	27"	0.013
2950-004_2950-005	2950-004_2950-005	Storm Sewer	AS2950-004	1022.84	1015.10	AS2950-005	1023.62	1014.07	114.4	0.9%	Circular	30"	0.013
2950-005_2950-023	2950-005_2950-023	Storm Sewer	AS2950-005	1023.62	1014.07	AS2950-023	1024.09	1013.98	25.0	0.4%	Circular	30"	0.013
2950-006_2950-005	2950-006_2950-005	Storm Sewer	AS2950-006	1026.44	1021.67	AS2950-005	1023.62	1014.07	298.2	2.5%	Circular	30"	0.013
2950-020_2950-006	2950-020_2950-006	Storm Sewer	AS2950-020	1033.55	1028.60	AS2950-006	1026.44	1021.67	350.2	2.0%	Circular	24"	0.013
2950-021_2950-022	2950-021_2950-022	Storm Sewer	IN2950-021	1022.37	1016.08	IN2950-022	1022.35	1015.10	10.6	9.3%	Circular	30"	0.013
2950-022_2950-004	2950-022_2950-004	Storm Sewer	IN2950-022	1022.35	1016.08	AS2950-004	1022.84	1015.10	109.0	0.9%	Circular	30"	0.013
2950-023_2949-002	2950-023_2949-002	Storm Sewer	AS2950-023	1024.09	1013.98	AS2949-002	1015.30	1010.60	358.0	0.9%	Circular	30"	0.013
2950-024_2950-023	2950-024_2950-023	Storm Sewer	AS2950-024	1024.26	1018.69	AS2950-023	1024.09	1013.98	66.0	7.1%	Circular	18"	0.013
2950-025_2950-024	2950-025_2950-024	Storm Sewer	AS2950-025	1028.08	1021.05	AS2950-024	1024.26	1018.69	232.0	1.0%	Circular	18"	0.013
2950-027_2950-025	2950-027_2950-025	Storm Sewer	AS2950-027	1033.22	1028.86	AS2950-025	1028.08	1021.05	283.4	2.8%	Circular	15"	0.013
3044-001_3045-003	3044-001_3045-003	Storm Sewer	IN3044-001	895.33	892.46	IN3045-003	894.94	891.50	29.8	3.2%	Circular	18"	0.013
3044-002_3044-036	3044-002_3044-036	Storm Sewer	AS3044-002	897.30	888.34	AS3044-036	896.95	888.11	29.3	0.8%	Circular	30"	0.013
3044-003_3044-001	3044-003_3044-001	Storm Sewer	AS3044-003	896.63	893.90	IN3044-001	895.33	892.46	9.0	16.0%	Circular	18"	0.013
3044-004_3044-002	3044-004_3044-002	Storm Sewer	IN3044-004	893.73	890.10	AS3044-002	897.30	888.34	132.3	1.3%	Special	19"x30"	0.013
3044-013_3044-002	3044-013_3044-002	Storm Sewer	CB3044-013	899.63	890.65	AS3044-002	897.30	888.34	75.1	3.1%	Circular	24"	0.013
3044-019_3044-013	3044-019_3044-013	Storm Sewer	CB3044-019	903.83	894.27	CB3044-013	899.63	890.65	144.3	2.5%	Circular	24"	0.013
3044-022_3044-019	3044-022_3044-019	Storm Sewer	AS3044-022	909.54	899.25	CB3044-019	903.83	894.27	199.7	2.5%	Circular	24"	0.013
3044-023_3044-022	3044-023_3044-022	Storm Sewer	CB3044-023	912.42	903.46	AS3044-022	909.54	899.25	108.0	3.9%	Circular	24"	0.013
3044-030_3044-023	3044-030_3044-023	Storm Sewer	AS3044-030	919.46	913.55	CB3044-023	912.42	903.46	259.0	3.9%	Circular	24"	0.013
3044-033_3044-030	3044-033_3044-030	Storm Sewer	AS3044-033	926.33	920.35	AS3044-030	919.46	913.55	254.4	2.7%	Circular	24"	0.013
3044-036_3044-037	3044-036_3044-037	Storm Sewer	AS3044-036	896.95	888.11	AS3044-037	892.49	885.06	152.4	2.0%	Circular	30"	0.013
3044-037_3145-018	3044-037_3145-018	Storm Sewer	AS3044-037	892.49	885.06	AS3145-018	886.39	881.65	203.5	1.7%	Circular	30"	0.013
3045-003_3044-004	3045-003_3044-004	Storm Sewer	IN3045-003	894.94	891.50	IN3044-004	893.73	890.10	97.1	1.4%	Circular	18"	0.013

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Link Name	Conduit Name	Type	Upstream Node Name	Upstream Rim Elevation	Upstream Invert Elevation	Downstream Node Name	Downstream Rim Elevation	Downstream Invert Elevation	Length (feet)	Slope	Pipe Shape	Size (inches)	Manning's n
3045-013_BC_JCT_7	3045-013_BC_JCT_7	Storm Sewer	IN3045-013	887.20	879.17	BC_JCT_7	885.65	879.00	82.7	0.2%	Circular	36"	0.014
3045-015_3045-016	3045-015_3045-016	Storm Sewer	IN3045-015	890.14	882.40	PD_3046-028	892.60	882.10	57.0	0.5%	Circular	18"	0.013
3045-017_3045-015	3045-017_3045-015	Storm Sewer	IN3045-017	894.20	890.49	IN3045-015	890.14	882.40	70.2	11.5%	Circular	15"	0.013
3045-020_3045-017	3045-020_3045-017	Storm Sewer	IN3045-020	907.65	904.06	IN3045-017	894.20	890.49	238.5	5.7%	Circular	15"	0.013
3045-023_3045-020	3045-023_3045-020	Storm Sewer	IN3045-023	919.61	915.97	IN3045-020	907.65	904.06	200.3	5.9%	Circular	15"	0.013
3045-024_3045-023	3045-024_3045-023	Storm Sewer	AS3045-024	928.28	924.39	IN3045-023	919.61	915.97	185.0	4.6%	Circular	15"	0.013
3045-026_3045-024	3045-026_3045-024	Storm Sewer	AS3045-026	931.81	926.67	AS3045-024	928.28	924.39	175.1	1.3%	Circular	12"	0.013
3045-028_3045-026	3045-028_3045-026	Storm Sewer	IN3045-028	933.03	931.23	AS3045-026	931.81	926.67	98.9	4.6%	Circular	12"	0.013
3046-003_3046-004	3046-003_3046-004	Storm Sewer	PD3046-003	924.00	892.80	PD3046-004	924.00	888.70	112.4	3.6%	Circular	66"	0.013
3046-010_3046-011	3046-010_3046-011	Storm Sewer	IN3046-010	885.22	881.29	PD_3046-029	883.60	881.10	29.0	0.7%	Special	19"x30"	0.013
3046-010_3046-021	3046-010_3046-021	Storm Sewer	IN3046-010	885.22	881.29	IN3046-021	885.14	877.43	19.8	19.5%	Special	14"x23"	0.013
3046-012_3046-010	3046-012_3046-010	Storm Sewer	IN3046-012	885.26	881.44	IN3046-010	885.22	881.29	24.4	0.6%	Special	14"x23"	0.013
3046-014_3046-010	3046-014_3046-010	Storm Sewer	AS3046-014	889.55	883.73	IN3046-010	885.22	881.29	222.0	1.1%	Special	24"x38"	0.013
3046-018_3046-014	3046-018_3046-014	Storm Sewer	IN3046-018	892.18	888.28	AS3046-014	889.55	883.73	63.3	7.2%	Circular	24"	0.013
3046-019_3046-018	3046-019_3046-018	Storm Sewer	IN3046-019	901.94	898.22	IN3046-018	892.18	888.28	183.3	5.4%	Circular	24"	0.013
3046-021_BC_JCT_7	3046-021_BC_JCT_7	Storm Sewer	IN3046-021	885.14	877.43	BC_JCT_7	885.65	877.00	48.6	0.9%	Circular	36"	0.014
3046-022_3046-021	3046-022_3046-021	Storm Sewer	AS3046-022	881.52	878.27	IN3046-021	885.14	877.43	154.0	0.5%	Circular	12"	0.013
3046-024_3045-013	3046-024_3045-013	Storm Sewer	IN3046-024	892.60	879.51	IN3045-013	887.20	879.17	69.0	0.5%	Circular	12"	0.013
3046-025_3046-025_01	3046-025_3046-025_01	Open Channel	HD3046-025	886.47	876.47	HD3046-025_01	879.49	869.49	640.1	1.1%	Natural	N/A	0.014
3046-025_3046-025_02	3046-025_3046-025_02	Open Channel	HD3046-025_01	879.49	869.49	HD3046-025_02	877.47	867.47	240.8	0.8%	Natural	N/A	0.014
3046-025_BC_JCT_7	3046-025_BC_JCT_7	Storm Sewer	BC_JCT_7	885.65	876.47	HD3046-025	886.47	876.40	68.8	0.1%	Rectangular	4'x12'	0.014
3046-025_SM_GW)05	3046-025_SM_GW)05	Open Channel	HD3046-025_02	877.47	867.47	SM_GW_05	876.91	866.91	142.1	0.4%	Natural	N/A	0.014
3144-006_3244-006	3144-006_3244-006	Storm Sewer	GR3144-006	857.22	853.02	GR3244-006	856.50	852.50	124.1	0.4%	Circular	48"	0.024
3145-018_3145-019	3145-018_3145-019	Storm Sewer	AS3145-018	886.39	881.65	IN3145-019	885.32	878.39	33.5	9.7%	Circular	30"	0.013
3145-019_3145-020	3145-019_3145-020	Storm Sewer	IN3145-019	885.32	878.39	CB3145-020	885.02	874.52	11.2	34.5%	Circular	30"	0.013
3145-020_3145-023	3145-020_3145-023	Storm Sewer	CB3145-020	885.02	874.52	AS3145-023	881.34	871.91	130.0	2.0%	Circular	30"	0.014
3145-023_3145-024	3145-023_3145-024	Storm Sewer	AS3145-023	881.34	871.91	AS3145-024	880.03	869.95	115.7	1.7%	Circular	30"	0.013
3145-024_3145-025	3145-024_3145-025	Storm Sewer	AS3145-024	880.03	869.95	IN3145-025	880.98	869.87	15.2	0.5%	Circular	30"	0.013
3145-025_3145-028	3145-025_3145-028	Storm Sewer	IN3145-025	880.98	869.87	AS3145-028	881.16	869.80	9.5	0.7%	Circular	30"	0.013
3145-028_3145-030	3145-028_3145-030	Storm Sewer	AS3145-028	881.16	869.80	IN3145-030	881.72	869.68	19.3	0.6%	Circular	42"	0.013
3145-030_3145-031	3145-030_3145-031	Storm Sewer	IN3145-030	881.72	869.68	CB3145-031	881.11	866.53	29.7	10.6%	Circular	42"	0.013
3145-031_3145-035	3145-031_3145-035	Storm Sewer	CB3145-031	881.11	866.53	AE3145-035	874.62	869.71	38.0	-8.4%	Circular	42"	0.013
3145-036_3145-028	3145-036_3145-028	Storm Sewer	CB3145-036	884.98	874.76	AS3145-028	881.16	869.80	219.7	2.3%	Circular	24"	0.013
3145-040_3145-036	3145-040_3145-036	Storm Sewer	AS3145-040	895.26	887.13	CB3145-036	884.98	874.76	222.0	5.6%	Circular	24"	0.013
3145-043_3145-040	3145-043_3145-040	Storm Sewer	CB3145-043	902.37	891.50	AS3145-040	895.26	887.13	141.3	3.1%	Circular	24"	0.013
3145-048_3145-043	3145-048_3145-043	Storm Sewer	AS3145-048	909.63	901.41	CB3145-043	902.37	891.50	245.8	4.0%	Circular	24"	0.013
3146-013_3046-019	3146-013_3046-019	Storm Sewer	IN3146-013	917.44	912.90	IN3046-019	901.94	898.22	334.5	4.4%	Circular	24"	0.013
3244-003_3244-002	3244-003_3244-002	Storm Sewer	GR3244-003	857.02	852.72	GR3244-002	861.20	851.20	121.3	1.3%	Circular	48"	0.024
3245-001_3245-002	3245-001_3245-002	Storm Sewer	AS3245-001	862.11	857.10	AS3245-002	859.06	854.20	250.2	1.2%	Circular	30"	0.013
3245-002_3245-005	3245-002_3245-005	Storm Sewer	AS3245-002	859.06	854.20	AS3245-005	858.66	854.53	48.9	-0.7%	Circular	36"	0.013
3245-003_3245-001	3245-003_3245-001	Storm Sewer	AS3245-003	865.69	860.60	AS3245-001	862.11	857.10	226.8	1.5%	Circular	24"	0.013
3245-004_BC_JCT_11	3245-004_BC_JCT_11	Storm Sewer	IN3245-004	868.95	863.20	BC_JCT_11	865.72	860.50	188.1	1.4%	Circular	24"	0.013
3245-005_BC_JCT_9	3245-005_BC_JCT_9	Storm Sewer	AS3245-005	858.66	854.53	BC_JCT_9	860.00	852.00	385.1	0.7%	Circular	36"	0.013
3246-004_3246-016	3246-004_3246-016	Storm Sewer	AS3246-004	907.01	901.12	AS3246-016	904.85	900.27	254.9	0.3%	Circular	18"	0.013
3246-009_3245-004	3246-009_3245-004	Storm Sewer	IN3246-009	878.33	873.20	IN3245-004	868.95	863.20	298.9	3.3%	Circular	24"	0.013
3246-014_3246-023	3246-014_3246-023	Storm Sewer	AS3246-014	907.18	902.23	IN3246-023	905.82	901.22	200.9	0.5%	Circular	18"	0.013

Table C-1
Existing XPSWMM™ Model Link Inputs
Stricker's / Mendota Watershed Study Report, City of Madison, WI

Link Name	Conduit Name	Type	Upstream Node Name	Upstream Rim Elevation	Upstream Invert Elevation	Downstream Node Name	Downstream Rim Elevation	Downstream Invert Elevation	Length (feet)	Slope	Pipe Shape	Size (inches)	Manning's n
3246-016_3246-019	3246-016_3246-019	Storm Sewer	AS3246-016	904.85	900.27	SS3246-019	904.73	899.60	31.8	2.1%	Circular	18"	0.013
3246-019_3246-020	3246-019_3246-020	Storm Sewer	SS3246-019	904.73	899.60	AS3246-020	904.18	899.74	20.0	-0.7%	Circular	24"	0.013
3246-020_3246-009	3246-020_3246-009	Storm Sewer	AS3246-020	904.18	899.74	IN3246-009	878.33	873.20	403.2	6.6%	Circular	24"	0.013
3246-023_3246-024	3246-023_3246-024	Storm Sewer	IN3246-023	905.82	901.22	AS3246-024	905.86	900.72	89.9	0.6%	Circular	18"	0.013
3246-024_3246-019	3246-024_3246-019	Storm Sewer	AS3246-024	905.86	900.72	SS3246-019	904.73	899.60	37.7	3.0%	Circular	24"	0.013
3246-025_3246-024	3246-025_3246-024	Storm Sewer	IN3246-025	905.91	900.89	AS3246-024	905.86	900.72	31.0	0.5%	Circular	24"	0.013
3246-027_3246-025	3246-027_3246-025	Storm Sewer	IN3246-027	905.82	901.05	IN3246-025	905.91	900.89	29.4	0.5%	Circular	24"	0.013
AS2447-003_IC	AS2447-003.2	Inlet Rating Curve	ME04-A-0014-H-002	971.19	N/A	AS2447-003	972.30	N/A	N/A	N/A	N/A	N/A	N/A
AS2546-001_IC	AS2546-001.2	Inlet Rating Curve	ME04-A-0406-H-001	939.06	N/A	AS2546-001	939.26	N/A	N/A	N/A	N/A	N/A	N/A
AS2546-020_IC	AS2546-020.2	Inlet Rating Curve	ME04-A-0406-H-002	929.49	N/A	AS2546-020	929.85	N/A	N/A	N/A	N/A	N/A	N/A
AS2646-001_IC	AS2646-001.2	Inlet Rating Curve	ME04-A-0015-H-000	933.96	N/A	AS2646-001	934.23	N/A	N/A	N/A	N/A	N/A	N/A
AS2646-003_IC	AS2646-003.2	Inlet Rating Curve	ME04-A-0015-H-001	959.66	N/A	AS2646-003	960.17	N/A	N/A	N/A	N/A	N/A	N/A
AS2647-002_IC	AS2647-002.2	Inlet Rating Curve	ME04-A-0015-H-002	973.80	N/A	AS2647-002	974.22	N/A	N/A	N/A	N/A	N/A	N/A
AS2648-003_IC	AS2648-003.2	Inlet Rating Curve	ME04-A-0015-H-004	978.24	N/A	AS2648-003	978.34	N/A	N/A	N/A	N/A	N/A	N/A
AS2648-030_IC	AS2648-030.2	Inlet Rating Curve	ME04-A-0015-H-006	987.43	N/A	AS2648-030	987.86	N/A	N/A	N/A	N/A	N/A	N/A
AS2649-001_IC	AS2649-001.2	Inlet Rating Curve	ME04-A-0015-H-009	1010.49	N/A	AS2649-001	1010.93	N/A	N/A	N/A	N/A	N/A	N/A
AS2649-006_IC	AS2649-006.2	Inlet Rating Curve	ME04-A-0015-H-013	1026.00	N/A	AS2649-006	1026.26	N/A	N/A	N/A	N/A	N/A	N/A
AS2747-005_IC	AS2747-005.2	Inlet Rating Curve	ME04-A-0013-H-000	968.03	N/A	AS2747-005	968.07	N/A	N/A	N/A	N/A	N/A	N/A
AS2748-001_IC	AS2748-001.2	Inlet Rating Curve	ME04-A-0015-H-008	1000.19	N/A	AS2748-001	1000.80	N/A	N/A	N/A	N/A	N/A	N/A
AS2749-013_IC	AS2749-013.2	Inlet Rating Curve	ME04-A-0015-H-010	1003.87	N/A	AS2749-013	1004.33	N/A	N/A	N/A	N/A	N/A	N/A
AS2847-001_IC	AS2847-001.2	Inlet Rating Curve	ME04-A-0029-H-004	976.25	N/A	AS2847-001	976.56	N/A	N/A	N/A	N/A	N/A	N/A
AS2848-004_IC	AS2848-004.2	Inlet Rating Curve	ME04-A-0015-H-011	1007.67	N/A	AS2848-004	1007.87	N/A	N/A	N/A	N/A	N/A	N/A
AS2948-001_IC	AS2948-001.2	Inlet Rating Curve	ME03-A-0021-H-004	996.29	N/A	AS2948-001	997.71	N/A	N/A	N/A	N/A	N/A	N/A
AS2949-002_IC	AS2949-002.2	Inlet Rating Curve	ME03-A-0021-H-005	1014.62	N/A	AS2949-002	1015.30	N/A	N/A	N/A	N/A	N/A	N/A
AS2950-005_IC	AS2950-005.2	Inlet Rating Curve	ME03-A-0021-H-006	1023.40	N/A	AS2950-005	1023.62	N/A	N/A	N/A	N/A	N/A	N/A
AS2950-020_IC	AS2950-020.2	Inlet Rating Curve	ME03-A-0021-H-009	1033.05	N/A	AS2950-020	1033.55	N/A	N/A	N/A	N/A	N/A	N/A
AS2950-027_IC	AS2950-027.2	Inlet Rating Curve	ME03-A-0021-H-007	1032.98	N/A	AS2950-027	1033.22	N/A	N/A	N/A	N/A	N/A	N/A
AS3044-033_IC	AS3044-033.2	Inlet Rating Curve	ME03-A-0039-K-010	925.72	N/A	AS3044-033	926.33	N/A	N/A	N/A	N/A	N/A	N/A
AS3046-014_IC	AS3046-014.2	Inlet Rating Curve	ME03-A-0040-K-000	889.10	N/A	AS3046-014	889.55	N/A	N/A	N/A	N/A	N/A	N/A
AS3145-024_IC	AS3145-024.2	Inlet Rating Curve	ME03-A-0039-K-002	880.77	N/A	AS3145-024	880.03	N/A	N/A	N/A	N/A	N/A	N/A
AS3145-048_IC	AS3145-048.2	Inlet Rating Curve	ME03-A-0039-K-004	909.10	N/A	AS3145-048	909.63	N/A	N/A	N/A	N/A	N/A	N/A
AS3146-010_IN3146-003	AS3146-010_IN3146-003	Storm Sewer	AS3146-010	912.03	904.74	IN3146-003	910.79	904.52	22.0	1.0%	Special	14"x23"	0.014
AS3245-003_IC	AS3245-003.2	Inlet Rating Curve	ME03-B-0040-A-003	865.41	N/A	AS3245-003	865.69	N/A	N/A	N/A	N/A	N/A	N/A
AS3245-005_IC	AS3245-005.2	Inlet Rating Curve	ME03-B-0040-A-000	858.45	N/A	AS3245-005	858.66	N/A	N/A	N/A	N/A	N/A	N/A
AS3246-020_IC	AS3246-020.2	Inlet Rating Curve	ME03-B-0040-A-004	903.81	N/A	AS3246-020	904.18	N/A	N/A	N/A	N/A	N/A	N/A
BC_JCT_11_3245-003	BC_JCT_11_3245-003	Storm Sewer	BC_JCT_11	865.72	860.50	AS3245-003	865.69	860.60	25.9	-0.4%	Circular	24"	0.013
BC_JCT_12_2648-030	BC_JCT_12_2648-030	Storm Sewer	BC_JCT_12	989.05	984.16	AS2648-030	987.86	983.74	170.2	0.2%	Circular	18"	0.013
BC_JCT_13_BC_JCT_12	BC_JCT_13_BC_JCT_12	Storm Sewer	BC_JCT_13	989.73	984.63	BC_JCT_12	989.05	984.16	78.2	0.6%	Circular	18"	0.013
BC_JCT_14_IC	BC_JCT_14.2	Inlet Rating Curve	ME04-A-0015-H-007	990.76	N/A	BC_JCT_14	990.99	N/A	N/A	N/A	N/A	N/A	N/A
BC_JCT_14_BC_JCT_13	BC_JCT_14_BC_JCT_13	Storm Sewer	BC_JCT_14	990.99	985.88	BC_JCT_13	989.73	984.63	196.8	0.6%	Circular	18"	0.013
BC_JCT_15_IC	BC_JCT_15.2	Inlet Rating Curve	ME04-A-0015-H-003	978.55	N/A	BC_JCT_15	978.90	N/A	N/A	N/A	N/A	N/A	N/A
BC_JCT_15_2648-001	BC_JCT_15_2648-001	Storm Sewer	BC_JCT_15	978.90	973.60	AS2648-001	979.03	971.60	55.6	3.6%	Circular	18"	0.013
BC_JCT_16_BC_JCT_15	BC_JCT_16_BC_JCT_15	Storm Sewer	BC_JCT_16	979.04	975.60	BC_JCT_15	978.90	973.60	5.6	35.8%	Circular	18"	0.013
BC_JCT_2_2545-001	BC_JCT_2_2545-001	Storm Sewer	BC_JCT_2	929.80	924.75	AS2545-001	929.74	923.10	164.8	1.0%	Circular	48"	0.013
BC_JCT_3_2749-002	BC_JCT_3_2749-002	Storm Sewer	BC_JCT_3	1033.20	1029.48	AS2749-002	1026.98	1021.33	180.3	4.5%	Circular	18"	0.013
BC_JCT_4_BC_JCT_5	BC_JCT_4_BC_JCT_5	Storm Sewer	BC_JCT_4	988.49	982.07	BC_JCT_5	980.83	976.35	152.3	3.8%	Circular	36"	0.024

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Link Name	Conduit Name	Type	Upstream Node Name	Upstream Rim Elevation	Upstream Invert Elevation	Downstream Node Name	Downstream Rim Elevation	Downstream Invert Elevation	Length (feet)	Slope	Pipe Shape	Size (inches)	Manning's n
BC_JCT_5_2947-013	BC_JCT_5_2947-013	Storm Sewer	BC_JCT_5	980.83	976.35	IN2947-013	978.21	972.09	74.0	5.8%	Circular	36"	0.013
BC_JCT_6_2947-002	BC_JCT_6_2947-002	Storm Sewer	BC_JCT_6	977.37	970.30	AS2947-002	965.06	961.94	158.0	5.3%	Circular	36"	0.013
BC_JCT_7_3046-026	BC_JCT_7_3046-026	Storm Sewer	HD3046-026	886.47	876.50	BC_JCT_7	885.65	876.47	41.7	0.1%	Rectangular	4'x12'	0.014
BC_JCT_8_2648-016	BC_JCT_8_2648-016	Storm Sewer	BC_JCT_8	986.63	983.44	IN2648-016	985.44	982.73	154.0	0.5%	Circular	18"	0.013
CB3044-023_IC	CB3044-023.2	Inlet Rating Curve	ME03-A-0039-K-009	912.28	N/A	CB3044-023	912.42	N/A	N/A	N/A	N/A	N/A	N/A
CB3145-036_IC	CB3145-036.2	Inlet Rating Curve	ME03-A-0039-K-003	884.45	N/A	CB3145-036	884.98	N/A	N/A	N/A	N/A	N/A	N/A
GR3244-002_BC_JCT_17	GR3244-002_BC_JCT_17	Open Channel	GR3244-002	861.20	851.20	BC_JCT_17	860.00	850.00	297.5	0.4%	Natural	N/A	0.014
GrassmanOutlet	GrassmanWeir	Outfall/Weir	PD_3046-006	887.60	N/A	SM_GW_09	885.27	N/A	N/A	N/A	N/A	N/A	N/A
GrassmanOutlet	GrassmanWeir2	Outfall/Weir	PD_3046-006	887.60	N/A	SM_GW_09	885.27	N/A	N/A	N/A	N/A	N/A	N/A
IN2446-007_IC	IN2446-007.2	Inlet Rating Curve	ME04-A-0014-H-001	961.02	N/A	IN2446-007	961.37	N/A	N/A	N/A	N/A	N/A	N/A
IN2546-002_IC	IN2546-002.2	Inlet Rating Curve	ME04-A-0406-H-000	927.48	N/A	IN2546-002	927.62	N/A	N/A	N/A	N/A	N/A	N/A
IN2546-019_IC	IN2546-019.2	Inlet Rating Curve	ME04-A-0014-H-000	953.20	N/A	IN2546-019	953.38	N/A	N/A	N/A	N/A	N/A	N/A
IN2646-011_IC	IN2646-011.2	Inlet Rating Curve	ME04-A-0013-H-002	965.39	N/A	IN2646-011	965.76	N/A	N/A	N/A	N/A	N/A	N/A
IN2648-024_IC	IN2648-024.2	Inlet Rating Curve	ME04-A-0015-H-005	984.99	N/A	IN2648-024	985.18	N/A	N/A	N/A	N/A	N/A	N/A
IN2749-004_IC	IN2749-004.2	Inlet Rating Curve	ME04-A-0022-H-000	1014.97	N/A	IN2749-004	1015.14	N/A	N/A	N/A	N/A	N/A	N/A
IN2749-035_IC	IN2749-035.2	Inlet Rating Curve	ME04-A-0022-H-002	1022.49	N/A	IN2749-035	1022.69	N/A	N/A	N/A	N/A	N/A	N/A
IN2749-047_IC	IN2749-047.2	Inlet Rating Curve	ME04-A-0022-H-001	1018.81	N/A	IN2749-047	1018.93	N/A	N/A	N/A	N/A	N/A	N/A
IN2847-009_IC	IN2847-009.2	Inlet Rating Curve	ME04-A-0029-H-001	980.99	N/A	IN2847-009	981.35	N/A	N/A	N/A	N/A	N/A	N/A
IN2847-012_AE2847-022	IN2847-012_AE2847-022	Storm Sewer	IN2847-021	981.04	978.08	AE2847-022	987.64	977.64	147.8	0.3%	Special	14"x23"	0.014
IN2847-018_IC	IN2847-018.2	Inlet Rating Curve	ME04-A-0029-H-000	996.68	N/A	IN2847-018	996.78	N/A	N/A	N/A	N/A	N/A	N/A
IN2847-021_IC	IN2847-021.2	Inlet Rating Curve	ME04-A-0029-H-003	980.96	N/A	IN2847-021	981.04	N/A	N/A	N/A	N/A	N/A	N/A
IN2848-012_IC	IN2848-012.2	Inlet Rating Curve	ME04-A-0015-H-012	1013.64	N/A	IN2848-012	1014.02	N/A	N/A	N/A	N/A	N/A	N/A
IN2849-013_IC	IN2849-013.2	Inlet Rating Curve	ME04-A-0022-H-003	1022.06	N/A	IN2849-013	1022.19	N/A	N/A	N/A	N/A	N/A	N/A
IN2850-004_IC	IN2850-004.2	Inlet Rating Curve	ME03-A-0021-H-008	1021.89	N/A	IN2850-004	1022.19	N/A	N/A	N/A	N/A	N/A	N/A
IN2947-013_IC	IN2947-013.2	Inlet Rating Curve	ME03-A-0021-H-002	978.02	N/A	IN2947-013	978.21	N/A	N/A	N/A	N/A	N/A	N/A
IN3044-004_IC	IN3044-004.2	Inlet Rating Curve	ME03-A-0039-K-007	893.30	N/A	IN3044-004	893.73	N/A	N/A	N/A	N/A	N/A	N/A
IN3045-003_IC	IN3045-003.2	Inlet Rating Curve	ME03-A-0039-K-008	894.83	N/A	IN3045-003	894.94	N/A	N/A	N/A	N/A	N/A	N/A
IN3045-009_IC	IN3045-009.2	Inlet Rating Curve	ME03-A-0039-K-005	876.88	N/A	IN3045-009	976.98	N/A	N/A	N/A	N/A	N/A	N/A
IN3045-009_GR3045-010	IN3045-009_GR3045-010	Storm Sewer	IN3045-009	976.98	874.60	GR3045-010	884.50	874.50	30.8	0.3%	Circular	18"	0.014
IN3045-015_IC	IN3045-015.2	Inlet Rating Curve	ME03-A-0041-K-000	889.88	N/A	IN3045-015	890.14	N/A	N/A	N/A	N/A	N/A	N/A
IN3045-020_IC	IN3045-020.2	Inlet Rating Curve	ME03-A-0041-K-001	907.43	N/A	IN3045-020	907.65	N/A	N/A	N/A	N/A	N/A	N/A
IN3146-003_IN3146-004	IN3146-003_IN3146-004	Storm Sewer	IN3146-003	910.79	904.52	IN3146-004	911.22	904.41	11.0	1.0%	Special	14"x23"	0.014
IN3146-004_IN3146-006	IN3146-004_IN3146-006	Storm Sewer	IN3146-004	911.22	904.41	IN3146-006	906.44	902.92	74.9	2.0%	Circular	12"	0.024
IN3146-006_AE3146-009	IN3146-006_AE3146-009	Storm Sewer	IN3146-006	906.44	902.92	AE3146-009	912.15	902.15	76.6	1.0%	Circular	15"	0.014
IN3146-011_IC	IN3146-011.2	Inlet Rating Curve	ME03-A-0039-K-006	911.71	N/A	IN3146-011	911.71	N/A	N/A	N/A	N/A	N/A	N/A
IN3146-011_AS3146-010	IN3146-011_AS3146-010	Storm Sewer	IN3146-011	911.71	904.84	AS3146-010	912.03	904.74	9.4	1.0%	Special	14"x23"	0.014
IN3146-013_IC	IN3146-013.2	Inlet Rating Curve	ME03-A-0040-K-001	916.95	N/A	IN3146-013	917.44	N/A	N/A	N/A	N/A	N/A	N/A
3244-003_01-3244-003.1	InletWeir	Outfall/Weir	3244-003_01-3244-003	865.40	N/A	GR3244-003	857.02	N/A	N/A	N/A	N/A	N/A	N/A
Link335	Link335	Storm Sewer	Node373	891.60	878.47	AS3046-022	881.52	878.27	41.0	0.5%	Circular	12"	0.013
Link334	Outlet	Outfall/Weir	PD_3046-028	892.60	N/A	IN3046-024	892.60	N/A	N/A	N/A	N/A	N/A	N/A
Link336	OutletS	Outfall/Weir	PD_3046-029	883.60	N/A	Node373	891.60	N/A	N/A	N/A	N/A	N/A	N/A
PONWOOD_2747-007	PONWOOD_2747-007	Storm Sewer	PONDWOOD	966.10	963.60	IN2747-007	972.75	962.64	140.0	0.7%	Circular	30"	0.014
SkylinePondOutlet	SkylineOrifice	Outfall/Weir	GR_2946-016	916.50	N/A	PD3046-003	924.00	N/A	N/A	N/A	N/A	N/A	N/A
SkylinePondOutlet	SkylineWeir.1	Outfall/Weir	GR_2946-016	916.50	N/A	PD3046-003	924.00	N/A	N/A	N/A	N/A	N/A	N/A
SkylinePondOutlet	SkylineWeir3.1	Outfall/Weir	GR_2946-016	916.50	N/A	PD3046-003	924.00	N/A	N/A	N/A	N/A	N/A	N/A
SM_GW_04_3244-003_01	SM_GW_04_3244-003_01	Open Channel	GR3244-003_02	871.55	861.55	3244-003_01-3244-003	865.40	855.40	733.4	0.8%	Natural	N/A	0.014

Table C-1
Existing XPSWMM™ Model Link Inputs
Stricker's / Mendota Watershed Study Report, City of Madison, WI

Link Name	Conduit Name	Type	Upstream Node Name	Upstream Rim Elevation	Upstream Invert Elevation	Downstream Node Name	Downstream Rim Elevation	Downstream Invert Elevation	Length (feet)	Slope	Pipe Shape	Size (inches)	Manning's n
SM_GW_04_3244-003_02	SM_GW_04_3244-003_02	Open Channel	SM_GW_04	875.34	865.34	GR3244-003_02	871.55	861.55	285.7	1.3%	Natural	N/A	0.014
SM_GW_05_SM_GW_04	SM_GW_05_SM_GW_04	Storm Sewer	SM_GW_05	876.91	866.91	SM_GW_04	875.34	865.34	140.1	1.1%	Rectangular	6'x10'	0.014
SM_GW_06_3046-026	SM_GW_06_3046-026	Open Channel	SM_GW_06	890.40	880.40	HD3046-026	886.47	876.47	159.8	2.5%	Natural	N/A	0.014
SM_GW_09_SM_GW_06	SM_GW_09_SM_GW_06	Storm Sewer	SM_GW_09	885.27	880.40	SM_GW_06	890.40	880.40	20.0	0.0%	Circular	30"	0.014
SM_GW_16_SM_GW_12	SM_GW_16_SM_GW_12	Storm Sewer	SM_GW_16	885.10	884.10	PD_3046-006	887.60	883.90	20.0	1.0%	Circular	12"	0.024
SM_GW_17_SM_GW_13	SM_GW_17_SM_GW_13	Storm Sewer	SM_GW_17	885.42	884.10	PD_3046-006	887.60	883.90	20.0	1.0%	Circular	12"	0.024
SM_GW_18_SM_GW_14	SM_GW_18_SM_GW_14	Storm Sewer	SM_GW_18	888.10	884.10	PD_3046-006	887.60	883.90	19.3	1.0%	Circular	12"	0.024
SM_GW_19_SM_GW_15	SM_GW_19_SM_GW_15	Storm Sewer	SM_GW_19	885.34	884.10	PD_3046-006	887.60	883.90	19.9	1.0%	Circular	12"	0.024
SM_GW_27_SM_GW_24	SM_GW_27_SM_GW_24	Storm Sewer	SM_GW_27	926.06	921.21	SM_GW_24	924.09	921.12	27.0	0.3%	Circular	30"	0.013

Table C-2
Existing XPSWMM™ Model Node Inputs
Stricker's / Mendota Watershed Study Report, City of Madison, WI

Node Name	Node Type	Ponding Type	Invert Elevation (ft)	Spill Crest Elevation (ft)
3244-003_01-3244-003	Conveyance	Link Spill Crest to 2D	855.40	891.60
AE2944-014	Conveyance	Link Invert to 2D	917.60	926.33
AE3145-035	Conveyance	Link Invert to 2D	869.71	979.03
AE3146-009	Conveyance	Link Invert to 2D	902.15	912.15
AS2446-012	Conveyance	Link Spill Crest to 2D	957.25	974.10
AS2446-013	Conveyance	Link Spill Crest to 2D	957.75	885.22
AS2446-014	Conveyance	Link Spill Crest to 2D	962.00	885.26
AS2446-020	Conveyance	Link Spill Crest to 2D	964.00	889.55
AS2447-003	Conveyance	Sealed	967.94	901.94
AS2447-008	Conveyance	Link Spill Crest to 2D	970.22	892.60
AS2545-001	Conveyance	Link Spill Crest to 2D	923.10	953.38
AS2546-001	Conveyance	Sealed	934.30	934.23
AS2546-009	Conveyance	Link Spill Crest to 2D	948.26	966.66
AS2546-010	Conveyance	Link Spill Crest to 2D	942.91	966.79
AS2546-011	Conveyance	Link Spill Crest to 2D	931.25	965.57
AS2546-020	Conveyance	Sealed	924.44	993.02
AS2646-001	Conveyance	Sealed	926.56	959.86
AS2646-003	Conveyance	Sealed	951.88	929.85
AS2646-004	Conveyance	Link Spill Crest to 2D	943.63	961.37
AS2646-005	Conveyance	Link Spill Crest to 2D	935.57	961.19
AS2646-009	Conveyance	Link Spill Crest to 2D	955.19	966.51
AS2646-018	Conveyance	Link Spill Crest to 2D	944.18	886.47
AS2647-001	Conveyance	Link Spill Crest to 2D	959.70	1004.06
AS2647-002	Conveyance	Sealed	963.02	985.44
AS2647-003	Conveyance	Link Spill Crest to 2D	969.66	985.37
AS2647-004	Conveyance	Link Spill Crest to 2D	955.85	1010.93
AS2648-001	Conveyance	Link Spill Crest to 2D	971.60	886.47
AS2648-002	Conveyance	Link Spill Crest to 2D	987.36	1012.02
AS2648-003	Conveyance	Sealed	974.60	1026.26
AS2648-005	Conveyance	Link Spill Crest to 2D	977.45	893.73
AS2648-006	Conveyance	Link Spill Crest to 2D	992.43	1004.14
AS2648-007	Conveyance	Link Spill Crest to 2D	998.61	999.70
AS2648-030	Conveyance	Sealed	983.74	857.22
AS2649-001	Conveyance	Sealed	1003.30	978.21
AS2649-002	Conveyance	Link Spill Crest to 2D	1007.65	904.74
AS2649-006	Conveyance	Sealed	1020.45	1009.66
AS2747-005	Conveyance	Sealed	960.83	1008.72
AS2747-006	Conveyance	Link Spill Crest to 2D	962.02	1008.53
AS2748-001	Conveyance	Sealed	995.33	1010.50
AS2748-004	Conveyance	Link Spill Crest to 2D	994.73	961.34
AS2748-006	Conveyance	Link Spill Crest to 2D	994.10	1014.02
AS2749-002	Conveyance	Link Spill Crest to 2D	1021.33	1005.12
AS2749-007	Conveyance	Link Spill Crest to 2D	1007.27	1021.17
AS2749-013	Conveyance	Sealed	998.33	1022.19
AS2749-017	Conveyance	Link Spill Crest to 2D	1013.52	965.06
AS2749-018	Conveyance	Link Spill Crest to 2D	1015.43	966.07
AS2749-024	Conveyance	Link Spill Crest to 2D	1000.20	950.81
AS2749-027	Conveyance	Link Spill Crest to 2D	997.13	997.71
AS2749-033	Conveyance	Link Spill Crest to 2D	996.07	995.86
AS2847-001	Conveyance	Sealed	972.16	968.07
AS2847-006	Conveyance	Link Spill Crest to 2D	973.01	973.63

Table C-2
Existing XPSWMM™ Model Node Inputs
Stricker's / Mendota Watershed Study Report, City of Madison, WI

Node Name	Node Type	Ponding Type	Invert Elevation (ft)	Spill Crest Elevation (ft)
AS2847-012	Conveyance	Link Spill Crest to 2D	978.01	1000.80
AS2847-013	Conveyance	Link Spill Crest to 2D	978.51	998.40
AS2848-004	Conveyance	Sealed	1002.18	1026.98
AS2848-006	Conveyance	Link Spill Crest to 2D	1003.95	1026.07
AS2849-001	Conveyance	Link Spill Crest to 2D	1000.18	1024.48
AS2849-005	Conveyance	Link Spill Crest to 2D	1001.48	1024.07
AS2944-013	Runoff	Link Spill Crest to 2D	919.00	919.46
AS2946-003	Conveyance	Link Spill Crest to 2D	908.70	980.58
AS2946-004	Conveyance	Link Spill Crest to 2D	924.70	996.78
AS2946-005	Conveyance	Link Spill Crest to 2D	940.15	974.98
AS2947-002	Conveyance	Link Spill Crest to 2D	961.94	926.18
AS2947-003	Conveyance	Link Spill Crest to 2D	956.56	929.74
AS2947-004	Conveyance	Link Spill Crest to 2D	946.11	939.26
AS2948-001	Conveyance	Sealed	993.60	927.62
AS2948-002	Conveyance	Link Spill Crest to 2D	991.20	927.47
AS2948-004	Conveyance	Link Spill Crest to 2D	997.20	953.45
AS2948-005	Conveyance	Link Spill Crest to 2D	1000.36	953.48
AS2949-002	Conveyance	Sealed	1010.60	947.11
AS2949-012	Conveyance	Link Spill Crest to 2D	1006.99	972.97
AS2950-004	Conveyance	Link Spill Crest to 2D	1015.10	1022.37
AS2950-005	Conveyance	Sealed	1014.07	1022.35
AS2950-006	Conveyance	Link Spill Crest to 2D	1021.67	1024.09
AS2950-020	Conveyance	Sealed	1028.60	1024.26
AS2950-023	Conveyance	Link Spill Crest to 2D	1013.98	868.95
AS2950-024	Conveyance	Link Spill Crest to 2D	1018.69	907.01
AS2950-025	Conveyance	Link Spill Crest to 2D	1021.05	878.33
AS2950-027	Conveyance	Sealed	1028.86	896.95
AS3044-002	Conveyance	Link Spill Crest to 2D	888.34	981.49
AS3044-003	Conveyance	Link Spill Crest to 2D	893.90	982.25
AS3044-022	Conveyance	Link Spill Crest to 2D	899.25	1022.42
AS3044-030	Conveyance	Link Spill Crest to 2D	913.55	1047.63
AS3044-033	Conveyance	Sealed	920.35	1022.48
AS3044-036	Conveyance	Link Spill Crest to 2D	888.11	905.82
AS3044-037	Conveyance	Link Spill Crest to 2D	885.06	858.66
AS3045-024	Conveyance	Link Spill Crest to 2D	924.39	903.83
AS3045-026	Conveyance	Link Spill Crest to 2D	926.67	909.54
AS3046-014	Conveyance	Sealed	883.73	907.65
AS3046-022	Conveyance	None	878.27	865.40
AS3145-018	Conveyance	Link Spill Crest to 2D	881.65	874.62
AS3145-023	Conveyance	Link Spill Crest to 2D	871.91	902.37
AS3145-024	Conveyance	Sealed	869.95	857.02
AS3145-028	Conveyance	Link Spill Crest to 2D	869.80	880.03
AS3145-040	Conveyance	Link Spill Crest to 2D	887.13	924.00
AS3145-048	Conveyance	Sealed	901.41	861.20
AS3146-010	Conveyance	Link Spill Crest to 2D	904.74	912.03
AS3245-001	Runoff	Link Spill Crest to 2D	857.10	907.18
AS3245-002	Runoff	Link Spill Crest to 2D	854.20	904.85
AS3245-003	Conveyance	Sealed	860.60	904.18
AS3245-005	Conveyance	Sealed	854.53	881.72
AS3246-004	Conveyance	Link Spill Crest to 2D	901.12	905.86
AS3246-014	Conveyance	Link Spill Crest to 2D	902.23	917.44

Table C-2
Existing XPSWMM™ Model Node Inputs
Stricker's / Mendota Watershed Study Report, City of Madison, WI

Node Name	Node Type	Ponding Type	Invert Elevation (ft)	Spill Crest Elevation (ft)
AS3246-016	Conveyance	Link Spill Crest to 2D	900.27	886.39
AS3246-020	Conveyance	Sealed	899.74	885.32
AS3246-024	Conveyance	Link Spill Crest to 2D	900.72	881.34
BC_JCT_11	Conveyance	Link Spill Crest to 2D	860.50	989.05
BC_JCT_12	Conveyance	Link Spill Crest to 2D	984.16	989.73
BC_JCT_13	Conveyance	Link Spill Crest to 2D	984.63	990.99
BC_JCT_14	Conveyance	Link Spill Crest to 2D	985.88	978.90
BC_JCT_15	Conveyance	Sealed	973.60	979.04
BC_JCT_16	Conveyance	Link Spill Crest to 2D	975.60	984.58
BC_JCT_17	Conveyance	Link Spill Crest to 2D	850.00	887.60
BC_JCT_2	Conveyance	Link Spill Crest to 2D	924.75	1033.20
BC_JCT_3	Conveyance	Link Spill Crest to 2D	1029.48	988.49
BC_JCT_4	Conveyance	Link Spill Crest to 2D	982.07	980.83
BC_JCT_5	Conveyance	Link Spill Crest to 2D	976.35	977.37
BC_JCT_6	Conveyance	Link Spill Crest to 2D	970.30	885.65
BC_JCT_7	Conveyance	Link Spill Crest to 2D	876.40	986.63
BC_JCT_8	Conveyance	Link Spill Crest to 2D	983.44	860.00
BC_JCT_9	Conveyance	Link Spill Crest to 2D	852.00	865.72
CB2749-046	Conveyance	Link Spill Crest to 2D	1004.12	1022.84
CB3044-013	Conveyance	Link Spill Crest to 2D	890.65	1026.44
CB3044-019	Conveyance	Link Spill Crest to 2D	894.27	1033.55
CB3044-023	Conveyance	Sealed	903.46	1022.19
CB3145-020	Conveyance	Link Spill Crest to 2D	874.52	895.26
CB3145-031	Conveyance	Link Spill Crest to 2D	866.53	987.86
CB3145-036	Conveyance	Sealed	874.76	956.66
CB3145-043	Conveyance	Link Spill Crest to 2D	891.50	924.00
GR_2946-016	Runoff	Link Spill Crest to 2D	893.70	881.52
GR3045-010	Conveyance	Link Invert to 2D	874.50	884.50
GR3244-002	Conveyance	Link Spill Crest to 2D	851.20	885.42
GR3244-003	Conveyance	Allowed	852.72	885.10
GR3244-003_02	Runoff	Link Spill Crest to 2D	861.55	879.49
HD3046-025	Conveyance	Link Invert to 2D	876.40	924.09
HD3046-025_01	Runoff	Link Spill Crest to 2D	869.49	877.47
HD3046-025_02	Conveyance	Link Spill Crest to 2D	867.47	928.86
HD3046-026	Conveyance	Link Invert to 2D	876.47	925.41
HIGHLANDDEPRESSION	Runoff	Link Spill Crest to 2D	984.50	860.00
IN2446-007	Conveyance	Sealed	957.22	978.34
IN2446-008	Conveyance	Link Spill Crest to 2D	957.80	981.47
IN2446-011	Conveyance	Link Spill Crest to 2D	953.23	998.44
IN2446-021	Conveyance	Link Spill Crest to 2D	967.69	892.18
IN2447-006	Conveyance	Link Spill Crest to 2D	969.50	885.14
IN2447-007	Conveyance	Link Spill Crest to 2D	969.63	887.20
IN2546-002	Conveyance	Sealed	923.83	960.17
IN2546-003	Conveyance	Link Spill Crest to 2D	923.71	955.32
IN2546-008	Conveyance	Link Spill Crest to 2D	949.74	942.95
IN2546-019	Conveyance	Sealed	948.00	965.76
IN2645-002	Conveyance	Link Spill Crest to 2D	923.32	937.22
IN2646-006	Conveyance	Link Spill Crest to 2D	955.98	957.51
IN2646-010	Conveyance	Link Spill Crest to 2D	958.31	974.22
IN2646-011	Conveyance	Sealed	958.15	975.56
IN2646-015	Conveyance	Link Spill Crest to 2D	956.85	970.21

Table C-2
Existing XPSWMM™ Model Node Inputs
Stricker's / Mendota Watershed Study Report, City of Madison, WI

Node Name	Node Type	Ponding Type	Invert Elevation (ft)	Spill Crest Elevation (ft)
IN2648-016	Conveyance	Link Spill Crest to 2D	982.73	1032.84
IN2648-017	Conveyance	Link Spill Crest to 2D	982.69	1032.51
IN2648-024	Conveyance	Sealed	982.52	973.17
IN2747-002	Conveyance	Link Spill Crest to 2D	971.10	1007.87
IN2747-007	Conveyance	Link Spill Crest to 2D	962.64	1009.38
IN2749-003	Conveyance	Link Spill Crest to 2D	1020.73	1003.09
IN2749-004	Conveyance	Sealed	1011.35	1002.04
IN2749-005	Conveyance	Link Spill Crest to 2D	1007.30	1022.69
IN2749-009	Conveyance	Link Spill Crest to 2D	999.38	985.18
IN2749-035	Conveyance	Sealed	1015.23	1002.95
IN2749-042	Conveyance	Link Spill Crest to 2D	1029.19	963.04
IN2749-043	Conveyance	Link Spill Crest to 2D	1029.77	966.75
IN2749-047	Conveyance	Sealed	1013.12	1023.62
IN2847-009	Conveyance	Sealed	978.00	972.75
IN2847-014	Conveyance	Link Spill Crest to 2D	980.10	1003.67
IN2847-018	Conveyance	Sealed	993.00	1011.61
IN2847-021	Conveyance	Sealed	978.08	987.64
IN2848-001	Conveyance	Link Spill Crest to 2D	1000.10	1005.69
IN2848-002	Conveyance	Link Spill Crest to 2D	1008.09	1006.99
IN2848-007	Conveyance	Link Spill Crest to 2D	1004.75	1015.14
IN2848-009	Conveyance	Link Spill Crest to 2D	1006.20	1012.52
IN2848-011	Conveyance	Link Spill Crest to 2D	1007.44	1012.77
IN2848-012	Conveyance	Sealed	1010.44	1004.33
IN2849-012	Conveyance	Link Spill Crest to 2D	1018.17	1005.22
IN2849-013	Conveyance	Sealed	1017.12	1015.30
IN2850-003	Conveyance	Link Spill Crest to 2D	1017.05	1028.08
IN2850-004	Conveyance	Sealed	1016.10	1033.22
IN2850-005	Conveyance	Link Spill Crest to 2D	1018.20	1021.47
IN2850-010	Conveyance	Link Spill Crest to 2D	1018.76	862.11
IN2850-015	Conveyance	Link Spill Crest to 2D	1019.40	892.49
IN2946-014	Runoff	None	898.50	971.41
IN2947-013	Conveyance	Sealed	972.09	969.44
IN2949-010	Conveyance	Link Spill Crest to 2D	1006.18	972.30
IN2950-021	Conveyance	Link Spill Crest to 2D	1016.08	859.06
IN2950-022	Conveyance	Link Spill Crest to 2D	1015.10	865.69
IN3044-001	Conveyance	Link Spill Crest to 2D	892.46	981.35
IN3044-004	Conveyance	Sealed	890.10	1011.02
IN3045-003	Conveyance	Sealed	891.50	983.43
IN3045-009	Conveyance	Sealed	874.60	976.98
IN3045-013	Conveyance	Link Spill Crest to 2D	879.17	933.03
IN3045-015	Conveyance	Sealed	882.40	919.50
IN3045-017	Conveyance	Link Spill Crest to 2D	890.49	1009.96
IN3045-020	Conveyance	Sealed	904.06	1018.93
IN3045-023	Conveyance	Link Spill Crest to 2D	915.97	899.63
IN3045-028	Conveyance	Link Spill Crest to 2D	931.23	912.42
IN3046-010	Conveyance	Link Spill Crest to 2D	881.29	890.14
IN3046-012	Conveyance	Link Spill Crest to 2D	881.44	894.20
IN3046-018	Conveyance	Link Spill Crest to 2D	888.28	919.61
IN3046-019	Conveyance	Link Spill Crest to 2D	898.22	928.28
IN3046-021	Conveyance	Link Spill Crest to 2D	877.43	931.81
IN3046-024	Conveyance	None	879.51	923.11

Table C-2
Existing XPSWMM™ Model Node Inputs
Stricker's / Mendota Watershed Study Report, City of Madison, WI

Node Name	Node Type	Ponding Type	Invert Elevation (ft)	Spill Crest Elevation (ft)
IN3145-019	Conveyance	Link Spill Crest to 2D	878.39	884.98
IN3145-025	Conveyance	Link Spill Crest to 2D	869.87	909.63
IN3145-030	Conveyance	Link Spill Crest to 2D	869.68	904.73
IN3146-003	Conveyance	Link Spill Crest to 2D	904.52	910.79
IN3146-004	Conveyance	Link Spill Crest to 2D	904.41	911.22
IN3146-006	Conveyance	Link Spill Crest to 2D	902.92	906.44
IN3146-011	Conveyance	Sealed	904.84	911.71
IN3146-013	Conveyance	Sealed	912.90	881.11
IN3245-004	Conveyance	Link Spill Crest to 2D	863.20	905.82
IN3246-009	Conveyance	Link Spill Crest to 2D	873.20	905.91
IN3246-023	Conveyance	Link Spill Crest to 2D	901.22	885.02
IN3246-025	Conveyance	Link Spill Crest to 2D	900.89	880.98
IN3246-027	Conveyance	Link Spill Crest to 2D	901.05	881.16
ME03-A-0021-H-002	Runoff	Link Invert to 2D	978.02	894.83
ME03-A-0021-H-004	Runoff	Link Invert to 2D	996.29	1014.62
ME03-A-0021-H-005	Runoff	Link Invert to 2D	1014.62	1023.40
ME03-A-0021-H-006	Runoff	Link Invert to 2D	1023.40	1033.05
ME03-A-0021-H-007	Runoff	Link Invert to 2D	1032.98	925.72
ME03-A-0021-H-008	Runoff	Link Invert to 2D	1021.89	978.02
ME03-A-0021-H-009	Runoff	Link Invert to 2D	1033.05	1032.98
ME03-A-0039-K-002	Runoff	Link Invert to 2D	880.77	865.41
ME03-A-0039-K-003	Runoff	Link Invert to 2D	884.45	961.02
ME03-A-0039-K-004	Runoff	Link Invert to 2D	909.10	916.95
ME03-A-0039-K-005	Runoff	Link Invert to 2D	876.88	876.88
ME03-A-0039-K-006	Runoff	Link Invert to 2D	911.71	911.71
ME03-A-0039-K-007	Runoff	Link Invert to 2D	893.30	912.28
ME03-A-0039-K-008	Runoff	Link Invert to 2D	894.83	889.88
ME03-A-0039-K-009	Runoff	Link Invert to 2D	912.28	971.19
ME03-A-0039-K-010	Runoff	Link Invert to 2D	925.73	889.10
ME03-A-0040-K-000	Runoff	Link Invert to 2D	889.10	880.77
ME03-A-0040-K-001	Runoff	Link Invert to 2D	916.95	903.81
ME03-A-0041-K-000	Runoff	Link Invert to 2D	889.88	907.43
ME03-A-0041-K-001	Runoff	Link Invert to 2D	907.43	909.10
ME03-B-0040-A-000	Runoff	Link Invert to 2D	858.45	990.76
ME03-B-0040-A-003	Runoff	Link Invert to 2D	865.41	858.45
ME03-B-0040-A-004	Runoff	Link Invert to 2D	903.81	971.04
ME04-A-0013-H-000	Runoff	Link Invert to 2D	968.03	1000.19
ME04-A-0013-H-002	Runoff	Link Invert to 2D	965.39	984.99
ME04-A-0014-H-000	Runoff	Link Invert to 2D	953.20	965.39
ME04-A-0014-H-001	Runoff	Link Invert to 2D	961.02	927.48
ME04-A-0014-H-002	Runoff	Link Invert to 2D	971.19	939.06
ME04-A-0015-H-000	Runoff	Link Invert to 2D	933.96	959.66
ME04-A-0015-H-001	Runoff	Link Invert to 2D	959.66	973.80
ME04-A-0015-H-002	Runoff	Link Invert to 2D	973.80	978.24
ME04-A-0015-H-003	Runoff	Link Invert to 2D	978.55	884.45
ME04-A-0015-H-004	Runoff	Link Invert to 2D	978.24	987.43
ME04-A-0015-H-005	Runoff	Link Invert to 2D	984.99	1014.97
ME04-A-0015-H-006	Runoff	Link Invert to 2D	987.43	1010.49
ME04-A-0015-H-007	Runoff	None	990.76	988.55
ME04-A-0015-H-008	Runoff	Link Invert to 2D	1000.19	1003.87
ME04-A-0015-H-009	Runoff	Link Invert to 2D	1010.49	1026.00

Table C-2
Existing XPSWMM™ Model Node Inputs
Stricker's / Mendota Watershed Study Report, City of Madison, WI

Node Name	Node Type	Ponding Type	Invert Elevation (ft)	Spill Crest Elevation (ft)
ME04-A-0015-H-010	Runoff	Link Invert to 2D	1003.87	976.25
ME04-A-0015-H-011	Runoff	Link Invert to 2D	1007.67	996.29
ME04-A-0015-H-012	Runoff	Link Invert to 2D	1013.64	1022.06
ME04-A-0015-H-013	Runoff	Link Invert to 2D	1026.00	968.03
ME04-A-0022-H-000	Runoff	Link Invert to 2D	1014.97	1022.49
ME04-A-0022-H-001	Runoff	Link Invert to 2D	1018.81	980.99
ME04-A-0022-H-002	Runoff	Link Invert to 2D	1022.49	1018.81
ME04-A-0022-H-003	Runoff	Link Invert to 2D	1022.06	1021.89
ME04-A-0029-H-000	Runoff	Link Invert to 2D	996.68	1013.64
ME04-A-0029-H-001	Runoff	Link Invert to 2D	980.99	996.68
ME04-A-0029-H-003	Runoff	Link Invert to 2D	980.96	980.96
ME04-A-0029-H-004	Runoff	Link Invert to 2D	976.25	1007.67
ME04-A-0406-H-000	Runoff	Link Invert to 2D	927.48	953.20
ME04-A-0406-H-001	Runoff	Link Invert to 2D	939.06	929.49
ME04-A-0406-H-002	Runoff	Link Invert to 2D	929.49	933.96
Node373	Conveyance	None	878.47	871.55
PD_2046-021	Runoff	Link Spill Crest to 2D	920.00	930.00
PD_2847-023	Runoff	Link Spill Crest to 2D	975.60	918.00
PD_3046-006	Runoff	Link Spill Crest to 2D	879.60	892.60
PD_3046-028	Conveyance	Link Spill Crest to 2D	879.60	883.60
PD_3046-029	Conveyance	Link Spill Crest to 2D	878.60	930.00
PD3046-003	Conveyance	Link Spill Crest to 2D	892.80	885.34
PD3046-004	Conveyance	Link Invert to 2D	888.70	888.10
PONDWOOD	Runoff	Link Spill Crest to 2D	953.60	922.00
SM_GW_04	Conveyance	Link Invert to 2D	865.34	876.91
SM_GW_05	Conveyance	Link Invert to 2D	866.91	890.40
SM_GW_06	Conveyance	Link Invert to 2D	880.40	885.27
SM_GW_09	Conveyance	Link Spill Crest to 2D	880.40	929.34
SM_GW_16	Conveyance	Link Invert to 2D	884.10	875.34
SM_GW_17	Conveyance	Link Invert to 2D	884.10	924.24
SM_GW_18	Conveyance	Link Invert to 2D	884.10	925.51
SM_GW_19	Conveyance	Link Invert to 2D	884.10	924.48
SS3246-019	Conveyance	Link Spill Crest to 2D	899.60	856.50
STONEFIELD_MIDDLETON	Runoff	Link Spill Crest to 2D	909.80	916.50
STRICKERS_POND	Runoff	Link Spill Crest to 2D	918.00	966.10
T12450	Conveyance	Link Spill Crest to 2D	924.34	932.04
T12451	Runoff	Link Spill Crest to 2D	927.40	936.63
T12454	Conveyance	Link Spill Crest to 2D	931.60	932.66
T12456	Conveyance	Link Spill Crest to 2D	927.50	939.97
T13016	Conveyance	Link Invert to 2D	934.00	945.76
T13017	Conveyance	Link Spill Crest to 2D	940.66	945.87
T13018	Conveyance	Link Spill Crest to 2D	940.88	945.97
T13021	Conveyance	Link Spill Crest to 2D	940.92	945.57
T13025	Conveyance	Link Spill Crest to 2D	940.51	945.38
T13027	Conveyance	Link Spill Crest to 2D	940.61	947.43
T13028	Conveyance	Link Spill Crest to 2D	944.43	949.80
T13031	Runoff	Link Spill Crest to 2D	947.30	953.06
T13034	Conveyance	Link Spill Crest to 2D	950.56	958.88
T13037	Conveyance	Link Spill Crest to 2D	953.68	966.12
T13038	Conveyance	Link Spill Crest to 2D	957.76	968.35
T13040	Runoff	Link Spill Crest to 2D	960.92	966.04

Table C-2
Existing XPSWMM™ Model Node Inputs
Stricker's / Mendota Watershed Study Report, City of Madison, WI

Node Name	Node Type	Ponding Type	Invert Elevation (ft)	Spill Crest Elevation (ft)
T13041	Conveyance	Link Spill Crest to 2D	961.02	965.80
T13043	Conveyance	Link Spill Crest to 2D	961.04	970.66
T13050	Conveyance	Link Spill Crest to 2D	965.22	972.50
T13055	Conveyance	Link Spill Crest to 2D	967.48	974.02
T13056	Conveyance	Link Spill Crest to 2D	968.91	974.73
T13059MAD	Conveyance	Link Spill Crest to 2D	969.72	933.68
T13067	Conveyance	Link Spill Crest to 2D	928.62	932.72
T13068	Conveyance	Link Invert to 2D	928.72	923.50
T13078	Conveyance	Link Invert to 2D	918.40	925.73
T13080	Conveyance	Link Spill Crest to 2D	922.42	927.86
T13081	Conveyance	Link Spill Crest to 2D	924.51	929.59
T13082	Conveyance	Link Spill Crest to 2D	924.51	929.31
T13084	Conveyance	Link Spill Crest to 2D	924.61	941.33
T13087	Runoff	Link Spill Crest to 2D	933.92	960.97
T13093	Conveyance	Link Spill Crest to 2D	942.88	971.39
T13095	Conveyance	Link Spill Crest to 2D	947.20	976.95
T13096	Conveyance	Link Spill Crest to 2D	953.11	975.17
T13097	Conveyance	Link Spill Crest to 2D	956.50	973.05
T13098	Conveyance	Link Spill Crest to 2D	963.05	972.21
T13099	Conveyance	Link Spill Crest to 2D	966.05	972.09
T13100	Conveyance	Link Spill Crest to 2D	967.44	972.85
T13101	Conveyance	Link Spill Crest to 2D	967.01	973.33
T13102	Conveyance	Link Spill Crest to 2D	968.29	924.10
T13105	Conveyance	Link Invert to 2D	919.00	926.00
T13106	Runoff	Link Invert to 2D	921.00	917.10
T13108	Conveyance	Link Invert to 2D	922.00	925.39
T13109	Conveyance	Link Spill Crest to 2D	923.39	928.45
T13110	Runoff	Link Spill Crest to 2D	923.39	923.90
T13116	Conveyance	Link Invert to 2D	918.80	924.57
T13117	Conveyance	Link Spill Crest to 2D	918.89	924.00
T13118	Runoff	Link Spill Crest to 2D	918.89	923.87
T13119	Conveyance	Link Spill Crest to 2D	918.99	924.81
T13122	Conveyance	Link Spill Crest to 2D	919.83	916.75
T13128	Conveyance	Link Invert to 2D	915.00	920.27
T13129	Conveyance	Link Spill Crest to 2D	915.28	917.30
T13130	Conveyance	Link Invert to 2D	911.11	917.50
T13131	Conveyance	Link Invert to 2D	914.20	920.50
T13134	Conveyance	Link Invert to 2D	917.00	922.30
T13135	Runoff	Link Invert to 2D	917.20	913.00
T13136	Conveyance	Link Invert to 2D	918.00	925.65
T13137	Conveyance	Link Spill Crest to 2D	920.72	925.20
T13138	Conveyance	Link Spill Crest to 2D	920.72	925.96
T13139	Conveyance	Link Spill Crest to 2D	920.76	913.20
T13145	Conveyance	Link Invert to 2D	909.20	915.47
T13146	Conveyance	Link Spill Crest to 2D	909.57	913.57
T13149	Conveyance	Allowed	909.57	910.23
T13152	Conveyance	Link Invert to 2D	904.50	903.30
T13153	Runoff	Link Spill Crest to 2D	907.00	931.23
T13170	Conveyance	Link Invert to 2D	914.20	929.80
T13171	Conveyance	Link Invert to 2D	911.32	917.50
T14001	Conveyance	Link Spill Crest to 2D	926.50	930.94

Table C-2 Existing XPSWMM™ Model Node Inputs Stricker's / Mendota Watershed Study Report, City of Madison, WI				
Node Name	Node Type	Ponding Type	Invert Elevation (ft)	Spill Crest Elevation (ft)
T14002	Runoff	Link Spill Crest to 2D	926.80	927.74
T14006	Conveyance	Link Spill Crest to 2D	925.86	906.00
T14087	Runoff	Link Spill Crest to 2D	922.20	929.01
T14096	Runoff	Link Spill Crest to 2D	922.10	931.82
T14126	Conveyance	Link Spill Crest to 2D	927.00	934.09
T14128	Conveyance	Link Spill Crest to 2D	928.40	928.49
T14135	Conveyance	Link Spill Crest to 2D	920.66	927.16
T14136	Conveyance	Link Spill Crest to 2D	920.49	923.87
T14137	Conveyance	Link Spill Crest to 2D	920.13	923.32
T14138	Conveyance	Link Spill Crest to 2D	920.06	926.26
T14139	Conveyance	Link Invert to 2D	923.38	928.14
T14140	Conveyance	Link Invert to 2D	923.38	929.30
T14143	Conveyance	Link Invert to 2D	926.30	933.07
T14159	Runoff	Link Spill Crest to 2D	927.80	932.32
T14165	Conveyance	Link Spill Crest to 2D	920.86	917.30
TIEDEMANN_POND	Runoff	Link Spill Crest to 2D	910.00	980.00

Table C-3 Modeled Pond Summary Stricker's / Mendota Watershed Study Report, City of Madison, WI						
Pond Name	Node Name	Normal Water Elevation	Permanent Pool Area (acres)	Total Storage Volume (acre-feet)	Outlet Description	Data Sources
Grassman	PD_3046-006	884.6	0.8	3.6	V-Notch Weir, Broad-Crested Weir	As-Builts Plans, Site Visit
Old Middleton Road North	PD_3046-028	882.6	0.1	0.2	12" Pipe, Broad-Crested Weir	As-Built Plans
Old Middleton Road South	PD_3046-029	881.6	0.2	0.5	12" Pipe, Broad-Crested Weir	As-Built Plans
Ponwood Circle	PONDWOOD	963.6	1.5	3.2	30" Pipe	As-Built Plans, Site Visit
Skyview	GR_2946-016	N/A - Dry Pond	N/A - Dry Pond	2.9	15"x15" Orifice, Trapezoidal Weir	LiDAR, Site Visit
Stonefield Madison	PD_2847-023	N/A - Dry Pond	N/A - Dry Pond	3.7	24" Pipe	LiDAR, As-Builts
Stonefield Middleton	STONEFIELD_MIDDLETON	N/A - Dry Pond	N/A - Dry Pond	9.8	V-Notch Weir, Broad-Crested Weir	LiDAR, Site Visit
Stricker's Forebay	PD_2046-021	923.0	1.0	8.7	29"x45" Pipe (3)	LiDAR, Survey, Site Visit
Stricker's Pond	STRICKERS_POND	923.0	25.1	136.0	15" Pipe	LiDAR, Survey, Site Visit
Tiedeman Pond	TIEDEMANN_POND	911.0	27.9	271.0	N/A	LiDAR

Appendix D: Flooding Depth and Duration Results

Table D-1
Base (Un-Calibrated) Existing Conditions Flooding Results
Stricker's / Mendota Watershed Study Report, City of Madison, WI

Point	XP-SWMM Node	Location	Flood Elevation	50% Chance Storm				20% Chance Storm				10% Chance Storm				4% Chance Storm				2% Chance Storm				1% Chance Storm				0.2% Chance Storm			
				Peak WSE	Flood Depth (feet)	Flooding Duration (hours)		Peak WSE	Flood Depth (feet)	Flooding Duration (hours)		Peak WSE	Flood Depth (feet)	Flooding Duration (hours)		Peak WSE	Flood Depth (feet)	Flooding Duration (hours)		Peak WSE	Flood Depth (feet)	Flooding Duration (hours)		Peak WSE	Flood Depth (feet)	Flooding Duration (hours)		Peak WSE	Flood Depth (feet)	Flooding Duration (hours)	
1	3244-003_01-3244-003	Mendota Greenway - Upstream Side of Lake Mendota Greenway	858.4	856.6	-1.8	0.0		858.0	-0.4	0.0		859.2	0.8	1.1		859.9	1.5	2.3		860.3	1.9	2.7		860.6	2.2	3.3		861.3	2.9	4.4	
2	GR3244-003_02	Mendota Greenway - Between Lake Mendota Drive & University Avenue	863.8	864.4	0.6	3.1		865.0	1.2	3.7		865.2	1.4	4.2		865.5	1.7	4.8		865.7	1.9	5.3		866.0	2.2	5.9		866.7	2.9	7.2	
3	SM_GW_05	Mendota Greenway - Upstream Side of University Avenue Culvert	874.4	868.3	-6.1	0.0		870.0	-4.4	0.0		870.6	-3.8	0.0		871.4	-3.0	0.0		871.9	-2.5	0.0		872.6	-1.8	0.0		874.2	-0.2	0.0	
4	HD3046-025_01	Mendota Greenway - Between University Avenue & Old Middleton Road	871.0	871.5	0.5	2.6		872.1	1.1	3.5		872.4	1.4	4.0		872.9	1.9	4.5		873.3	2.3	5.0		873.7	2.7	5.5		875.0	4.0	6.8	
5	ME03-A-0039-K-005	Northwest end of Julia Court	877.0	878.1	1.1	17.9	**	878.2	1.2	18.7	**	878.3	1.3	19.2	**	878.4	1.4	19.8	**	878.5	1.5	20.2	**	878.6	1.6	20.5	**	878.8	1.8	21.1	**
6	PD_3046-006	Grassman Pond	887.2	887.2	0.0	0.2		887.6	0.4	1.4		887.7	0.5	2.0		887.9	0.7	2.7		887.9	0.7	3.1		888.0	0.8	3.7		888.2	1.0	5.0	
7	GR_2946-016	Skyview Pond	898.7	900.0	1.3	1.7		900.4	1.7	2.1		900.5	1.8	2.4		900.7	2.0	3.0		900.8	2.1	3.3		900.9	2.2	3.7		901.6	2.9	6.6	
8	AS2947-002	Highland Avenue Low-Point - South of Skyline Drive	965.1	963.2	-1.8	0.0		963.7	-1.4	0.0		966.2	1.1	0.1		968.2	3.1	0.7		968.7	3.6	0.8		968.9	3.9	1.0		969.3	4.3	1.9	
9	IN2949-010	North End of Blue Ridge Parkway - North of Appalachian Way	1009.7	1010.1	0.4	0.2		1011.0	1.3	0.7		1011.1	1.5	1.0		1011.4	1.7	1.4		1011.6	1.9	1.6		1011.8	2.1	1.8		1012.2	2.5	2.3	
10	AS3245-002	Intersection of Capital Drive & Lake Mendota Drive	859.1	856.8	-2.2	0.0		858.1	-1.0	0.0		858.9	-0.2	0.0		859.2	0.1	0.3		859.4	0.3	0.5		859.6	0.5	0.6		859.9	0.8	0.9	
11	TIEDEMANN_POND	Tiedemann Pond	915.6	912.1	-3.5	0.0		912.4	-3.2	0.0		912.7	-2.9	0.0		913.2	-2.4	0.0		913.6	-2.0	0.0		914.0	-1.6	0.0		915.9	0.3	3.4	**
12	STRICKERS_POND	Stricker's Pond	926.7	924.4	-2.3	0.0		925.1	-1.6	0.0		925.7	-1.0	0.0		926.6	-0.1	0.0		927.3	0.6	10.0	**	928.1	1.4	10.6	**	929.5	2.8	11.2	**
13	PD_2046-021	Stricker's Pond Fore-Bay	927.9	925.9	-2.0	0.0		926.4	-1.5	0.0		926.5	-1.4	0.0		926.6	-1.3	0.0		927.3	-0.6	0.0		928.1	0.2	7.2	**	929.5	1.6	10.8	**
14	ME04-A-0406-H-000	Longmeadow Road Low-Point - Near Strickers Pond	927.6	928.0	0.5	2.3		928.1	0.6	2.9		928.5	0.9	3.3		928.7	1.1	4.0		928.8	1.2	4.9		929.0	1.4	13.3	**	929.5	1.9	14.2	**
15	ME04-A-0014-H-000	Westfield Road Low-Point - Between Apple Hill Circle & Tramore Trail	953.3	953.6	0.3	1.8		953.7	0.4	2.2		953.8	0.5	2.5		954.1	0.8	2.9		954.7	1.4	3.3		955.0	1.7	3.7		955.5	2.2	4.4	
16	ME04-A-0015-H-001	Intersection of Longmeadow Road & Quail Ridge Drive	959.8	960.1	0.4	1.3		960.6	0.9	1.8		961.1	1.4	2.4		962.5	2.7	3.0		963.1	3.4	3.5		963.7	3.9	3.9		964.3	4.6	4.5	
17	ME04-A-0013-H-002	Gammon Road Low-Point - Between Longmeadow Road & Stone Glen Road	965.5	965.8	0.3	2.1		965.9	0.4	3.6		966.2	0.7	5.0		966.9	1.4	6.3		967.7	2.2	7.0		968.0	2.5	7.9		968.5	3.0	12.3	
18	AS2648-006	Intersection of Gammon Road & Harvest Hill Road	998.4	995.5	-3.0	0.0		996.4	-2.0	0.0		997.2	-1.3	0.0		998.0	-0.4	0.0		998.2	-0.2	0.0		998.9	0.5	0.4		999.2	0.7	1.0	
19	ME04-A-0015-H-005	Harvest Hill Road - Between Strathfield Circle & Morningdale Circle	985.1	985.2	0.1	0.8		986.4	1.3	1.2		986.9	1.8	1.4		987.5	2.4	1.8		987.9	2.8	2.0		988.3	3.2	2.2		988.9	3.8	2.7	
20	ME04-A-0015-H-009	Intersection of Gammon Road & Old Sauk Road	1010.6	1010.9	0.3	2.4		1011.4	0.8	3.0		1011.6	1.0	3.5		1011.9	1.3	4.4		1012.0	1.4	4.7		1012.2	1.6	5.5		1012.5	1.9	7.0	
21	ME04-A-0015-H-010	Intersection of Harvest Hill Road & Pebble Beach Drive	1004.0	1004.2	0.2	1.1		1005.0	1.0	1.5		1005.4	1.4	1.7		1005.7	1.8	2.0		1006.0	2.0	2.2		1006.3	2.3	2.4		1007.1	3.1	3.2	
22	PD_2847-023	Stonefield Pond	979.8	977.8	-2.0	0.0		978.5	-1.3	0.0		979.0	-0.8	0.0		979.7	-0.1	0.0		980.1	0.3	1.0		980.4	0.6	1.7		981.1	1.3	2.4	
23	ME04-A-0029-H-004	Intersection of Pebble Beach Drive & Sauk Ridge Trail	976.4	976.5	0.1	1.0		976.5	0.2	1.3		976.8	0.4	1.6		977.3	0.9	2.2		977.5	1.1	2.6		977.7	1.4	3.0		978.2	1.8	3.9	
24	T14006	City of Middleton - Stricker's Pond Inlet Sewer - Westfield Road	928.9	928.6	-0.2	0.0		930.2	1.3	0.9		930.8	2.0	1.6		931.4	2.5	2.8		931.6	2.8	2.2		931.9	3.1	2.1		932.3	3.5	12.2	**
25	T14087	City of Middleton - Stricker's Pond Inlet Sewer - Voss Parkway	927.7	924.5	-3.2	0.0		925.1	-2.6	0.0		925.8	-1.9	0.0		927.5	-0.3	0.0		927.9	0.1	0.3		929.1	1.3	11.9	**	930.2	2.5	12.0	**

**The model runtime was 24-hours. Flooding above the identified flood elevation continues at the end of the model runtime.

Table D-2
Calibrated Existing Conditions Flooding Results
Stricker's / Mendota Watershed Study Report, City of Madison, WI

Point	XP-SWMM Node	Location	Flood Elevation	50% Chance Storm				20% Chance Storm				10% Chance Storm				4% Chance Storm				2% Chance Storm				1% Chance Storm				0.2% Chance Storm				Back to Back Storms			
				Peak WSE	Flood Depth (feet)	Flooding Duration (hours)		Peak WSE	Flood Depth (feet)	Flooding Duration (hours)		Peak WSE	Flood Depth (feet)	Flooding Duration (hours)		Peak WSE	Flood Depth (feet)	Flooding Duration (hours)		Peak WSE	Flood Depth (feet)	Flooding Duration (hours)		Peak WSE	Flood Depth (feet)	Flooding Duration (hours)		Peak WSE	Flood Depth (feet)	Flooding Duration (hours)		Peak WSE	Flood Depth (feet)	Flooding Duration (hours)	
1	3244-003_01-3244-003	Mendota Greenway - Upstream Side of Lake Mendota Greenway	858.4	857.3	-1.1	0.0		859.2	0.8	1.1		859.7	1.3	2.0		860.3	1.9	2.8		860.6	2.2	3.2		860.9	2.5	3.7		861.5	3.1	4.9		861.0	2.6	7.9	
2	GR3244-003_02	Mendota Greenway - Between Lake Mendota Drive & University Avenue	863.8	864.8	1.0	3.4		865.2	1.4	4.0		865.4	1.6	4.5		865.7	1.9	5.1		865.9	2.1	5.6		866.3	2.5	6.2		866.9	3.1	7.7		866.3	2.5	13.3	
3	SM_GW_05	Mendota Greenway - Upstream Side of University Avenue Culvert	874.4	869.7	-4.7	0.0		870.5	-3.9	0.0		871.1	-3.3	0.0		871.9	-2.5	0.0		872.4	-2.0	0.0		873.2	-1.2	0.0		874.7	0.3	0.5		873.3	-1.1	0.0	
4	HD3046-025_01	Mendota Greenway - Between University Avenue & Old Middleton Road	871.0	871.9	0.9	3.0		872.4	1.4	3.8		872.7	1.7	4.3		873.2	2.2	4.8		873.6	2.6	5.3		874.1	3.1	5.9		875.4	4.4	7.2		874.3	3.3	12.5	
5	ME03-A-0039-K-005	Northwest end of Julia Court	877.0	878.1	1.2	18.4	**	878.3	1.3	19.2	**	878.3	1.4	19.7	**	878.4	1.5	20.3	**	878.5	1.6	20.7	**	878.7	1.7	21.0	**	878.9	1.9	21.5	**	878.7	1.7	45.1	***
6	PD_3046-006	Grassman Pond	887.2	887.7	0.5	3.3		887.8	0.6	4.1		887.9	0.7	4.6		888.0	0.8	5.3		888.1	0.9	5.8		888.2	1.0	6.4		888.3	1.1	8.3		888.2	1.0	14.3	
7	GR_2946-016	Skyview Pond	898.7	900.3	1.6	2.2		900.5	1.8	2.7		900.6	1.9	3.2		900.7	2.0	3.6		900.8	2.1	4.0		900.9	2.2	4.5		901.9	3.2	7.8		901.0	2.3	11.6	
8	AS2947-002	Highland Avenue Low-Point - South of Skyline Drive	965.1	963.3	-1.8	0.0		964.1	-0.9	0.0		966.9	1.8	0.4		968.5	3.4	0.8		968.8	3.7	0.9		969.0	4.0	1.3		969.4	4.4	2.9		969.3	4.2	4.0	
9	IN2949-010	North End of Blue Ridge Parkway - North of Appalachian Way	1009.7	1010.7	1.0	0.6		1011.1	1.4	1.0		1011.2	1.6	1.4		1011.5	1.9	1.7		1011.7	2.1	1.8		1011.9	2.2	2.0		1012.3	2.6	2.6		1011.9	2.3	4.2	
10	AS3245-002	Intersection of Capital Drive & Lake Mendota Drive	859.1	857.5	-1.5	0.0		858.9	-0.1	0.0		859.1	0.1	0.1		859.4	0.3	0.5		859.5	0.4	0.6		859.6	0.6	0.7		860.0	0.9	0.9		859.7	0.6	1.3	
11	TIEDEMANN_POND	Tiedemann Pond	915.6	912.1	-3.5	0.0		912.5	-3.1	0.0		912.9	-2.7	0.0		913.4	-2.2	0.0		913.7	-1.9	0.0		914.3	-1.3	0.0		917.0	1.4	7.8	**	921.1	5.5	22.9	***
12	STRICKERS_POND	Stricker's Pond	926.7	924.9	-1.8	0.0		925.7	-1.0	0.0		926.3	-0.4	0.0		927.3	0.6	10.0	**	928.0	1.3	10.6	**	928.8	2.1	10.9	**	929.9	3.2	11.4	**	931.1	4.4	34.4	***
13	PD_2046-021	Stricker's Pond Fore-Bay	927.9	926.6	-1.3	0.0		926.7	-1.2	0.0		926.8	-1.1	0.0		927.3	-0.6	0.0		928.0	0.1	4.2	**	928.8	0.9	10.2	**	929.9	2.0	11.1	**	931.1	3.2	33.6	***
14	ME04-A-0406-H-000	Longmeadow Road Low-Point - Near Strickers Pond	927.6	928.1	0.5	3.0		928.4	0.9	3.7		928.6	1.0	4.2		928.8	1.2	4.8		928.9	1.3	13.4	**	929.1	1.5	13.4	**	929.9	2.3	14.5	**	931.1	3.5	37.0	***
15	ME04-A-0014-H-000	Westfield Road Low-Point - Between Apple Hill Circle & Tramore Trail	953.3	953.7	0.4	2.4		953.8	0.5	2.8		953.9	0.6	3.2		954.6	1.3	3.9		954.9	1.6	4.2		955.2	1.9	4.6		955.6	2.3	5.4		955.2	1.9	9.9	
16	ME04-A-0015-H-001	Intersection of Longmeadow Road & Quail Ridge Drive	959.8	960.2	0.4	1.7		961.0	1.3	2.3		961.5	1.7	2.8		963.0	3.3	3.3		963.5	3.8	3.8		963.9	4.1	4.1		964.5	4.7	5.0		963.9	4.2	8.4	
17	ME04-A-0013-H-002	Gammon Road Low-Point - Between Longmeadow Road & Stone Glen Road	965.5	965.9	0.4	2.3		966.3	0.8	4.4		966.5	1.0	5.5		967.6	2.1	6.4		967.9	2.4	7.1		968.2	2.7	8.7		968.6	3.1	12.0		968.2	2.7	18.2	
18	AS2648-006	Intersection of Gammon Road & Harvest Hill Road	998.4	996.4	-2.1	0.0		996.6	-1.9	0.0		997.8	-0.6	0.0		998.2	-0.3	0.0		998.4	-0.1	0.0		999.1	0.6	0.6		999.3	0.9	1.1		999.0	0.5	1.4	
19	ME04-A-0015-H-005	Harvest Hill Road - Between Strathfield Circle & Morningdale Circle	985.1	985.2	0.1	1.1		986.8	1.7	1.5		987.2	2.1	1.8		987.8	2.7	2.1		988.1	3.0	2.3		988.4	3.4	2.6		989.1	4.0	3.3		988.5	3.4	5.1	
20	ME04-A-0015-H-009	Intersection of Gammon Road & Old Sauk Road	1010.6	1011.3	0.7	3.0		1011.7	1.1	3.6		1011.9	1.3	4.1		1012.1	1.5	4.8		1012.2	1.6	5.1		1012.4	1.8	6.3		1012.7	2.1	8.1		1012.4	1.8	16.0	
21	ME04-A-0015-H-010	Intersection of Harvest Hill Road & Pebble Beach Drive	1004.0	1004.7	0.7	1.3		1005.3	1.3	1.6		1005.6	1.6	1.9		1005.9	1.9	2.1		1006.1	2.2	2.3		1006.5	2.6	2.6		1007.3	3.3	3.5		1006.7	2.7	5.5	
22	PD_2847-023	Stonefield Pond	979.8	978.1	-1.7	0.0		978.8	-1.0	0.0		979.4	-0.4	0.0		980.0	0.2	0.9		980.3	0.5	1.5		980.6	0.8	2.0		981.2	1.4	2.7		980.7	0.9	4.1	
23	ME04-A-0029-H-004	Intersection of Pebble Beach Drive & Sauk Ridge Trail	976.4	976.5	0.2	1.3		976.7	0.3	1.6		977.0	0.7	2.0		977.4	1.1	2.7		977.6	1.3	3.1		977.8	1.5	3.5		978.3	2.0	4.5		977.9	1.5	7.4	
24	T14006	City of Middleton - Stricker's Pond Inlet Sewer - Westfield Road	928.9	930.0	1.2	0.6		930.7	1.9	1.5		931.1	2.3	2.1		931.6	2.7	2.2		931.8	3.0	2.1		932.1	3.2	2.7		932.5	3.6	12.3	**	932.0	3.2	29.5	***
25	T14087	City of Middleton - Stricker's Pond Inlet Sewer - Voss Parkway	927.7	925.5	-2.3	0.0		926.6	-1.1	0.0		927.7	0.0	0.0		928.2	0.5	0.2		928.8	1.0	11.8	**	929.5	1.8	12.0	**	930.5	2.7	12.1	**	931.0	3.2	35.5	***

**The model runtime was 24-hours. Flooding above the identified flood elevation continues at the end of the model runtime.
***The model runtime was 48-hours. Flooding above the identified flood elevation continues at the end of the model runtime.

Appendix E: Inlet Capacity

Technical Memorandum

8383 Greenway Blvd. # 600
Middleton, WI 53562

Prepared for: City of Madison

Project Title: Strickers Pond / Lake Mendota Watershed Study and West Wingra Watershed Study

Project No.: City: 8411/8412, BC: 153393/153394

Subject: Description of Brown and Caldwell's Inlet Capacity Approach

Date: December 6, 2019 (Updated February 12, 2020)

To: Caroline Burger PE Env S; Lauren Striegl PE, Phil Gaebler PE

From: Mike Wegner PE

Copy to: Jim Bachhuber PE, Doug Joachim PE

Prepared by: Mike Wegner, PE, Principal Engineer

Reviewed by: Jim Bachhuber, PH, Manager; and Dough Joachim, PE, Engineer III

Limitations:

This document was prepared solely for City of Madison in accordance with professional standards at the time the services were performed and in accordance with the contract between City of Madison and Brown and Caldwell dated3/25/19. This document is governed by the specific scope of work authorized by City of Madison; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by City of Madison and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

This memo describes BC's approach for the inlet capacity analysis portion of the Stricker's / Mendota and West Wingra watershed studies. The document includes the proposed approach and supporting information.

Selected Inlet Capacity Methodologies:

BC will evaluate inlet capacity with two approaches:

1. Incorporation into the XPSWMM™ model through the use of a composite rating curve. Inlets are aggregated at the subbasin level.
    a. In the model, a runoff node adjacent to the existing storm sewer system near the location where the runoff enters into the system will be created. The node will have an invert elevation set 0.1-feet below the ground elevation. The slight lowering of the elevation relative to the ground elevation represent the depression that occurs at a standard City inlet. A link connecting the new node to the storm sewer system will be created. The link will use an internal rating curve to simulate the composite inlet capacity for the subbasin.
    b. Other nodes within the direct vicinity (intersection) at which the runoff is entered into the model will not have a connection to the 2D model. The ponding type will be changed to sealed.
    c. Other nodes within the model will remain linked to 2D to allow the transfer of water from the 1D to 2D portions of the model. Flow into these nodes will be restricted through the use of the global "2D Inflow Capture" settings in XPSWMM™.
    d. A detailed description of how the rating curve will be developed is provided below in this memo.
2. A spreadsheet analysis similar to the spreadsheets prepared for the November 26, 2019 meeting. The spreadsheets can be used in conjunction with the model to evaluate where inlet capacity may be an issue. The spreadsheet approach provides an independent analysis from the model approach described above.
    a. Cumulative Inlet Capacity vs Subbasin Runoff Spreadsheet
    b. Inlet Capacity vs Pipe Capacity Spreadsheet

Alternative Approaches Evaluated

Various approaches to modeling inlet capacity within XPSWMM were considered and evaluated in the software. Based on testing conducted by BC (both prior to, and after, the November 26, 2019 meeting), any use of the inlet capacity module built into XPSWMM™ (i.e. turning on the "inlet capacity" check box) results in significantly increased model runtimes. Because of this increase in model runtime, this approach was abandoned.

The approach described above (#1.), of creating a new runoff node and link to connect the runoff node to the storm sewer system resulted in a modest increase to model runtime. Table 1 provides a comparison of model run-times for various approaches that were considered.

Table-1. XPSWMM Model Runtime Comparison	
Model Scenario	10-yr, 24-hr Storm Event Model Runtime (minutes)
Stricker's / Mendota Watershed Model – No Inlet Capacity	75 minutes
Reduced Model Area – Stricker's Pond Tributary area from City of Madison	27 minutes
Reduced Model Area – With "Inlet Capacity" Check Box	117 - 475 minutes
Reduced Model Area – With Rating Curve Link for Inlet Capacity	31-minutes

1.1 Available Data / Key Assumptions

During the November 26, 2019 meeting BC described the GIS data used to classify inlet type and condition. BC will continue to use this approach. The City's GIS data provided the casting type for inlets. Where the casting type was missing from the GIS, the following assumptions were made:

1. If installed after 1980, the inlet was assumed to be a Neenah R-3067 inlet. This is the most common inlet used within the City.
2. If this inlet was installed prior to 1980, it was assumed that the inlet had one-half of the capacity of a Neenah R-3067 inlet. The City indicated the inlet capacity for most inlets installed prior to 1980 have one-half of the capacity of a modern inlet.
3. Inlets that are within WisDOT right-of-way were assumed to be Neenah R 3067 inlets.

Within GIS, BC classified the inlet condition (sag or slope). For slope inlets, the slope was assigned based on the slope of the street on which the inlet is located. Private inlets were not included as part of this analysis. Data for private inlets is largely unavailable. The analysis also does not include items such as daylighted pipes that may be present within the drainage system.

1.2 Inlet Capacity Rating Curve Development

At the November 26, 2019 meeting with City staff, BC described an approach used to develop rating curves for each inlet type, under the various conditions (sag or slope) within the watersheds. Based on the number of inlets within a subbasin, the type of inlets, and the inlet conditions, a composite inlet capacity rating curve is developed.

A further evaluation of the flow capacity of individual inlets was conducted. To conduct the evaluation two typical inlet types were selected. These inlets types were each evaluated with multiple methodologies. For each methodology a rating curve for the inlet capacity was developed for the typical inlets. The selected methodologies will be used to calculate a flow capacity rating curve for the other inlet types found in the study areas. These rating curves for the various inlet types will be used to develop the consolidated rating curves at the subbasin level.

1.2.1 Sag Condition: Neenah Foundry R-3067 Type R grate

1. The following methodologies were considered. A graph (Figure 1) is attached to illustrate the rating curves calculated with the various methodologies.
    a. Autodesk Storm and Sanitary Sewer Analysis software was used to generate a rating curve. It appears this rating curve is based on an inlet capacity calculator that was previously

available on the Neenah Foundry website. Although the source of the rating curve is not documented in the Autodesk software help manual, the observation was made by comparing the rating curve from the Autodesk software to a past project rating curve developed by BC from the Neenah Foundry website calculator and the two curves matched. The Neenah Foundry website calculator is not available at the present time. It is believed that this methodology does not include the curb opening at the rear of a typical inlet. A 50% grate clogging factor was applied to the rating curve. (Note: BC has been in contact with Neenah Foundry regarding inlet capacity tools formally available on their website. A response was not provided by Neenah Foundry.)

   b. The weir and orifice equations were used to develop a rating curve. Weir and orifice equations from HEC-22 were followed to develop a rating curve for both the grate and curb opening. A 50% clogging factor was applied to the grate rating curve. A 20% clogging factor was applied to the curb opening (Note: It is understood this factor is not consistent with the current Modeling Guidance. The back of curb clogging factor is based on the WisDOT FDM. We propose updating the Modeling Guidance to reflect a 20% clogging factor for curb openings.). In this approach flow through the curb opening was not a factor at lower depths when the inlet functions under weir flow. This is consistent with recommendations from HEC-22 and the WisDOT FDM. A weir length and open area as reported in the Neenah Foundry product catalog are used in the calculations.
   c. Only using the weir equation with a length consistent with the inlet perimeter was considered. This approach was considered as a method to potentially simplify the analysis. A 50% clogging factor was applied by reducing the weir length.

2. Based on a review of these methodologies the combined HEC-22 weir and orifice equations approach will be used for both the grate and curb opening in sag locations. The HEC-22 and Autodesk (Neenah Foundry) rating curve produce similar results for flows through the inlet grate. The differences appear to be due to difference in the coefficients used as part of the weir and orifice equations. Because the Neenah Foundry calculator is no longer available, HEC-22 guidance was followed.

1.2.2 Slope Condition: Neenah Foundry R-3067 Type L grate

1. The following methodologies were considered. Graphs (Figures 2, 3, and 4) were prepared for different longitudinal slopes to illustrate the rating curves calculated with the various methodologies.
   a. The methodology outlined in Section 13-25-30.3 of the WisDOT FDM was followed. The chart for the inlet "K" value was obtained from the Autodesk Storm and Sanitary Sewer Analysis software. This information formerly was available from Neenah Foundry. The information is no longer available from Neenah Foundry. For slopes less than 1% a 25% clogging factor was applied. Slopes of 1%, or greater had no clogging factor applied.
   b. The FHWA Hydraulic Toolbox was used to calculate inlet flow based on HEC-22 methodology. For slopes less than 1% a 25% clogging factor was applied. Slopes of 1%, or greater had no clogging factor applied.
   c. Solely using the weir equation with a length consistent with the inlet perimeter, excluding the curb side (7-feet), and just using the upstream side (2-feet) was considered. Again, the approach was considered as a method to simplify the analysis. The 7-foot length represents

the entire perimeter (excluding the curb-side) of the typical grate (2' x 3') and the 2-foot weir length represents the grate just utilizing the upstream side for the weir.

d. Under each methodology the curb opening was ignored under slope conditions. This is consistent with recommendations from HEC-22 and the WisDOT FDM.

a. Based on a review of these methodologies the FHWA Hydraulic Toolbox will be used for slope conditions. This methodology produces a higher inlet flow than the WisDOT FDM methodology. However, "K" value charts are no longer available directly from Neenah Foundry. Due to this information not being readily available we do not recommend it be used (even if it can be obtained from outside sources).

b. As part of this approach, BC will cap the inlet capacity at a 0.5-foot depth. In discussion with the City both parties identified that flows into an inlet at the rates seen with greater depths seemed unreasonable. Above 0.5-feet the flow would be above the top of curb and expand wider.

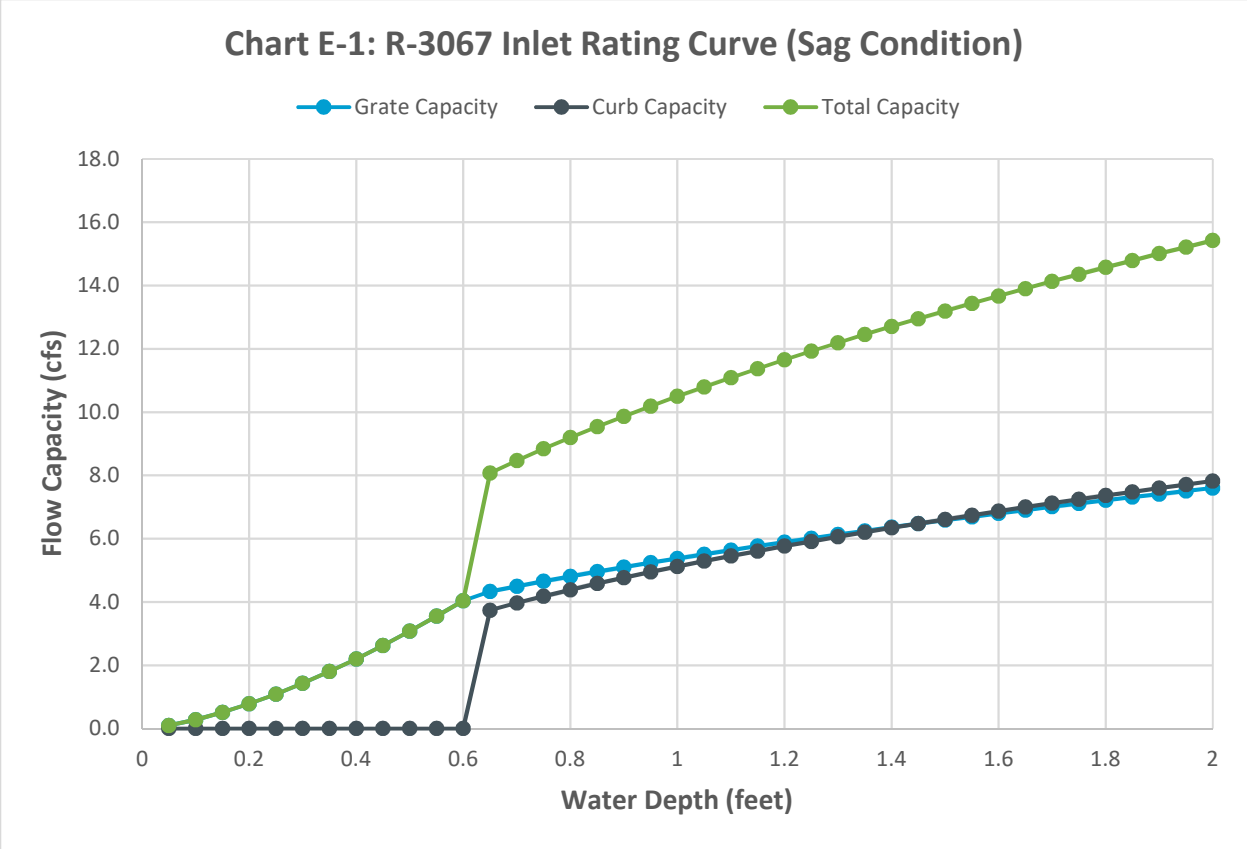


Chart E-1: R-3067 Inlet Rating Curve (Sag Condition)
Grate Capacity
Curb Capacity
Total Capacity
Flow Capacity (cfs)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Water Depth (feet)

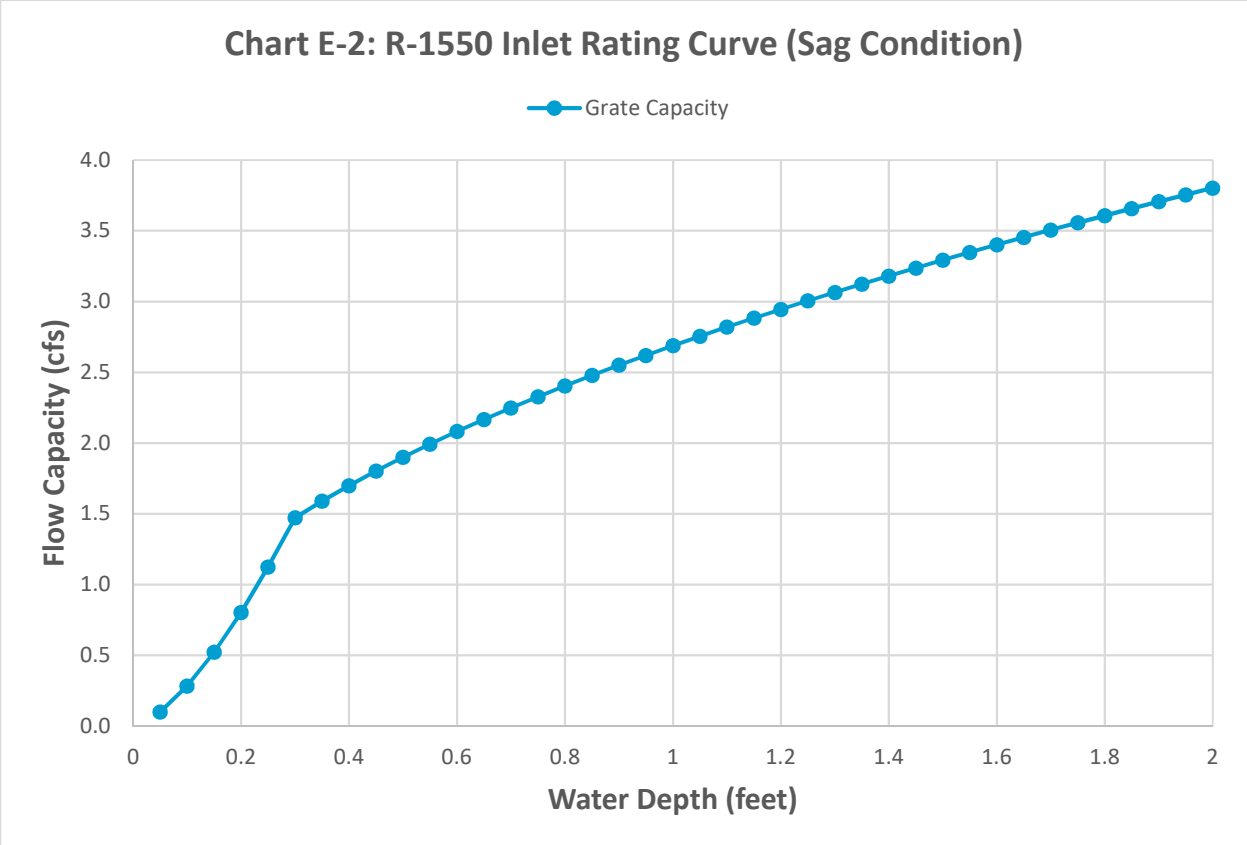


Chart E-2: R-1550 Inlet Rating Curve (Sag Condition)
Grate Capacity
Flow Capacity (cfs)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Water Depth (feet)

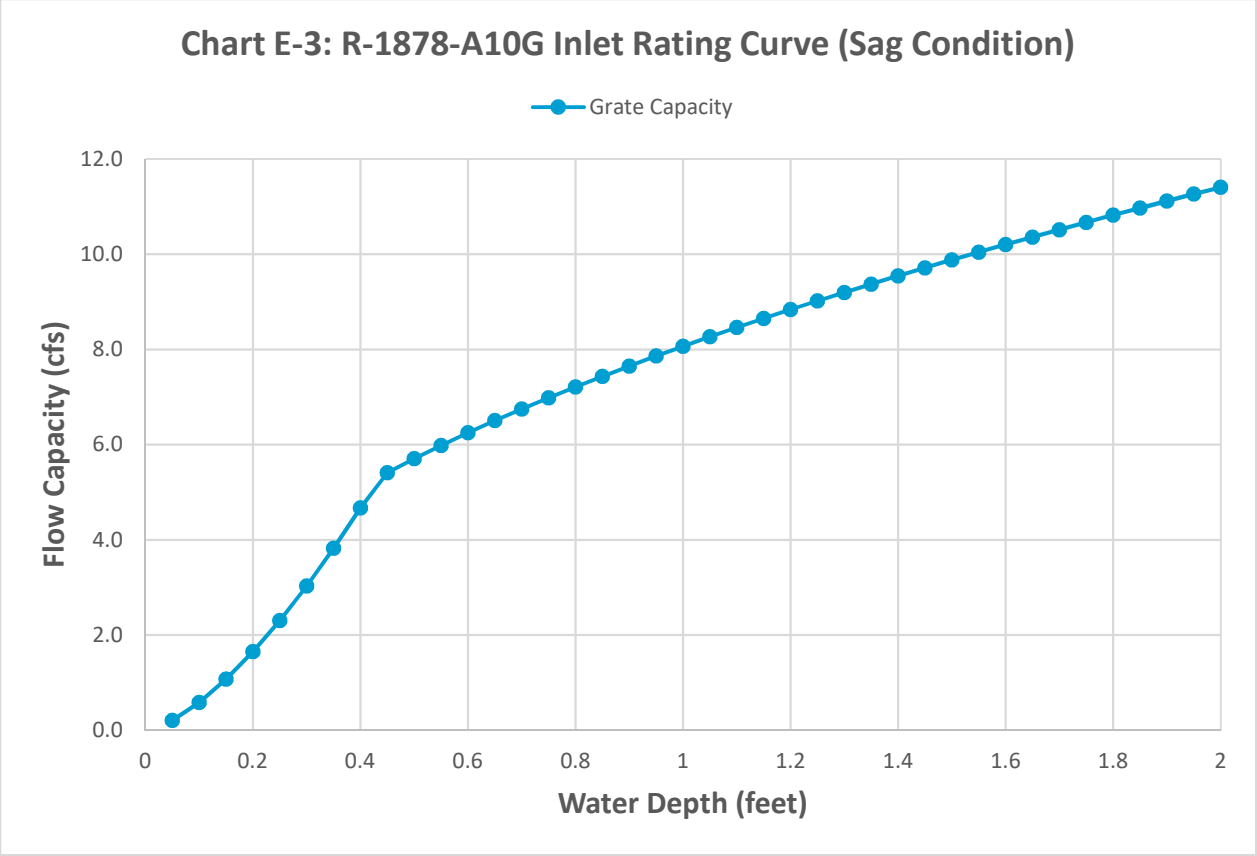


Chart E-3: R-1878-A10G Inlet Rating Curve (Sag Condition)
Grate Capacity
Flow Capacity (cfs)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Water Depth (feet)

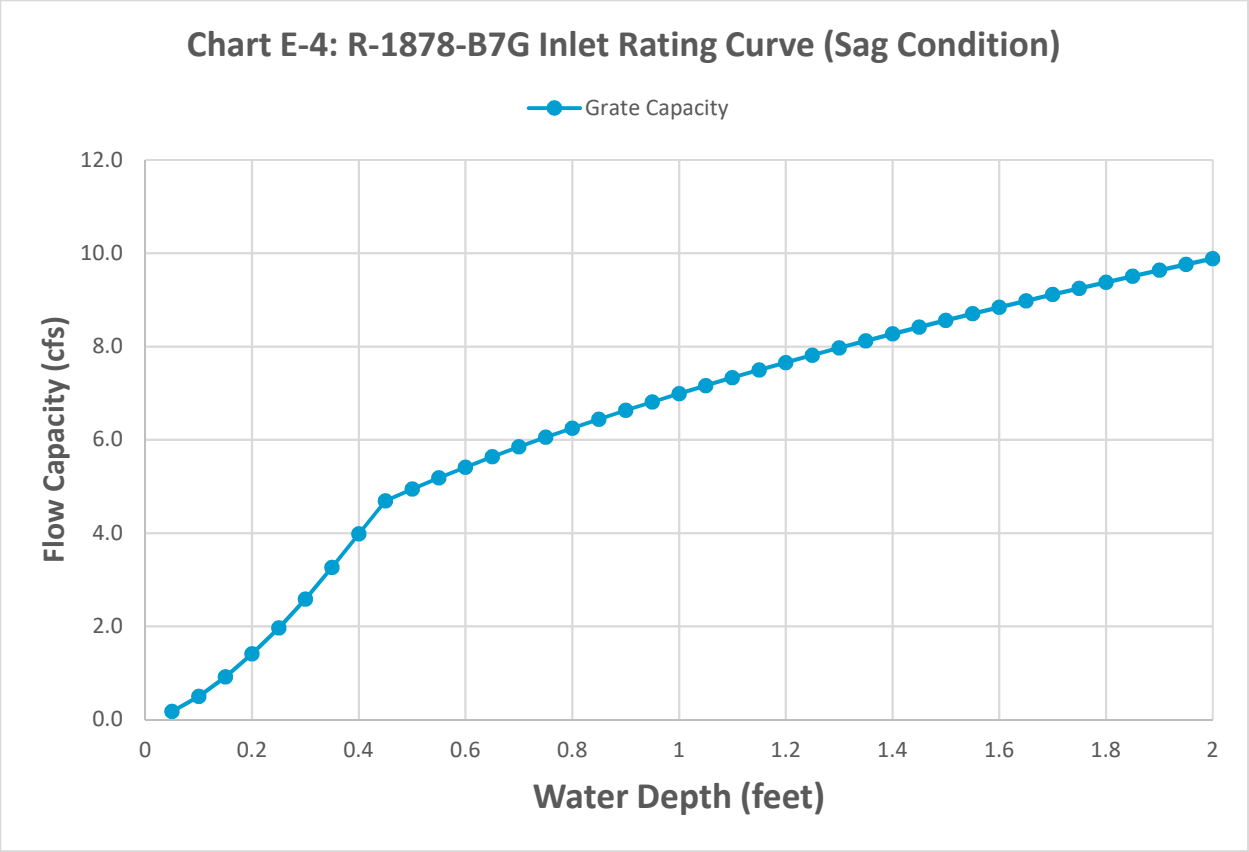


Chart E-4: R-1878-B7G Inlet Rating Curve (Sag Condition)
Grate Capacity
Flow Capacity (cfs)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Water Depth (feet)

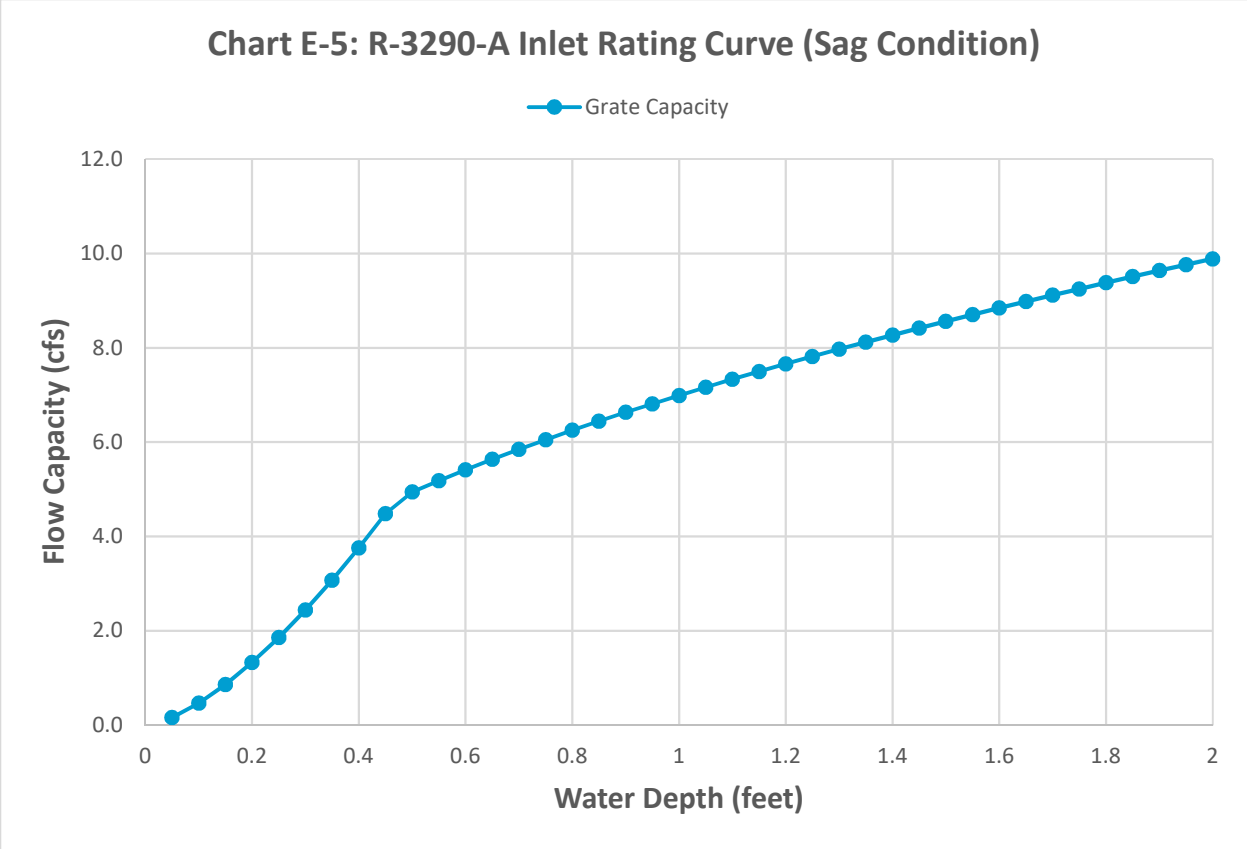


Chart E-5: R-3290-A Inlet Rating Curve (Sag Condition)
Grate Capacity
Flow Capacity (cfs)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Water Depth (feet)

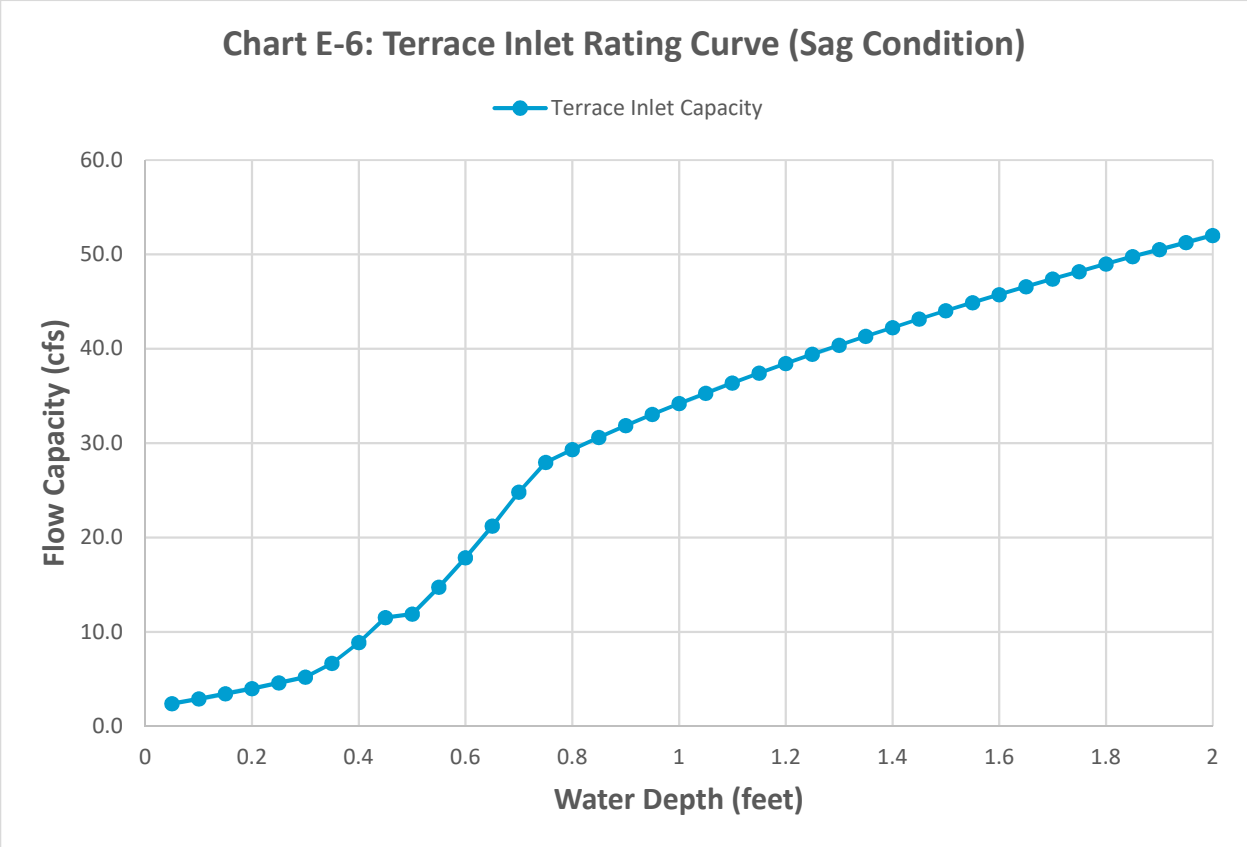


Chart E-6: Terrace Inlet Rating Curve (Sag Condition)
Terrace Inlet Capacity
Flow Capacity (cfs)
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Water Depth (feet)

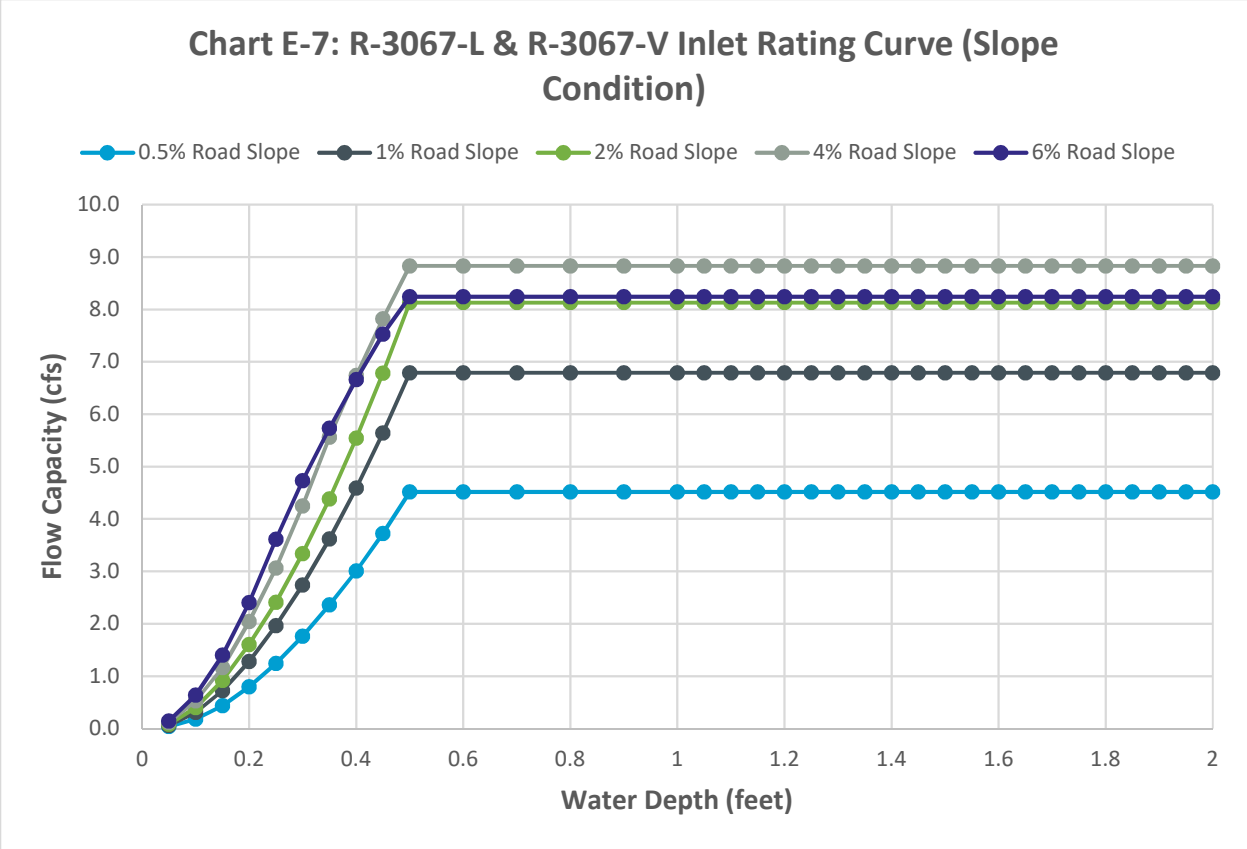


Chart E-7: R-3067-L & R-3067-V Inlet Rating Curve (Slope Condition)
0.5% Road Slope
1% Road Slope
2% Road Slope
4% Road Slope
6% Road Slope
Flow Capacity (cfs)
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Water Depth (feet)

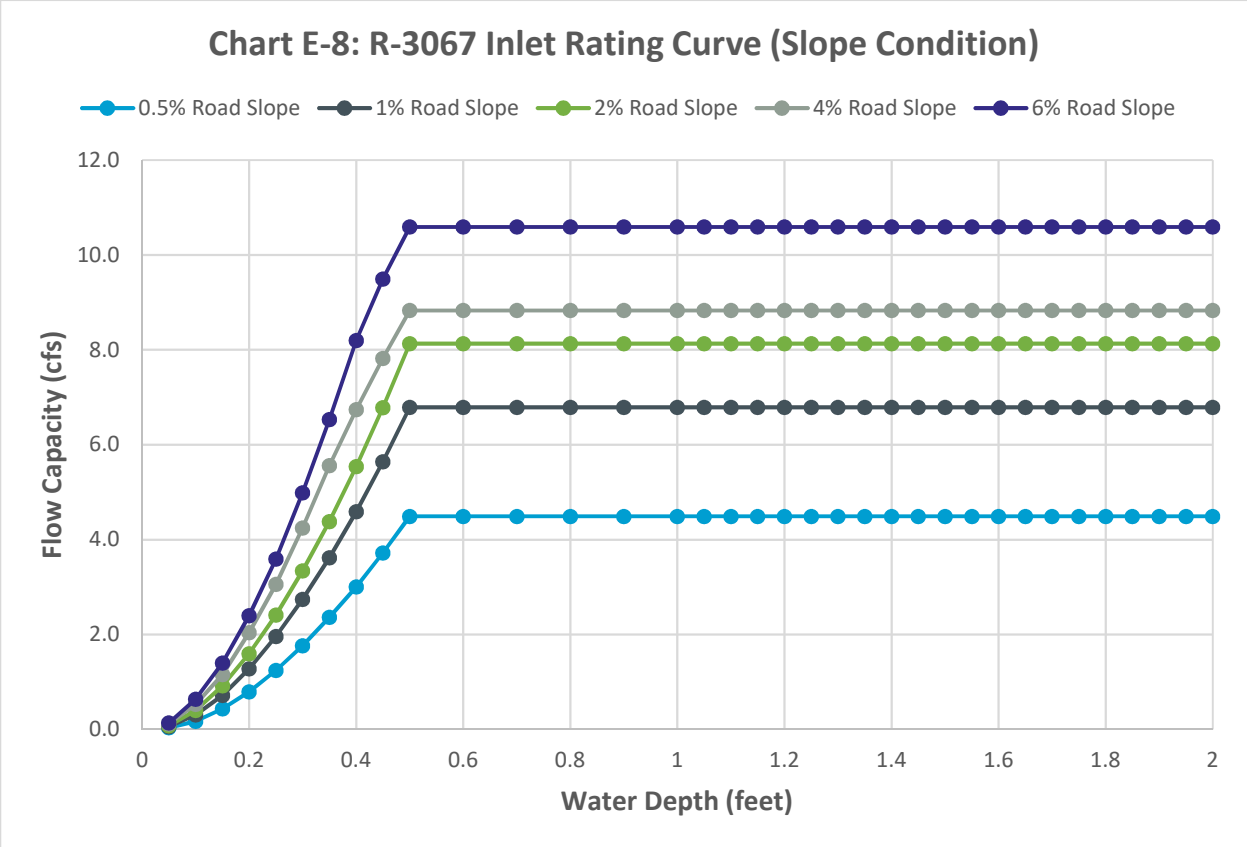


Chart E-8: R-3067 Inlet Rating Curve (Slope Condition)
0.5% Road Slope
1% Road Slope
2% Road Slope
4% Road Slope
6% Road Slope
Flow Capacity (cfs)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Water Depth (feet)

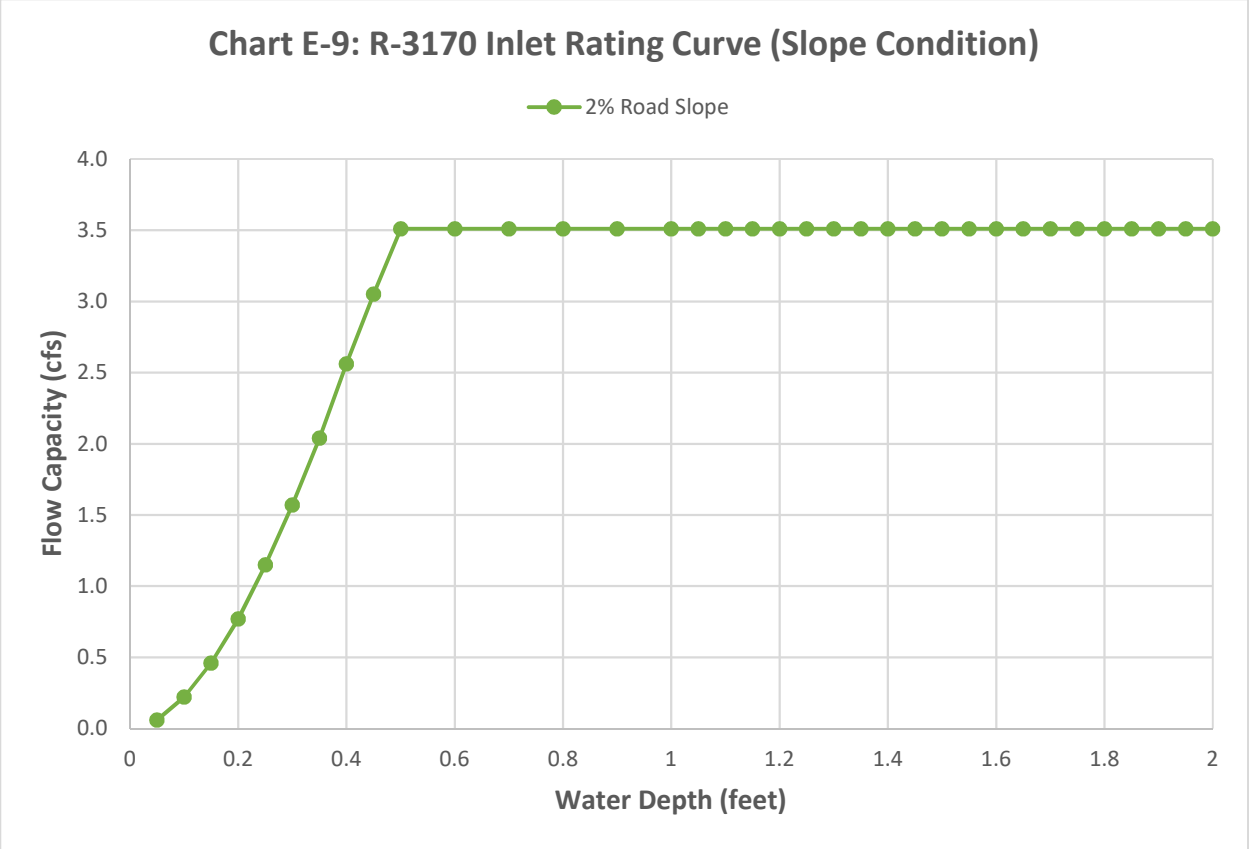


Chart E-9: R-3170 Inlet Rating Curve (Slope Condition)
2% Road Slope
Flow Capacity (cfs)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Water Depth (feet)

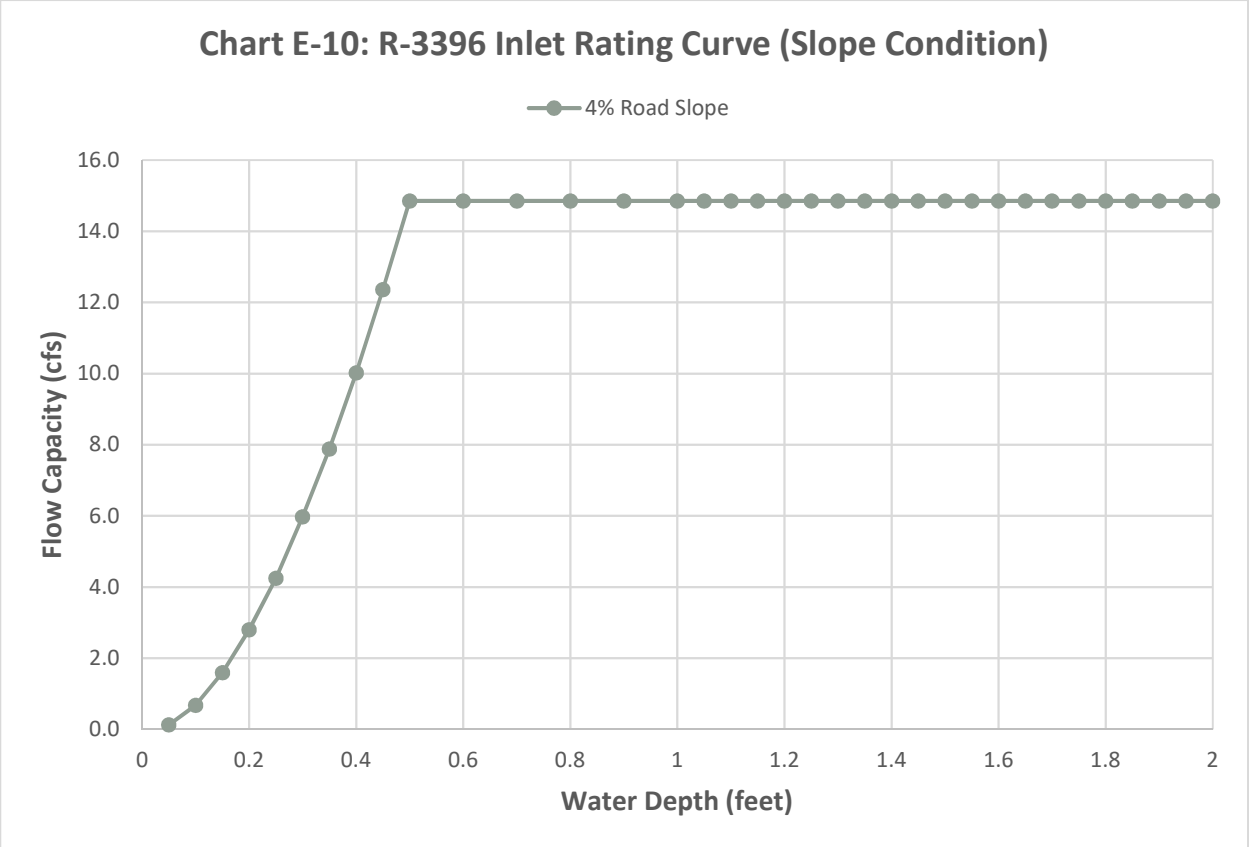


Chart E-10: R-3396 Inlet Rating Curve (Slope Condition)
4% Road Slope
Flow Capacity (cfs)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Water Depth (feet)

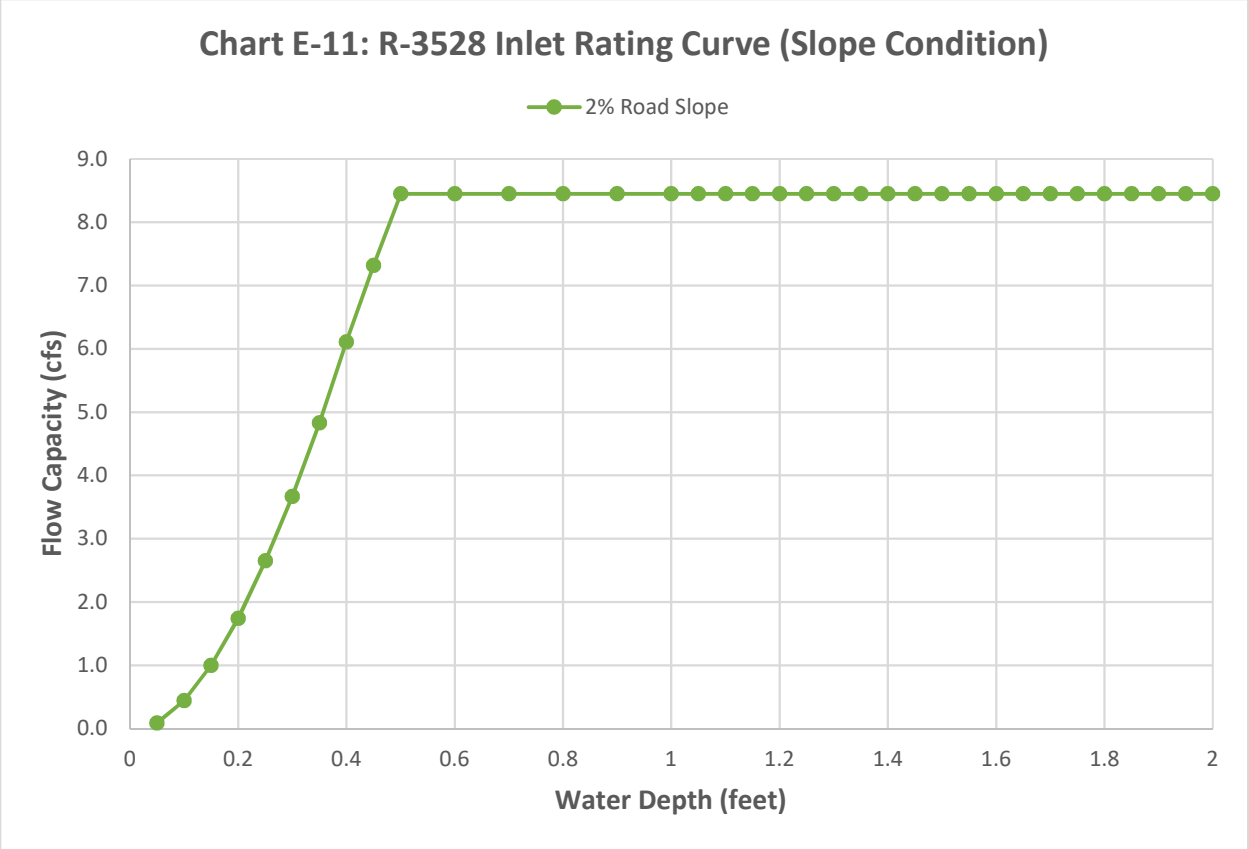


Chart E-11: R-3528 Inlet Rating Curve (Slope Condition)
2% Road Slope
Flow Capacity (cfs)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Water Depth (feet)

Table E-1
Inlets by Subwatershed
Stricker's / Mendota Watershed Study, City of Madison, WI

Inlet Type	Terrace	(2) Terrace	(2) R-3067	(2) R-3067	R-1550	R-1550	R-3067/R-1550	R-1878-A10G	R-1878-B7G	R-3067	R-3067	R-3067	R-3067	R-3067	R-3067	R-3067-V	R-3067-V	R-3067-V	R-3067-V	R-3067-V	R-3067-V	R-3067-V	R-3170	R-3290-A	R-3396	R-3528-V	R-4482	Pre1980	Pre1980	Pre1980	Pre1980	Pre1980	Pre1980	R-3067-L	R-3067-L	R-3067-L	R-3067-L	R-3067-L	
Condition (Sag or Slope)	Sag	Sag	Sag	Slope	Sag	Slope	Slope	Sag	Sag	Sag	Slope	Slope	Slope	Slope	Slope	Sag	Slope	Slope	Slope	Slope	Slope	Slope	Slope	Sag	Slope	Slope	Sag	Sag	Slope	Slope	Slope	Slope	Slope	Sag	Slope	Slope	Slope	Slope	
Slope (%)	N/A	N/A	N/A	2%	N/A	1%	2%	N/A	N/A	N/A	0.5%	1%	2%	4%	6%	N/A	0.5%	1%	2%	4%	6%	2%	N/A	4%	2%	N/A	N/A	0.5%	1%	2%	4%	6%	N/A	0.5%	1%	2%	4%	
Subwatershed																																							Total
ME03-A-0021-H-MAD-C-002	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
ME03-A-0021-H-MAD-C-004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
ME03-A-0021-H-MAD-C-005	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	5
ME03-A-0021-H-MAD-C-006	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	13
ME03-A-0021-H-MAD-C-007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
ME03-A-0021-H-MAD-C-008	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	8
ME03-A-0021-H-MAD-C-009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	6
ME03-A-0039-K-MAD-C-002	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	6	0	16
ME03-A-0039-K-MAD-C-003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	9
ME03-A-0039-K-MAD-C-004	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	7
ME03-A-0039-K-MAD-C-005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	4
ME03-A-0039-K-MAD-C-006	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
ME03-A-0039-K-MAD-C-007	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	12
ME03-A-0039-K-MAD-C-008	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	4
ME03-A-0039-K-MAD-C-009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	7
ME03-A-0039-K-MAD-C-010	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	6
ME03-A-0040-K-MAD-C-000	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
ME03-A-0040-K-MAD-C-001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
ME03-A-0041-K-MAD-C-000	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
ME03-A-0041-K-MAD-C-001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
ME03-B-0040-A-MAD-C-000	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
ME03-B-0040-A-MAD-C-003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	6
ME03-B-0040-A-MAD-C-004	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	13
ME04-A-0013-H-MAD-C-000	0	0	0	0	0	0	0	0	0	1	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
ME04-A-0013-H-MAD-C-002	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
ME04-A-0014-H-MAD-C-000	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
ME04-A-0014-H-MAD-C-001	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
ME04-A-0014-H-MAD-C-002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
ME04-A-0015-H-MAD-C-000	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
ME04-A-0015-H-MAD-C-001	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
ME04-A-0015-H-MAD-C-002	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
ME04-A-0015-H-MAD-C-003	0	0	0	0	0	0	0	1	0	5	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	13
ME04-A-0015-H-MAD-C-004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	3
ME04-A-0015-H-MAD-C-005	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	9
ME04-A-0015-H-MAD-C-006	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	5	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	11
ME04-A-0015-H-MAD-C-007	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
ME04-A-0015-H-MAD-C-013	0	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	8
ME04-A-0015-H-MAD-C-008	0	0	0	0	0	0	0	0	0	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	2	0	0	0	0	0	0	14
ME04-A-0015-H-MAD-C-009	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	4	1	0	0	0	0	0	0	0	11
ME04-A-0015-H-MAD-C-010	0	0	0	0	0	0	0	0	0	10	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
ME04-A-0015-H-MAD-C-011	0	0	0	0	0	0	0	0	0	4	5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
ME04-A-0015-H-MAD-C-012	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6

Table E-1
Inlets by Subwatershed
Stricker's / Mendota Watershed Study, City of Madison, WI

Inlet Type	Terrace	(2) Terrace	(2) R-3067	(2) R-3067	R-1550	R-1550	R-3067/R-1550	R-1878-A10G	R-1878-B7G	R-3067	R-3067	R-3067	R-3067	R-3067	R-3067	R-3067-V	R-3067-V	R-3067-V	R-3067-V	R-3067-V	R-3067-V	R-3067-V	R-3170	R-3290-A	R-3396	R-3528-V	R-4482	Pre1980	Pre1980	Pre1980	Pre1980	Pre1980	Pre1980	Pre1980	R-3067-L	R-3067-L	R-3067-L	R-3067-L	R-3067-L	
Condition (Sag or Slope)	Sag	Sag	Sag	Slope	Sag	Slope	Slope	Sag	Sag	Sag	Slope	Slope	Slope	Slope	Slope	Sag	Slope	Slope	Slope	Slope	Slope	Slope	Slope	Sag	Slope	Slope	Sag	Sag	Slope	Slope	Slope	Slope	Slope	Sag	Slope	Slope	Slope	Slope	
Slope (%)	N/A	N/A	N/A	2%	N/A	1%	2%	N/A	N/A	N/A	0.5%	1%	2%	4%	6%	N/A	0.5%	1%	2%	4%	6%	2%	N/A	4%	2%	N/A	N/A	0.5%	1%	2%	4%	6%	N/A	0.5%	1%	2%	4%	
Subwatershed																																							Total
ME04-A-0022-H-MAD-C-000	0	0	0	0	0	0	0	0	0	0	0	3	5	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
ME04-A-0022-H-MAD-C-001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
ME04-A-0022-H-MAD-C-002	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	2	0	0	0	0	0	0	0	0	0	0	10
ME04-A-0022-H-MAD-C-003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0	5
ME04-A-0029-H-MID-C-000	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
ME04-A-0029-H-MID-C-001	0	0	0	0	0	0	0	0	0	3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
ME04-A-0029-H-MID-C-003	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
ME04-A-0029-H-MID-C-004	0	0	0	0	0	0	0	0	0	2	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
ME04-A-0406-H-MAD-C-000	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
ME04-A-0406-H-MAD-C-001	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
ME04-A-0406-H-MAD-C-002	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
ME03-A-0256-H-MAD-C-000	No Inlet Capacity -Direct to Grassman Pond																																						
ME04-A-0013-H-MAD-C-001	No Inlet Capacity - Direct to Ponwood Pond																																						
ME03-B-0040-A-MAD-C-001	No Inlet Capacity - Daylighted Culverts																																						
ME03-A-0021-H-MAD-C-001	No Inlet Capacity - No Inlets identified in City GIS, Assume daylighted culverts																																						
ME03-A-0011-N-MID-C-000	No Inlet Capacity - In City of Middleton																																						
ME03-A-0011-N-MID-C-001	No Inlet Capacity - In City of Middleton																																						
ME03-A-0011-N-MID-C-002	No Inlet Capacity - In City of Middleton																																						
ME03-A-0012-H-MID-C-001	No Inlet Capacity - In City of Middleton																																						
ME03-A-0012-H-MID-C-002	No Inlet Capacity - In City of Middleton																																						
ME03-A-0012-H-MID-C-003	No Inlet Capacity - In City of Middleton																																						
ME03-A-0013-K-MID-C-000	No Inlet Capacity - In City of Middleton																																						
ME03-A-0013-K-MID-C-001	No Inlet Capacity - In City of Middleton																																						
ME04-A-0029-H-MID-C-008	No Inlet Capacity - In City of Middleton																																						
ME04-A-0029-H-MID-C-005	No Inlet Capacity - In City of Middleton																																						
ME04-A-0029-H-MID-C-006	No Inlet Capacity - In City of Middleton																																						
ME04-A-0029-H-MID-C-007	No Inlet Capacity - In City of Middleton																																						
ME04-A-0035-B-MID-C-000	No Inlet Capacity - In City of Middleton																																						
ME04-A-0036-I-MID-C-000	No Inlet Capacity - In City of Middleton																																						
ME04-A-0057-B-MID-C-000	No Inlet Capacity - In City of Middleton																																						
ME04-B-0056-P-MID-C-000	No Inlet Capacity - In City of Middleton																																						
ME03-A-0021-H-MAD-C-003	No Inlet Capacity - Direct to internally drained depression north of Highland Ave																																						
ME04-A-0079-H-MID-C-000	No Inlet Capacity - Direct to Stricker's Fore-bay																																						
ME04-A-0034-H-MID-C-000	No Inlet Capacity - Direct to Stricker's Pond																																						
ME03-A-0021-H-MAD-C-000	No Inlet Capacity - Direct to Skyview Pond																																						
ME04-A-0029-H-MID-C-002	No Inlet Capacity - Direct to Pond																																						
ME03-A-0039-K-MAD-C-000	No Inlet Capacity - Direct to Greenway																																						
ME03-A-0039-K-MAD-C-001	No Inlet Capacity - Direct to Greenway																																						
ME03-B-0040-A-MAD-C-002	No Inlet Capacity - No inlets identified in City GIS, Daylighted Private Pipe																																						
TOTAL	5	0	4	1	2	1	1	2	6	82	22	12	16	13	0	2	0	25	21	21	0	0	0	0	0	0	46	7	6	6	9	0	7	9	0	25	15	366	

Table E-2
Inlet Capacity Rating Curve by Subwatershed
Stricker's / Mendota Watershed Study, City of Madison, WI

Subwatershed	Total # of Inlets	Inlet Capacity Flow Rate (cfs) at Identified Depth															
		Water Depth (ft.)	0'	0.1'	0.2'	0.3'	0.4'	0.5'	0.6'	0.7'	0.8'	0.9'	1.0'	1.25'	1.5'	1.75'	2.0'
ME03-A-0021-H-MAD-C-002	1		0	0.3	0.8	1.5	1.7	1.9	2.1	2.2	2.4	2.6	2.7	3.0	3.3	3.6	3.8
ME03-A-0021-H-MAD-C-004	2		0	0.3	0.8	1.4	2.2	3.1	4.0	8.5	9.2	9.9	10.5	11.9	13.2	14.4	15.4
ME03-A-0021-H-MAD-C-005	5		0	1.2	4.0	7.9	12.7	18.3	20.3	29.1	30.6	31.9	33.2	36.0	38.6	40.9	43.1
ME03-A-0021-H-MAD-C-006	13		0	2.2	6.2	11.4	17.6	24.6	32.3	67.7	73.6	79.0	84.0	95.4	105.6	114.9	123.4
ME03-A-0021-H-MAD-C-007	3		0	1.2	4.8	10.0	16.6	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4
ME03-A-0021-H-MAD-C-008	8		0	1.7	4.7	8.6	13.2	18.5	24.3	50.8	55.2	59.2	63.0	71.6	79.2	86.1	92.6
ME03-A-0021-H-MAD-C-009	6		0	0.8	2.3	4.3	6.6	9.2	12.1	25.4	27.6	29.6	31.5	35.8	39.6	43.1	46.3
ME03-A-0039-K-MAD-C-002	16		0	8.3	22.2	41.0	65.8	93.3	109.2	160.5	172.5	181.9	190.6	210.5	228.1	244.1	258.9
ME03-A-0039-K-MAD-C-003	9		0	4.8	18.4	38.3	60.7	79.5	79.5	79.5	79.5	79.5	79.5	79.5	79.5	79.5	79.5
ME03-A-0039-K-MAD-C-004	7		0	6.1	16.2	30.7	49.3	64.9	70.8	77.8	82.3	84.8	87.2	92.4	97.0	101.2	105.0
ME03-A-0039-K-MAD-C-005	4		0	1.0	3.7	7.6	12.5	18.2	19.6	26.3	27.4	28.4	29.3	31.5	33.4	35.1	36.7
ME03-A-0039-K-MAD-C-006	3		0	0.8	2.4	4.3	6.1	8.1	10.2	19.2	20.8	22.3	23.7	26.9	29.7	32.3	34.7
ME03-A-0039-K-MAD-C-007	12		0	4.2	15.1	30.5	49.8	72.3	77.1	99.2	102.9	106.3	109.4	116.5	122.9	128.7	134.0
ME03-A-0039-K-MAD-C-008	4		0	1.2	4.8	10.0	16.6	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4
ME03-A-0039-K-MAD-C-009	7		0	2.8	11.2	23.4	38.8	56.9	56.9	56.9	56.9	56.9	56.9	56.9	56.9	56.9	56.9
ME03-A-0039-K-MAD-C-010	6		0	2.6	9.6	19.6	32.1	46.8	48.7	57.6	59.0	60.4	61.6	64.5	67.0	69.4	71.5
ME03-A-0040-K-MAD-C-000	10		0	4.5	16.6	34.0	53.8	71.0	73.9	87.2	89.4	91.4	93.3	97.6	101.4	104.9	108.1
ME03-A-0040-K-MAD-C-001	1		0	0.5	2.0	4.3	6.7	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8
ME03-A-0041-K-MAD-C-000	6		0	2.9	10.7	22.0	35.3	47.7	48.2	48.6	49.0	49.4	49.7	50.6	51.3	52.0	52.6
ME03-A-0041-K-MAD-C-001	7		0	3.7	14.3	29.8	47.2	61.8	61.8	61.8	61.8	61.8	61.8	61.8	61.8	61.8	61.8
ME03-B-0040-A-MAD-C-000	5		0	2.5	7.0	12.9	19.9	24.7	27.1	29.2	31.3	33.2	34.9	39.1	42.8	46.2	49.4
ME03-B-0040-A-MAD-C-003	6		0	2.4	9.2	19.1	30.3	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7	39.7
ME03-B-0040-A-MAD-C-004	13		0	10.8	20.7	34.4	58.1	82.5	102.3	132.0	147.0	155.9	164.2	182.7	199.1	213.9	227.5
ME04-A-0013-H-MAD-C-000	6		0	1.7	6.7	14.2	23.6	34.7	35.7	40.1	40.8	41.5	42.2	43.6	44.9	46.0	47.1
ME04-A-0013-H-MAD-C-002	4		0	1.1	3.1	5.7	8.8	12.3	16.2	33.9	36.8	39.5	42.0	47.7	52.8	57.4	61.7
ME04-A-0014-H-MAD-C-000	6		0	1.4	4.7	9.6	15.6	22.7	25.6	38.9	41.1	43.1	45.0	49.3	53.1	56.5	59.8
ME04-A-0014-H-MAD-C-001	12		0	4.8	19.2	40.1	66.5	97.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6
ME04-A-0014-H-MAD-C-002	8		0	2.5	10.2	21.9	36.7	54.3	54.3	54.3	54.3	54.3	54.3	54.3	54.3	54.3	54.3
ME04-A-0015-H-MAD-C-000	1		0	0.3	0.8	1.4	2.2	3.1	4.0	8.5	9.2	9.9	10.5	11.9	13.2	14.4	15.4
ME04-A-0015-H-MAD-C-001	5		0	1.4	3.9	7.1	11.0	15.4	20.2	42.3	46.0	49.3	52.5	59.6	66.0	71.8	77.1
ME04-A-0015-H-MAD-C-002	6		0	1.7	4.7	8.6	13.2	18.5	24.3	50.8	55.2	59.2	63.0	71.6	79.2	86.1	92.6
ME04-A-0015-H-MAD-C-003	13		0	4.5	15.4	30.6	48.3	64.7	70.6	95.4	99.9	104.0	107.9	116.7	124.6	131.7	138.4
ME04-A-0015-H-MAD-C-004	3		0	0.3	1.2	2.6	4.5	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7

Table E-2
Inlet Capacity Rating Curve by Subwatershed
Stricker's / Mendota Watershed Study, City of Madison, WI

Subwatershed	Total # of Inlets	Inlet Capacity Flow Rate (cfs) at Identified Depth														
		Water Depth (ft.)	0'	0.1'	0.2'	0.3'	0.4'	0.5'	0.6'	0.7'	0.8'	0.9'	1.0'	1.25'	1.5'	1.75'	2.0'
ME04-A-0015-H-MAD-C-005	9		0	2.6	9.1	18.4	29.9	43.3	46.7	62.2	64.7	67.1	69.3	74.3	78.7	82.8	86.5
ME04-A-0015-H-MAD-C-006	11		0	3.3	11.5	23.0	37.3	53.9	60.2	89.0	93.7	98.1	102.2	111.5	119.7	127.3	134.2
ME04-A-0015-H-MAD-C-007	8		0	2.5	10.2	21.9	36.7	54.3	54.3	54.3	54.3	54.3	54.3	54.3	54.3	54.3	54.3
ME04-A-0015-H-MAD-C-008	14		0	2.9	10.3	20.9	33.9	48.2	53.5	77.9	81.9	85.6	89.0	96.9	103.9	110.3	116.1
ME04-A-0015-H-MAD-C-009	11		0	1.9	6.9	14.1	23.0	33.5	35.9	46.9	48.8	50.4	52.0	55.6	58.8	61.7	64.3
ME04-A-0015-H-MAD-C-010	12		0	3.1	9.4	17.8	28.0	39.7	49.4	93.6	100.9	107.7	114.0	128.2	141.0	152.5	163.3
ME04-A-0015-H-MAD-C-011	10		0	2.4	8.7	17.9	29.4	42.9	46.8	64.5	67.4	70.1	72.6	78.3	83.4	88.0	92.3
ME04-A-0015-H-MAD-C-012	6		0	1.9	6.5	13.2	20.8	29.8	31.9	40.9	42.5	44.0	45.4	48.6	51.4	54.0	56.4
ME04-A-0015-H-MAD-C-013	8		0	2.4	8.5	17.0	26.8	35.7	38.6	51.9	54.1	56.1	58.0	62.3	66.1	69.6	72.8
ME04-A-0022-H-MAD-C-000	9		0	3.3	13.4	28.3	47.0	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2
ME04-A-0022-H-MAD-C-001	5		0	2.0	8.0	16.7	27.7	40.7	40.7	40.7	40.7	40.7	40.7	40.7	40.7	40.7	40.7
ME04-A-0022-H-MAD-C-002	10		0	1.6	5.1	10.0	15.9	22.8	27.2	47.1	50.4	53.4	56.2	62.7	68.4	73.6	78.4
ME04-A-0022-H-MAD-C-003	5		0	0.6	2.0	3.9	6.3	9.1	10.6	17.2	18.3	19.3	20.2	22.4	24.3	26.0	27.6
ME04-A-0029-H-MID-C-000	5		0	2.7	10.2	21.3	33.7	44.2	44.2	44.2	44.2	44.2	44.2	44.2	44.2	44.2	44.2
ME04-A-0029-H-MID-C-001	6		0	2.4	8.5	17.0	26.8	35.7	38.6	51.9	54.1	56.1	58.0	62.3	66.1	69.6	72.8
ME04-A-0029-H-MID-C-003	3		0	0.8	2.3	4.3	6.6	9.2	12.1	25.4	27.6	29.6	31.5	35.8	39.6	43.1	46.3
ME04-A-0029-H-MID-C-004	7		0	1.4	5.5	11.7	19.4	28.6	30.5	39.4	40.9	42.2	43.5	46.3	48.9	51.2	53.3
ME04-A-0406-H-MAD-C-000	3		0	0.8	2.3	4.3	6.6	9.2	12.1	25.4	27.6	29.6	31.5	35.8	39.6	43.1	46.3
ME04-A-0406-H-MAD-C-001	1		0	0.6	1.7	3.0	4.7	5.7	6.2	6.7	7.2	7.7	8.1	9.0	9.9	10.7	11.4
ME04-A-0406-H-MAD-C-002	5		0	1.6	6.4	13.7	23.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0

Table E-3
Cumulative Inlet Capacity vs. Subwatershed Runoff
Stricker's / Mendota Watershed Study, City of Madison, WI

Subwatershed	Total # of Inlets in Subwatershed	Peak Hydrologic Runoff Rate - Model Output (cfs)		Composite Inlet Capacity in Subwatershed		Is Inlet Capacity Greater than Peak Runoff Rate?		
		Storm Event		Water Depth (ft)*		10-yr		25-yr
		10-yr	25-yr	0.25-ft	0.55-ft	0.25-ft	0.5-ft	0.55-ft
ME03-A-0021-H-MAD-C-002	1	34.8	50.6	1.1	2.0	No	No	No
ME03-A-0021-H-MAD-C-004	2	18.5	26.7	1.1	3.6	No	No	No
ME03-A-0021-H-MAD-C-005	5	26.2	37.6	5.8	19.3	No	No	No
ME03-A-0021-H-MAD-C-006	13	38.4	52.7	8.7	28.5	No	No	No
ME03-A-0021-H-MAD-C-007	3	18.9	25.8	7.2	24.4	No	Yes	Maybe
ME03-A-0021-H-MAD-C-008	8	28.2	38.3	6.5	21.4	No	No	No
ME03-A-0021-H-MAD-C-009	6	43.6	59.2	3.3	10.7	No	No	No
ME03-A-0039-K-MAD-C-002	16	8.0	10.4	31.1	101.2	Yes	Yes	Yes
ME03-A-0039-K-MAD-C-003	9	8.6	11.1	27.5	79.5	Yes	Yes	Yes
ME03-A-0039-K-MAD-C-004	7	9.1	12.2	23.0	67.9	Yes	Yes	Yes
ME03-A-0039-K-MAD-C-005	4	20.8	28.2	5.6	18.9	No	Maybe	No
ME03-A-0039-K-MAD-C-006	3	26.5	36.5	3.3	9.1	No	No	No
ME03-A-0039-K-MAD-C-007	12	20.8	26.4	22.3	74.7	Maybe	Yes	Yes
ME03-A-0039-K-MAD-C-008	4	15.7	21.2	7.2	24.4	No	Yes	Yes
ME03-A-0039-K-MAD-C-009	7	33.6	43.5	16.9	56.9	No	Yes	Yes
ME03-A-0039-K-MAD-C-010	6	4.7	6.1	14.2	47.8	Yes	Yes	Yes
ME03-A-0040-K-MAD-C-000	10	22.2	30.5	24.7	72.5	Yes	Yes	Yes
ME03-A-0040-K-MAD-C-001	1	12.2	16.4	3.1	8.8	No	No	No
ME03-A-0041-K-MAD-C-000	6	6.3	8.2	16.0	47.9	Yes	Yes	Yes
ME03-A-0041-K-MAD-C-001	7	11.7	15.3	21.4	61.8	Yes	Yes	Yes
ME03-B-0040-A-MAD-C-000	5	14.2	18.7	9.8	25.9	No	Yes	Yes
ME03-B-0040-A-MAD-C-003	6	27.6	37.2	13.8	39.7	No	Yes	Maybe
ME03-B-0040-A-MAD-C-004	13	26.8	33.7	27.2	92.4	Maybe	Yes	Yes
ME04-A-0013-H-MAD-C-000	6	49.3	64.8	10.2	35.2	No	No	No
ME04-A-0013-H-MAD-C-002	4	28.4	36.7	4.4	14.2	No	No	No
ME04-A-0014-H-MAD-C-000	6	39.1	53.4	7.0	24.2	No	No	No

ME04-A-0014-H-MAD-C-001	12	36.5	49.8	28.9	97.6	No	Yes	Yes
ME04-A-0014-H-MAD-C-002	8	29.9	40.9	15.7	54.3	No	Yes	Yes
ME04-A-0015-H-MAD-C-000	1	27.8	39.8	1.1	3.6	No	No	No
ME04-A-0015-H-MAD-C-001	5	32.6	43.0	5.4	17.8	No	No	No
ME04-A-0015-H-MAD-C-002	6	43.6	58.8	6.5	21.4	No	No	No
ME04-A-0015-H-MAD-C-003	13	31.2	42.4	22.5	67.7	No	Yes	Yes
ME04-A-0015-H-MAD-C-004	3	11.8	16.1	1.9	6.7	No	No	No
ME04-A-0015-H-MAD-C-005	9	18.0	24.5	13.4	45.0	No	Yes	Yes
ME04-A-0015-H-MAD-C-006	11	37.8	51.4	16.9	57.1	No	Yes	Yes
ME04-A-0015-H-MAD-C-007	8	27.0	36.6	15.7	54.3	No	Yes	Yes
ME04-A-0015-H-MAD-C-008	14	42.9	57.4	15.3	50.9	No	Yes	No
ME04-A-0015-H-MAD-C-009	11	43.9	56.5	10.3	34.7	No	No	No
ME04-A-0015-H-MAD-C-010	12	39.1	52.6	13.4	44.6	No	Yes	No
ME04-A-0015-H-MAD-C-011	10	32.9	44.7	13.0	44.8	No	Yes	Maybe
ME04-A-0015-H-MAD-C-012	6	31.9	42.4	9.6	30.8	No	Maybe	No
ME04-A-0015-H-MAD-C-013	8	34.0	47.2	12.4	37.2	No	Maybe	No
ME04-A-0022-H-MAD-C-000	9	14.0	19.4	20.3	69.2	Yes	Yes	Yes
ME04-A-0022-H-MAD-C-001	5	11.6	15.2	12.1	40.7	Maybe	Yes	Yes
ME04-A-0022-H-MAD-C-002	10	70.4	95.0	7.4	25.0	No	No	No
ME04-A-0022-H-MAD-C-003	5	18.9	25.1	2.9	9.8	No	No	No
ME04-A-0029-H-MID-C-000	5	29.3	39.1	15.3	44.2	No	Yes	Yes
ME04-A-0029-H-MID-C-001	6	21.7	28.7	12.4	37.2	No	Yes	Yes
ME04-A-0029-H-MID-C-003	3	49.6	66.5	3.3	10.7	No	No	No
ME04-A-0029-H-MID-C-004	7	16.2	21.5	8.4	29.6	No	Yes	Yes
ME04-A-0406-H-MAD-C-000	3	25.0	33.6	3.3	10.7	No	No	No
ME04-A-0406-H-MAD-C-001	0	44.2	62.7	2.3	6.0	No	No	No
ME04-A-0406-H-MAD-C-002	5	19.2	26.3	9.8	34.0	No	Yes	Yes

* Equals flow depth for slope inlets and ponding depth for sag inlets

NOTE: **Yes** = Inlet capacity is more than 110% of the pipe capacity.
Maybe = Inlet capacity is between 90% and 110% of pipe capacity.
No = Inlet capacity is less than 90% of pipe capacity.

Table E-4
Inlet Capacity vs. Pipe Capacity
Stricker's / Mendota Watershed Study, City of Madison, WI

Node Name	# of Directly Connected Inlets	Downstream Link Name	D/S Pipe Size (inches)	D/S Pipe Capacity (cfs)	# of U/S Links	Downstream Node Name	Total # of Inlets	Total Inlet Capacity (cfs) at Selected Water Depth (ft) *		Is Total Inlet Capacity Greater than Pipe Capacity?	
								0.25-ft	0.55-ft	0.25-ft	0.55-ft
Stricker's Forebay - West Inlet											
AS2447-008	3	2447-008_2447-007	15	4.6	0	IN2447-007	3	5.9	20.4	Yes	Yes
IN2447-007	1	2447-007_2447-006	15	4.6	1	IN2447-006	4	7.8	27.2	Yes	Yes
IN2447-006	1	2447-006_2447-003	15	7.2	1	AS2447-003	5	9.8	34.0	Yes	Yes
AS2447-003	2	2447-003_2446-021	15	4.6	1	IN2446-021	7	13.7	47.5	Yes	Yes
IN2446-021	1	2446-021_2446-020	15	10.8	1	AS2446-020	8	15.7	54.3	Yes	Yes
AS2446-020	0	2446-020_2446-014	15	7.1	1	AS2446-014	8	15.7	54.3	Yes	Yes
AS2446-014	5	2446-014_2446-013	15	8.7	1	AS2446-013	13	27.7	95.0	Yes	Yes
AS2446-013	1	2446-013_2446-012	15	4.0	1	AS2446-012	14	30.1	103.1	Yes	Yes
IN2446-007	4	2446-007_2446-012	21	5.5	0	AS2446-012	4	9.6	32.5	Yes	Yes
AS2446-012	0	2446-012_2446-008	21	41.7	2	IN2446-008	18	39.8	135.6	Maybe	Yes
IN2446-008	2	2446-008_2446-011	24	30.2	1	IN2446-011	20	44.6	151.9	Yes	Yes
IN2446-011	3	2446-011_2546-009	24	29.3	1	AS2546-009	23	49.6	169.9	Yes	Yes
IN2546-008	1	2546-008_2546-009	18	50.5	0	AS2546-009	1	1.1	3.5	No	No
AS2546-009	1	2546-009_2546-019	18	11.4	2	IN2546-019	25	51.8	176.9	Yes	Yes
IN2546-019	1	2546-019_2546-010	30	75.7	1	AS2546-010	26	52.8	180.5	No	Yes
AS2546-010	0	2546-010_2546-011	30	74.4	1	AS2546-011	26	52.8	180.5	No	Yes
AS2546-011	2	2546-011_2546-020	36	101.1	1	AS2546-020	28	56.8	194.1	No	Yes
AS2546-020	3	2546-020_2546-015	36	46.6	1	PD_2046-021	31	62.6	214.4	Yes	Yes
Stricker's Forebay - Middle Inlet											
AS2546-001	0	2546-001_2546-002	21	29.5	0	IN2546-002	0	0.0	0.0	No	No
IN2546-002	2	2546-002_2546-003	24x38	25.3	1	IN2546-003	2	2.2	7.1	No	No
IN2546-003	1	2546-003_2546-005	30	22.6	1	PD_2046-021	3	3.3	10.6	No	No
Stricker's Forebay - East Inlet											
IN2749-043	2	2749-043_2749-042	18	11.0	0	IN2749-042	2	2.2	7.1	No	No
IN2749-042	1	2749-042_BC_JCT_3	18	16.6	1	BC_JCT_3	3	3.3	10.6	No	No
BC_JCT_3	0	BC_JCT_3_2749-002	18	22.3	1	AS2749-002	3	3.3	10.6	No	No
AS2749-002	0	2749-002_2749-003	18	13.8	1	IN2749-003	3	3.3	10.6	No	No
IN2749-003	3	2749-003_2649-006	18	10.6	1	AS2649-006	6	7.9	23.9	No	Yes
AS2649-006	2	2649-006_2649-002	21	27.0	1	AS2649-002	8	12.4	37.1	No	Yes
AS2649-002	5	2649-002_2649-001	21	32.3	1	AS2649-001	13	15.2	46.0	No	Yes
AS2649-001	4	2649-001_2648-007	24	27.0	1	AS2648-007	17	19.1	59.6	No	Yes
AS2648-007	2	2648-007_2648-006	24	33.8	1	AS2648-006	19	22.7	71.8	No	Yes

Table E-4
Inlet Capacity vs. Pipe Capacity
Stricker's / Mendota Watershed Study, City of Madison, WI

Node Name	# of Directly Connected Inlets	Downstream Link Name	D/S Pipe Size (inches)	D/S Pipe Capacity (cfs)	# of U/S Links	Downstream Node Name	Total # of Inlets	Total Inlet Capacity (cfs) at Selected Water Depth (ft) *		Is Total Inlet Capacity Greater than Pipe Capacity?	
								0.25-ft	0.55-ft	0.25-ft	0.55-ft
IN2850-010	4	2850-010_2849-013	18	16.3	0	IN2849-013	4	2.3	7.6	No	No
IN2849-013	1	2849-013_2849-012	18	8.2	1	IN2849-012	5	2.9	9.8	No	Yes
IN2849-012	2	2849-012_2749-035	24	16.0	1	IN2749-035	7	4.0	13.4	No	No
IN2749-035	6	2749-035_2749-018	36	56.9	1	AS2749-018	13	9.0	30.5	No	No
AS2749-018	0	2749-018_2749-017	30	74.1	1	AS2749-017	13	9.0	30.5	No	No
AS2749-017	2	2749-017_2749-005	30	65.1	1	IN2749-005	15	10.7	36.3	No	No
IN2749-005	1	2749-005_2749-007	30	22.4	1	AS2749-007	16	12.6	43.1	No	Yes
IN2848-012	6	2848-012_2848-011	18	15.5	0	IN2848-011	6	9.6	30.8	No	Yes
IN2848-011	1	2848-011_2848-009	18	10.6	1	IN2848-009	7	12.0	38.9	Yes	Yes
IN2848-009	2	2848-009_2848-007	18	11.5	1	IN2848-007	9	14.8	48.5	Yes	Yes
IN2848-007	1	2848-007_2848-006	18	35.3	1	AS2848-006	10	16.4	54.5	No	Yes
AS2848-006	1	2848-006_2848-004	24	22.0	1	AS2848-004	11	18.1	60.4	No	Yes
AS2848-004	4	2848-004_2849-005	48	89.7	1	AS2849-005	15	23.0	77.1	No	No
AS2849-005	1	2849-005_2849-001	38x60	105.5	1	AS2849-001	16	24.7	83.1	No	No
AS2849-001	3	2849-001_2749-024	38x60	15.6	1	AS2749-024	19	28.0	93.7	Yes	Yes
AS2749-024	2	2749-024_2749-013	30	42.4	1	AS2749-013	21	31.3	105.7	No	Yes
AS2749-013	3	2749-013_2749-027	42	70.5	2	AS2749-027	40	47.2	159.4	No	Yes
AS2749-027	2	2749-027_2749-033	42	73.3	1	AS2749-033	42	50.5	171.4	No	Yes
AS2749-033	3	2749-033_2748-001	34x53	57.5	1	AS2748-001	45	54.3	184.5	Maybe	Yes
AS2748-001	2	2748-001_2748-004	34x53	58.1	1	AS2748-004	47	56.5	191.6	Maybe	Yes
AS2748-004	2	2748-004_2748-006	34x53	57.9	1	AS2748-006	49	59.8	203.5	Maybe	Yes
AS2748-006	4	2748-006_2648-006	34x53	194.0	1	AS2648-006	53	63.0	213.3	No	Maybe
AS2648-006	1	2648-006_2648-002	42	125.5	2	AS2648-002	75	95.8	323.4	No	Yes
AS2648-002	2	2648-002_2648-001	42	245.7	1	AS2648-001	77	101.9	341.1	No	Yes
BC_JCT_16	2	BC_JCT_16_BC_JCT_15	18	62.8	0	BC_JCT_15	2	4.1	12.4	No	No
BC_JCT_15	4	BC_JCT_15_2648-001	18	19.9	1	AS2648-001	6	9.7	29.0	No	Yes
BC_JCT_14	8	BC_JCT_14_BC_JCT_13	18	8.4	0	BC_JCT_13	8	15.7	54.3	Yes	Yes
BC_JCT_13	2	BC_JCT_13_BC_JCT_12	18	8.1	1	BC_JCT_12	10	19.6	67.9	Yes	Yes
BC_JCT_12	3	BC_JCT_12_2648-030	18	5.2	1	AS2648-030	13	25.5	88.3	Yes	Yes
AS2648-030	2	2648-030_BC_JCT_8	18	5.2	1	BC_JCT_8	15	28.2	97.1	Yes	Yes
BC_JCT_8	4	BC_JCT_8_2648-016	18	7.1	1	IN2648-016	19	32.5	111.3	Yes	Yes
IN2648-016	1	2648-016_2648-017	18	7.5	1	IN2648-017	20	33.1	113.1	Yes	Yes
IN2648-017	2	2648-017_2648-024	18	15.0	1	IN2648-024	22	34.2	116.7	Yes	Yes

Table E-4
Inlet Capacity vs. Pipe Capacity
Stricker's / Mendota Watershed Study, City of Madison, WI

Node Name	# of Directly Connected Inlets	Downstream Link Name	D/S Pipe Size (inches)	D/S Pipe Capacity (cfs)	# of U/S Links	Downstream Node Name	Total # of Inlets	Total Inlet Capacity (cfs) at Selected Water Depth (ft) *		Is Total Inlet Capacity Greater than Pipe Capacity?	
								0.25-ft	0.55-ft	0.25-ft	0.55-ft
IN2648-024	6	2648-024_2648-005	24	32.2	1	AS2648-005	28	46.0	156.3	Yes	Yes
AS2648-005	1	2648-005_2648-003	30	32.2	1	AS2648-003	29	46.6	158.5	Yes	Yes
AS2648-003	4	2648-003_2648-001	30	111.5	1	AS2648-001	33	49.5	168.3	No	Yes
AS2648-001	1	2648-001_2647-003	48	156.9	3	AS2647-003	117	164.2	547.2	Maybe	Yes
AS2647-003	2	2647-003_2647-002	48	245.0	1	AS2647-002	119	166.1	554.0	No	Yes
AS2647-002	6	2647-002_2647-001	48	136.1	1	AS2647-001	125	172.7	575.3	Yes	Yes
AS2647-001	0	2647-001_2646-003	48	227.3	1	AS2646-003	125	172.7	575.3	No	Yes
IN2646-015	2	2646-015_2646-003	18	65.7	0	AS2646-003	2	2.2	7.1	No	No
AS2646-003	3	2646-003_2646-018	48	275.7	3	AS2646-018	130	178.1	593.1	No	Yes
AS2646-018	0	2646-018_2646-004	48	275.1	1	AS2646-004	130	178.1	593.1	No	Yes
AS2646-004	0	2646-004_2646-005	48	227.1	1	AS2646-005	130	178.1	593.1	No	Yes
AS2646-005	0	2646-005_2646-001	48	224.3	1	AS2646-001	130	178.1	593.1	No	Yes
AS2646-001	0	2646-001_BC_JCT_2	48	143.6	1	BC_JCT_2	130	178.1	593.1	Yes	Yes
BC_JCT_2	1	BC_JCT_2_2545-001	48	143.7	1	AS2545-001	131	179.2	596.6	Yes	Yes
AS2545-001	0	2545-001_BC_JCT_1	60	8.2	1	PD_2046-021	131	179.2	596.6	Yes	Yes
Pebble Beach Drive - Into City of Middleton											
IN2848-002	2	2848-002_2848-001	15	14.0	0	IN2848-001	2	6.1	17.7	No	Yes
IN2848-001	1	2848-001_2847-018	15	13.9	1	IN2847-018	3	9.2	26.5	No	Yes
IN2847-018	2	2847-018_2847-014	18	21.6	1	IN2847-014	5	15.3	44.2	No	Yes
IN2847-014	3	2847-014_2847-013	18	18.2	1	AS2847-013	8	24.5	70.6	Yes	Yes
AS2847-013	0	2847-013_2847-012	19x30	5.9	1	AS2847-012	8	24.5	70.6	Yes	Yes
AS2847-012	2	2847-012_2847-009	24	6.2	1	IN2847-009	10	26.7	77.7	Yes	Yes
IN2847-009	1	2847-009_2847-017	24	12.3	1	AE2847-017	11	27.7	81.3	Yes	Yes
Skyview Park Pond Inlet Sewer											
AS2950-020	6	2950-020_2950-006	24	31.8	0	AS2950-006	6	3.3	10.6	No	No
AS2950-006	6	2950-006_2950-005	30	65.5	1	AS2950-005	12	6.5	21.3	No	No
IN2850-005	3	2850-005_2850-003	15	3.1	0	IN2850-003	3	3.3	10.6	Maybe	Yes
IN2850-003	2	2850-003_2850-004	15	9.8	1	IN2850-004	5	4.4	14.2	No	Yes
IN2850-015	2	2850-015_2850-004	18	18.1	0	IN2850-004	2	1.6	5.3	No	No
IN2850-004	1	2850-004_2950-021	24	1.5	2	IN2950-021	8	6.5	21.3	Yes	Yes
IN2950-021	2	2950-021_2950-022	30	124.8	1	IN2950-022	10	8.7	28.4	No	No
IN2950-022	1	2950-022_2950-004	30	38.9	1	AS2950-004	11	9.8	31.9	No	No
AS2950-004	0	2950-004_2950-005	30	38.9	1	AS2950-005	11	9.8	31.9	No	No

Table E-4
Inlet Capacity vs. Pipe Capacity
Stricker's / Mendota Watershed Study, City of Madison, WI

Node Name	# of Directly Connected Inlets	Downstream Link Name	D/S Pipe Size (inches)	D/S Pipe Capacity (cfs)	# of U/S Links	Downstream Node Name	Total # of Inlets	Total Inlet Capacity (cfs) at Selected Water Depth (ft) *		Is Total Inlet Capacity Greater than Pipe Capacity?	
								0.25-ft	0.55-ft	0.25-ft	0.55-ft
AS2950-005	1	2950-005_2950-023	30	24.6	2	AS2950-023	23	16.9	55.0	No	Yes
AS2950-027	3	2950-027_2950-025	15	10.7	0	AS2950-025	3	7.2	24.4	No	Yes
AS2950-025	0	2950-025_2950-024	18	10.6	1	AS2950-024	3	7.2	24.4	No	Yes
AS2950-024	3	2950-024_2950-023	18	28.1	1	AS2950-023	6	8.9	29.7	No	Maybe
AS2950-023	0	2950-023_2949-002	30	39.9	2	AS2949-002	29	25.7	84.7	No	Yes
AS2949-002	3	2949-002_2949-012	27	40.5	1	AS2949-012	32	29.3	96.9	No	Yes
AS2949-012	1	2949-012_2949-010	27	40.8	1	IN2949-010	33	30.4	100.5	No	Yes
IN2949-010	1	2949-010_2948-005	27	44.5	1	AS2948-005	34	31.5	104.0	No	Yes
AS2948-005	0	2948-005_2948-004	30	49.5	1	AS2948-004	34	31.5	104.0	No	Yes
AS2948-004	0	2948-004_2948-001	30	40.3	1	AS2948-001	34	31.5	104.0	No	Yes
AS2948-001	2	2948-001_2948-002	33	41.2	1	AS2948-002	36	32.6	107.6	No	Yes
AS2948-002	0	2948-002_BC_JCT_4	33	80.3	1	BC_JCT_4	36	32.6	107.6	No	Yes
BC_JCT_4	0	BC_JCT_4_BC_JCT_5	36	70.0	1	BC_JCT_5	36	32.6	107.6	No	Yes
BC_JCT_5	0	BC_JCT_5_2947-013	36	160.0	1	IN2947-013	36	32.6	107.6	No	No
IN2947-013	1	2947-013_BC_JCT_6	36	86.8	1	BC_JCT_6	37	33.7	109.6	No	Yes
BC_JCT_6	0	BC_JCT_6_2947-002	36	153.4	1	AS2947-002	37	33.7	109.6	No	No
AS2947-002	0	2947-002_2947-003	36	148.1	1	AS2947-003	37	33.7	109.6	No	No
AS2947-003	0	2947-003_2947-004	36	72.4	1	AS2947-004	37	33.7	109.6	No	Yes
AS2947-004	0	2947-004_2946-005	36	198.9	1	AS2946-005	37	33.7	109.6	No	No
AS2946-005	1	2946-005_2946-004	36	152.5	1	AS2946-004	38	35.7	114.7	No	No
AS2946-004	0	2946-004_2946-003	36	117.6	1	AS2946-003	38	35.7	114.7	No	Maybe
AS2946-003	0	2946-003_2946-014	36	116.7	1	IN2946-014	38	35.7	114.7	No	Maybe
IN2946-014	1	2946-014_2946-006	36	110.6	1	GR_2946-016	39	36.8	116.7	No	Maybe
Old Middleton Road - North of Mendota/Grassman Greenway											
IN3045-028	1	3045-028_3045-026	12	7.7	0	AS3045-026	1	3.1	8.8	No	Yes
AS3045-026	1	3045-026_3045-024	12	4.1	1	AS3045-024	2	6.1	17.7	Yes	Yes
AS3045-024	1	3045-024_3045-023	15	13.8	1	IN3045-023	3	9.2	26.5	No	Yes
IN3045-023	1	3045-023_3045-020	15	15.8	1	IN3045-020	4	12.2	35.3	No	Yes
IN3045-020	3	3045-020_3045-017	15	15.4	1	IN3045-017	7	21.4	61.8	Yes	Yes
IN3045-017	2	3045-017_3045-015	15	21.9	1	IN3045-015	9	26.4	75.8	Yes	Yes
IN3045-015	2	3045-015_3045-016	18	7.6	1	PD_3046-028	11	32.6	93.5	Yes	Yes
Old Middleton Road - South of Mendota/Grassman Greenway											
IN3146-013	5	3146-013_3046-019	24	47.4	0	IN3046-019	5	9.4	26.8	No	No

Table E-4
Inlet Capacity vs. Pipe Capacity
Stricker's / Mendota Watershed Study, City of Madison, WI

Node Name	# of Directly Connected Inlets	Downstream Link Name	D/S Pipe Size (inches)	D/S Pipe Capacity (cfs)	# of U/S Links	Downstream Node Name	Total # of Inlets	Total Inlet Capacity (cfs) at Selected Water Depth (ft) *		Is Total Inlet Capacity Greater than Pipe Capacity?	
								0.25-ft	0.55-ft	0.25-ft	0.55-ft
IN3046-019	3	3046-019_3046-018	24	52.7	1	IN3046-018	8	17.5	49.6	No	Maybe
IN3046-018	2	3046-018_3046-014	24	60.6	1	AS3046-014	10	23.6	67.3	No	Yes
AS3046-014	2	3046-014_3046-010	24x38	11.1	1	IN3046-010	12	29.7	84.9	Yes	Yes
IN3046-010	1	3046-010_3046-011	19x30	19.0	2	PD_3046-029	13	30.8	88.5	Yes	Yes
University Avenue - South of Mendota/Grassman Greenway											
AS3145-048	7	3145-048_3145-043	24	45.4	0	CB3145-043	7	23.0	67.7	No	Yes
CB3145-043	4	3145-043_3145-040	24	39.8	1	AS3145-040	11	35.2	103.0	No	Yes
AS3145-040	5	3145-040_3145-036	24	53.4	1	CB3145-036	16	46.1	134.6	No	Yes
CB3145-036	3	3145-036_3145-028	24	34.0	1	AS3145-028	19	55.2	161.1	Yes	Yes
University Avenue - North of Mendota/Grassman Greenway											
AS3044-033	6	3044-033_3044-030	24	37.0	0	AS3044-030	6	16.9	56.9	No	Yes
AS3044-030	2	3044-030_3044-023	24	44.7	1	CB3044-023	8	21.7	73.2	No	Yes
CB3044-023	5	3044-023_3044-022	24	44.7	1	AS3044-022	13	33.7	113.8	No	Yes
AS3044-022	0	3044-022_3044-019	24	35.7	1	CB3044-019	13	33.7	113.8	Maybe	Yes
CB3044-019	2	3044-019_3044-013	24	35.8	1	CB3044-013	15	38.6	130.1	Maybe	Yes
CB3044-013	5	3044-013_3044-002	24	39.7	1	AS3044-002	20	50.6	170.7	Yes	Yes
AS3044-003	1	3044-003_3044-001	18	42.1	0	IN3044-001	1	1.2	4.1	No	No
IN3044-001	2	3044-001_3045-003	18	18.9	1	IN3045-003	3	4.8	16.3	No	No
IN3045-003	1	3045-003_3044-004	18	12.6	1	IN3044-004	4	7.2	24.4	No	Yes
IN3044-004	5	3044-004_3044-002	19x30	27.1	1	AS3044-002	9	12.7	42.1	No	Yes
AS3044-002	0	3044-002_3044-036	30	36.4	2	AS3044-036	29	63.3	212.9	Yes	Yes
AS3044-036	0	3044-036_3044-037	30	58.0	1	AS3044-037	29	63.3	212.9	Maybe	Yes
AS3044-037	3	3044-037_3145-018	30	53.1	1	AS3145-018	32	70.5	237.3	Yes	Yes
AS3145-018	1	3145-018_3145-019	30	127.9	1	IN3145-019	33	75.1	252.0	No	Yes
IN3145-019	2	3145-019_3145-020	30	241.0	1	CB3145-020	35	79.9	268.3	No	Yes
CB3145-020	2	3145-020_3145-023	30	54.0	1	AS3145-023	37	85.9	285.5	Yes	Yes
AS3145-023	0	3145-023_3145-024	30	53.4	1	AS3145-024	37	85.9	285.5	Yes	Yes
AS3145-024	0	3145-024_3145-025	30	29.8	1	IN3145-025	37	85.9	285.5	Yes	Yes
IN3145-025	3	3145-025_3145-028	30	35.3	1	AS3145-028	40	89.1	296.1	Yes	Yes
AS3145-028	0	3145-028_3145-030	42	79.4	2	IN3145-030	59	144.4	457.2	Yes	Yes
IN3145-030	1	3145-030_3145-031	42	327.8	1	CB3145-031	60	146.5	464.3	No	Yes
CB3145-031	4	3145-031_3145-035	42	291.0	1	AE3145-035	64	150.9	478.5	No	Yes
Capital Avenue Outfall											

Table E-4
Inlet Capacity vs. Pipe Capacity
Stricker's / Mendota Watershed Study, City of Madison, WI

Node Name	# of Directly Connected Inlets	Downstream Link Name	D/S Pipe Size (inches)	D/S Pipe Capacity (cfs)	# of U/S Links	Downstream Node Name	Total # of Inlets	Total Inlet Capacity (cfs) at Selected Water Depth (ft) *		Is Total Inlet Capacity Greater than Pipe Capacity?	
								0.25-ft	0.55-ft	0.25-ft	0.55-ft
AS3246-014	3	3246-014_3246-023	18	7.5	0	IN3246-023	3	10.8	35.5	Yes	Yes
IN3246-023	1	3246-023_3246-024	18	7.8	1	AS3246-024	4	12.5	41.5	Yes	Yes
IN3246-027	1	3246-027_3246-025	24	16.7	0	IN3246-025	1	4.6	14.7	No	No
IN3246-025	3	3246-025_3246-024	24	16.8	1	AS3246-024	4	9.6	32.8	No	Yes
AS3246-024	0	3246-024_3246-019	24	39.0	2	SS3246-019	8	22.1	74.3	No	Yes
AS3246-004	2	3246-004_3246-016	18	6.1	0	AS3246-016	2	3.8	13.1	No	Yes
AS3246-016	3	3246-016_3246-019	18	15.2	1	SS3246-019	5	8.8	31.2	No	Yes
SS3246-019	0	3246-019_3246-020	24	18.9	2	AS3246-020	13	30.9	105.5	Yes	Yes
AS3246-020	0	3246-020_3246-009	24	58.0	1	IN3246-009	13	30.9	105.5	No	Yes
IN3246-009	2	3246-009_3245-004	24	41.4	1	IN3245-004	15	33.9	114.3	No	Yes
IN3245-004	1	3245-004_BC_JCT_11	24	27.1	1	BC_JCT_11	16	35.5	118.8	Yes	Yes
BC_JCT_11	3	BC_JCT_11_3245-003	24	14.1	1	AS3245-003	19	44.7	145.3	Yes	Yes
AS3245-003	3	3245-003_3245-001	24	28.1	1	AS3245-001	22	50.6	160.8	Yes	Yes
AS3245-001	0	3245-001_3245-002	30	44.2	1	AS3245-002	22	50.6	160.8	Yes	Yes
AS3245-002	2	3245-002_3245-005	36	54.8	1	AS3245-005	24	53.6	169.5	Maybe	Yes
AS3245-005	1	3245-005_BC_JCT_9	36	54.1	1	BC_JCT_9	25	55.6	174.7	Maybe	Yes

* Equals flow depth for slope inlets and ponding depth for sag inlets

NOTE: **Yes** = Inlet capacity is more than 110% of the pipe capacity.
Maybe = Inlet capacity is between 90% and 110% of pipe capacity.
No = Inlet capacity is less than 90% of pipe capacity.

Appendix F: Focus Group Summary

WATERSHED FOCUS GROUPS

Information for outreach

CITY OF MADISON ENGINEERING DIVISION

WATERSHED FOCUS GROUPS

Information for outreach

Goal of focus groups

Focus groups are the next part of the Watershed Studies the City of Madison Engineering Division is doing to look closer at stormwater infrastructure in the City. This comes after the August 2018 flooding and heavy rain events in recent years that have exposed ways to improve the City's stormwater infrastructure as a whole.

The purpose of the first round of focus group meetings will be to gather information. It is not the intention to share or discuss detailed modeling results. Once the modeling progresses further, the City will set up a second round of focus group meeitngs to discuss results and possible design solutions.

How the focus groups will work

- Meetings are expected to take 1 hour.
- Most focus group meetings will be held outside, rain or shine, walk-and talk format.
- If rain is predicted, please dress and accessorize (umbrella, jacket, and proper footwear).
- City Engineers will facilitate the group.
- If you need accessible accommodations, please let the project manager know.

Timeline

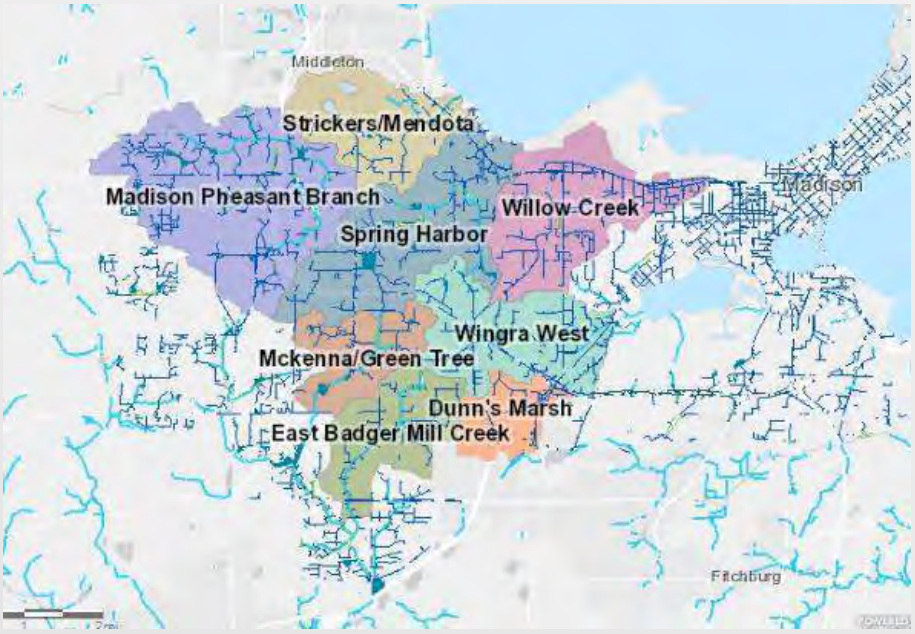
- May/June 2019:
  - Public information meetings
- Aug./Sept. 2019:
  - Focus group meetings
- Winter 2019:
  - Data sharing from Watershed Studies
- Spring 2020:
  - Second round of PIMS: Concept Sharing

Watersheds

- Strickers/Mendota
- Madison Pheasant Branch
- Spring Harbor
- Willow Creek
- Wingra West
- Mckenna/Green Tree
- East Badger Mill Creek
- Dunn's Marsh

Resources for residents

- Report flooding: www.cityofmadson.com/reportflooding
- City of Madison's Flooding Website: www.cityofmadison.com/flooding
- City of Madison's Engineering Division Facebook page: www.facebook.com/CityofMadisonEngineering
- City of Madison Engineering Division Podcast on Flooding:
    - Search Everyday Engineering on Apple iTunes or Google Play, the first 15-20 minute episode is about flooding and ways to flood-proof your home
- Sign up for the City's weekly flooding updates: www.cityofmadison.com/live-work/extreme-weather/flooding/updates
- On the City's flood website, how-to video on sandbagging technique
- Contacts
    - Lauren Striegl
        - Engineer, City of Madison Engineering Division
        - 608-266-4094
        - Lstriegl@cityofmadison.com
    - Hannah Mohelnitzky
        - Public Information Officer, City of Madison Engineering Division
        - 608-242-6003
        - hmohelnitzky@cityofmadison.com



Jim Bachhuber

From: Striegl, Lauren <LStriegl@cityofmadison.com>
Sent: Monday, August 26, 2019 11:52 AM
To: Mohelnitzky, Hannah; Jim Bachhuber
Subject: City of Madison Julia St/Baker Ave Focus Group Meeting TOMORROW!

Hi Julia St/Baker Ave residents,

Our City team is excited about the Julia St/Baker Ave focus group meeting tomorrow morning at 8am! We hope that we will see you and many of your neighbors at the meeting. I wanted to give you a heads up that, as this focus group meeting is the first in our series, it is possible that there may be some members of the media in attendance at tomorrow's meeting. Our Public Informational Officer, Hannah Mohelnitzky, will also be in attendance, and will be working with any media members that may be there to ensure that the meeting is not disrupted.

If you have any concerns about privacy or any other issues, please feel free to contact Hannah directly by email (hmohelnitzky@cityofmadison.com) or phone (608-242-6003) to discuss. Alternately, please catch Hannah or any other City employee or representative tomorrow and we can work with you to ensure that you are comfortable. We want to make sure all residents feel totally comfortable sharing their stories so that our team can best understand your flooding issues.

Thank you again, and we hope to see you tomorrow!

Lauren Striegl, PE
City of Madison - Engineering Division
210 Martin Luther King Jr. Blvd.
Madison, WI 53703
608-266-4094

Memorandum

8383 Greenway Blvd. # 600
Middleton, WI 53562

Date: April 9, 2020

Prepared for: City of Madison: Lauren Striegl, PE

Subject: Stricker's / Mendota Watershed – Julia Street and Baker Avenue Focus Group Meeting Summary (Meeting Date: August 27, 2019)

Project No.: City of Madison: 8411, BC: 153393

From: Mike Wegner, PE

Copy: Doug Joachim, PE; Jim Bachhuber, PH

General Information

- Focus Group date: August 27, 2019
- Number of attendees: 13
- Facilitators: Jim Bachhuber, Lauren Striegl, Hannah Mohelnitzky, Alder Furman

Summary of Focus Group Discussion

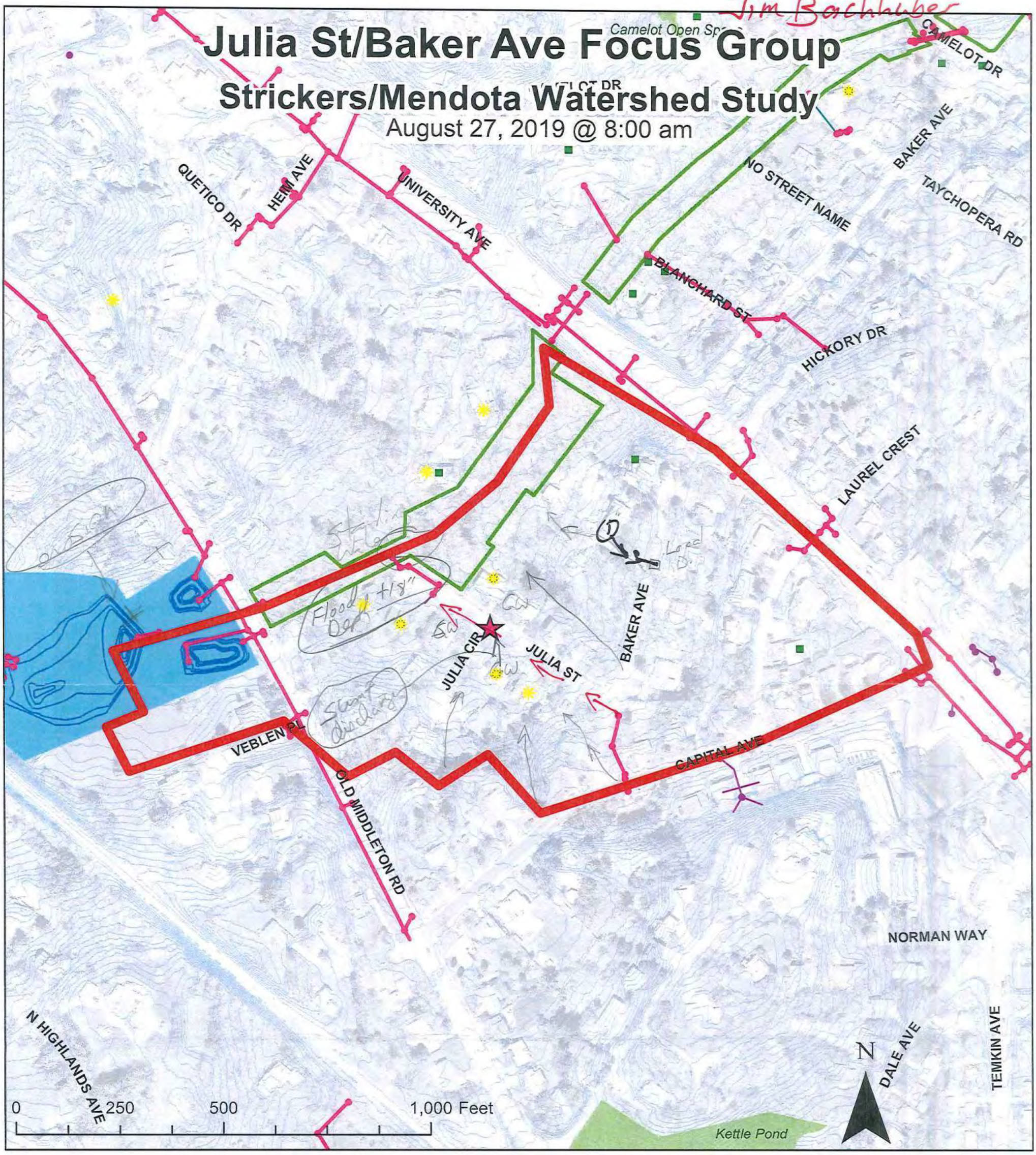
1. High groundwater in the area causes basement flooding for several houses on Julia Street and Julia Circle.
2. There is substantial stormwater runoff through the backyards of the houses on the north side of Julia Street. Also stormwater runoff through backyards and side yards of homes on south side of Julia Street and Julia Circle.
3. During the winter months, water from sump pumps and runoff often fails to enter the storm sewer on Julia Street, causing icing.
4. There is a large wet area in the greenway adjacent to Julia Street. This area was not always so wet, but has held standing water for long periods of time in the last few years.
5. Brushing crews in the greenway in 2018 seemed un-directed, and left trash littered in and adjacent to the greenway. Brush that was cut was often not removed from the greenway following cutting, and several residents mentioned that this could be contributing to impeded drainage out of the greenway. Residents generally commented that it was not a good experience with the brushing crew.
6. Long-time residents generally agreed that groundwater and surface water runoff through the area has increased in recent years as compared to 15 to 25 years ago.

Jim Bachhuber

Julia St/Baker Ave Focus Group

Strickers/Mendota Watershed Study

August 27, 2019 @ 8:00 am



- Storm Sewer
- Storm Sewer Structures
- Private Pipes
- Private Structures
- Pond
- Greenway
- Pond Contours
- 2' Contours
- Meeting Location
- Focus Group Area
- Focus Group Request
- Reported Flooding Online

Document Path: F:\Encommon\STORM\Watershed Studies\GIS\MXDs\FocusGroup_Round1_FieldMaps.mxd Time: 8:26:19 AM Date: 8/26/2019

Brown AND Caldwell

Date Checked	Checked By	Job Number	By	Date	Calc. No.	Sheet No.

Project	Subject
8-27-19	Julia / Baker Focus Group

Julia - Continuous groundwater situation
- channel needs clearing
- blocked with debris

Tree Removal - / Debris in Greenway

Ice on road from sump discharg

5810 Julia - Sumps running 24/7 since Aug 18

Laurel - 1609 - huge rain garden
- SW credit?

References/Notes

Jim Bachhuber

From: Striegl, Lauren <LStriegl@cityofmadison.com>
Sent: Tuesday, August 20, 2019 10:08 AM
To: Burger, Caroline; OBrien, Joanna; Jim Bachhuber; Mike Wegner
Subject: RE: Focus Group Invitation - Hickory Hollow (Strickers/Mendota Watershed)
Attachments: WATERSHED FOCUS GROUPS Strickers Mendota.pdf; Focus Groups -_Hickory Hollow.pdf

Hello,

Based on responses to the Hickory Hollow Doodle poll, the City of Madison Engineering Division has organized the following Focus Group meeting for your neighborhood:

Focus Group Name: Hickory Hollow
Tuesday, August 27, 2019 from 12:00-1:00 pm
Meeting Location: Hickory Hollow Turnaround

Thank you to all who responded to the Doodle poll and helped us schedule this meeting. We tried to accommodate as many of you as possible, and apologize to those who we could not.

We are sending out postcards to notify your neighbors within the focus group area about the upcoming meeting so we hope to see you and your neighbors there! Please remember that the meeting will take place rain or shine, so dress and/or accessorize appropriately! Additionally, note that these Focus Groups will take us on or near City streets, so please be aware of your surroundings and walk or stand off the street whenever possible. Please contact us as soon as possible if you or someone you know require accommodations or a translator.

Attached please find a map of the meeting place location. Additionally, please find a document that describes our outreach efforts and these focus groups and provides resources for residents to learn about flooding. Please use this document to speak with your neighbors or others that you think might be interested in learning more about the City's efforts in this area!

If you have any questions, please contact me by phone or email. Thank you so much, and we look forward to seeing you at your neighborhood Focus Group meeting!

Best,

Lauren Striegl, PE
City of Madison - Engineering Division
210 Martin Luther King Jr. Blvd.
Madison, WI 53703
608-266-4094

From: Striegl, Lauren
Sent: Wednesday, August 07, 2019 12:30 PM
To: Burger, Caroline <CBurger@cityofmadison.com>; OBrien, Joanna <jobrien@cityofmadison.com>; Jim Bachhuber - Brown and Caldwell (jbachhuber@brwncald.com) <jbachhuber@brwncald.com>; Mike Wegner (mwegner@BrwnCald.com) <mwegner@BrwnCald.com>
Subject: Focus Group Invitation - Hickory Hollow (Strickers/Mendota Watershed)

Hello,

The City of Madison would like to offer you the chance to set up a Flooding Focus Group meeting in your neighborhood. As you may recall, City of Madison Engineering Division hosted four (4) Watershed Study Public Informational Meetings in May and April of 2019. These meetings described the City's watershed study projects in the Spring Harbor, Stricker's/Mendota, Wingra West and Pheasant Branch watersheds. You are receiving this email because you signed up for a Flooding Focus Group meeting at one of the City of Madison's watershed study Public Informational Meetings (PIMs) in April or May 2019, or because you reported flooding through the City's website in one of our focus group areas. We used the information from both the focus group sign-ups and flood reporting forms to compile areas and groups for these more personalized Focus Group meetings. Based on your address, we have placed you in the Hickory Hollow Focus Group. Attached please find a map of that focus group's boundaries.

We would like to work with you to schedule these focus group meetings such that all interested people can attend! Please click on the link below and fill out the Doodle Poll with your availability. We understand that the poll is long and has many availability options, but if possible please click through and select **every** time slot option that works for you! We have many group meetings to schedule, and we appreciate your time and flexibility in setting these up.

Doodle poll link: https://doodle.com/poll/5qcvxvf3pckfdqsb

We anticipate that each of these focus group meetings will last approximately 1 hour. Most focus group meetings will be held outside, **rain or shine**, and take the form of a walk-and-talk meeting. If rain is predicted, please dress and/or accessorize appropriately. Focus group meetings will only be cancelled in the event of a weather emergency. We understand that standing and walking may not be possible for all attendees, so if you would like to request different accommodations, please reply to this email as soon as possible so that we can find and reserve an accessible meeting space. Once we find a date and time that works for everyone, we will look for a nearby meeting space. If you have a space in mind, we would love to know that too!

Lastly, this first round of focus group meetings will largely be information-gathering opportunities for the City and its consultants. While focus group facilitators will come to each meeting with general maps, it is not our intention to share or discuss detailed modeling results. Once modeling progresses further, the City will set up a second round of focus group meetings to discuss results and possible design solutions.

Please fill out the Doodle poll above by **Friday, August 9, 2019.** Thank you so much for your time and your willingness to assist the City with these watershed studies! If you have any questions, please contact me by phone or email as shown below.

For more information on your watershed study, please visit the City of Madison Flooding website, or the Strickers/Mendota Watershed Study website.

Thank you for your time.

Best,

Lauren Striegl, PE
City of Madison - Engineering Division
210 Martin Luther King Jr. Blvd.
Madison, WI 53703
608-266-4094

Memorandum

8383 Greenway Blvd. # 600
Middleton, WI 53562

Date: April 9, 2020

Prepared for: City of Madison: Lauren Striegl, PE

Subject: Stricker's / Mendota Watershed –Hickory Hollow Focus Group Meeting Summary (Meeting Date: August 27, 2019)

Project No.: City of Madison: 8411, BC: 153393

From: Mike Wegner, PE

Copy: Doug Joachim, PE; Jim Bachhuber, PH

General Information

- Focus Group date: August 27, 2019
- Number of attendees: 11
- Facilitators: Jim Bachhuber, Lauren Striegl, Hannah Mohelnitzky, Alder Furman

Summary of Focus Group Discussion

1. High groundwater in the area causes flooding of the private median at the Hickory Hollow Condominiums turnaround.
2. There is substantial runoff from the area adjacent to University Avenue (south of University Avenue and east of Heim Avenue), which drains down through the Hickory Hollow Condominiums to the greenway.
3. There is substantial water in the greenway during storm events, as well as water (lower, but still present) in the greenway during dry periods.
4. Residents are concerned about many trees in the greenway and in the median; they are concerned that high groundwater and flooding are killing the trees. There is concern that the trees could eventually become dangerous to residents and properties.
5. Brushing crews in the greenway in 2018 did not remove cut brush from the greenway following cutting, and several residents mentioned that this could be contributing to impeded drainage out of the greenway.
6. Long-time residents generally agreed that groundwater and surface water runoff through the area has increased in recent years compared to 15 to 25 years ago.

Hickory Hollow Focus Group

J. Bachhuber Field Notes
8/27/2019

Strickers/Mendota Watershed Study

August 27, 2019 @ 12:00 pm

- short term fixes
- water to treat Frees

CAMELOT DR

QUETICO DR

HEIM AVE

UNIVERSITY AVE

ROUGH LEE CT

OLD MIDDLETON RD

18" deep

debris

JULIA ST

JULIA CIR

VEBLEN PL

BAKER AVE

Skyview Park

0 250 500 1,000 Feet

N

Storm Sewer
Storm Sewer Structures
Private Pipes
Private Structures
Pond
Greenway
Pond Contours
2' Contours
Meeting Location
Focus Group Area
Focus Group Request
Reported Flooding Online

CITY OF MADISON ENGINEERING

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Photo 1: Aug 2018 flood height at 17 Hickory Hollow Drive. (Parcel # 070918225090)



Photo 2: culvert above University Ave. at Hickory Hollow channel (8/27/19)

Jim Bachhuber

From: Striegl, Lauren <LStriegl@cityofmadison.com>
Sent: Tuesday, August 20, 2019 10:05 AM
To: Burger, Caroline; OBrien, Joanna; Jim Bachhuber; Mike Wegner
Subject: RE: Focus Group Invitation - Baker Ave/Lake Mendota (Strickers/Mendota Watershed)
Attachments: WATERSHED FOCUS GROUPS Strickers Mendota.pdf; Focus Groups -_Baker Ave_Lake Mendota.pdf

Hello,

Based on responses to the Baker Ave/Lake Mendota Doodle poll, the City of Madison Engineering Division has organized the following Focus Group meeting for your neighborhood:

Focus Group Name: Baker Ave/Lake Mendota
Tuesday, August 27, 2019 from 6:00-7:00 pm
Meeting Location: Corner of Baker Ave and Lake Mendota Dr

Thank you to all who responded to the Doodle poll and helped us schedule this meeting. We tried to accommodate as many of you as possible, and apologize to those who we could not.

We are sending out postcards to notify your neighbors within the focus group area about the upcoming meeting so we hope to see you and your neighbors there! Please remember that the meeting will take place rain or shine, so dress and/or accessorize appropriately! Additionally, note that these Focus Groups will take us on or near City streets, so please be aware of your surroundings and walk or stand off the street whenever possible. Please contact us as soon as possible if you or someone you know require accommodations or a translator.

Attached please find a map of the meeting place location. Additionally, please find a document that describes our outreach efforts and these focus groups and provides resources for residents to learn about flooding. Please use this document to speak with your neighbors or others that you think might be interested in learning more about the City's efforts in this area!

If you have any questions, please contact me by phone or email. Thank you so much, and we look forward to seeing you at your neighborhood Focus Group meeting!

Best,

Lauren Striegl, PE
City of Madison - Engineering Division
210 Martin Luther King Jr. Blvd.
Madison, WI 53703
608-266-4094

From: Striegl, Lauren
Sent: Wednesday, August 07, 2019 12:26 PM
To: Burger, Caroline <CBurger@cityofmadison.com>; OBrien, Joanna <jobrien@cityofmadison.com>; Jim Bachhuber - Brown and Caldwell (jbachhuber@brwncald.com) <jbachhuber@brwncald.com>; Mike Wegner (mwegner@BrwnCald.com) <mwegner@BrwnCald.com>
Subject: Focus Group Invitation - Baker Ave/Lake Mendota (Strickers/Mendota Watershed)

Hello,

The City of Madison would like to offer you the chance to set up a Flooding Focus Group meeting in your neighborhood. As you may recall, City of Madison Engineering Division hosted four (4) Watershed Study Public Informational Meetings in May and April of 2019. These meetings described the City's watershed study projects in the Spring Harbor, Stricker's/Mendota, Wingra West and Pheasant Branch watersheds. You are receiving this email because you signed up for a Flooding Focus Group meeting at one of the City of Madison's watershed study Public Informational Meetings (PIMs) in April or May 2019, or because you reported flooding through the City's website in one of our focus group areas. We used the information from both the focus group sign-ups and flood reporting forms to compile areas and groups for these more personalized Focus Group meetings. Based on your address, we have placed you in the Baker Ave/Lake Mendota Focus Group. Attached please find a map of that focus group's boundaries.

We would like to work with you to schedule these focus group meetings such that all interested people can attend! Please click on the link below and fill out the Doodle Poll with your availability. We understand that the poll is long and has many availability options, but if possible please click through and select **every** time slot option that works for you! We have many group meetings to schedule, and we appreciate your time and flexibility in setting these up.

Doodle poll link: https://doodle.com/poll/5qcvxvf3pckfdqsb

We anticipate that each of these focus group meetings will last approximately 1 hour. Most focus group meetings will be held outside, **rain or shine**, and take the form of a walk-and-talk meeting. If rain is predicted, please dress and/or accessorize appropriately. Focus group meetings will only be cancelled in the event of a weather emergency. We understand that standing and walking may not be possible for all attendees, so if you would like to request different accommodations, please reply to this email as soon as possible so that we can find and reserve an accessible meeting space. Once we find a date and time that works for everyone, we will look for a nearby meeting space. If you have a space in mind, we would love to know that too!

Lastly, this first round of focus group meetings will largely be information-gathering opportunities for the City and its consultants. While focus group facilitators will come to each meeting with general maps, it is not our intention to share or discuss detailed modeling results. Once modeling progresses further, the City will set up a second round of focus group meetings to discuss results and possible design solutions.

Please fill out the Doodle poll above by **Friday, August 9, 2019.** Thank you so much for your time and your willingness to assist the City with these watershed studies! If you have any questions, please contact me by phone or email as shown below.

For more information on your watershed study, please visit the City of Madison Flooding website, or the Strickers/Mendota Watershed Study website.

Thank you for your time.

Best,

Lauren Striegl, PE
City of Madison - Engineering Division
210 Martin Luther King Jr. Blvd.
Madison, WI 53703
608-266-4094

Jim Bachhuber

From: Striegl, Lauren <LStriegl@cityofmadison.com>
Sent: Monday, August 26, 2019 11:52 AM
To: Mohelnitzky, Hannah; Jim Bachhuber
Subject: City of Madison Julia St/Baker Ave Focus Group Meeting TOMORROW!

Hi Julia St/Baker Ave residents,

Our City team is excited about the Julia St/Baker Ave focus group meeting tomorrow morning at 8am! We hope that we will see you and many of your neighbors at the meeting. I wanted to give you a heads up that, as this focus group meeting is the first in our series, it is possible that there may be some members of the media in attendance at tomorrow's meeting. Our Public Informational Officer, Hannah Mohelnitzky, will also be in attendance, and will be working with any media members that may be there to ensure that the meeting is not disrupted.

If you have any concerns about privacy or any other issues, please feel free to contact Hannah directly by email (hmohelnitzky@cityofmadison.com) or phone (608-242-6003) to discuss. Alternately, please catch Hannah or any other City employee or representative tomorrow and we can work with you to ensure that you are comfortable. We want to make sure all residents feel totally comfortable sharing their stories so that our team can best understand your flooding issues.

Thank you again, and we hope to see you tomorrow!

Lauren Striegl, PE
City of Madison - Engineering Division
210 Martin Luther King Jr. Blvd.
Madison, WI 53703
608-266-4094

Memorandum

8383 Greenway Blvd. # 600
Middleton, WI 53562

Date: April 9, 2020

Prepared for: City of Madison: Lauren Striegl, PE

Subject: Stricker's / Mendota Watershed –Baker Avenue and Lake Mendota Focus Group Meeting Summary (Meeting Date: August 27, 2019)

Project No.: City of Madison: 8411, BC: 153393

From: Mike Wegner, PE

Copy: Doug Joachim, PE; Jim Bachhuber, PH

General Information

- Focus Group date: August 27, 2019
- Number of attendees: 20
- Facilitators: Jim Bachhuber

Summary of Focus Group Discussion

1. The channel between University Avenue and Lake Mendota Avenue was "cleaned out" (widened and stabilized) in 1993. This helped a lot with improved drainage, but it needs to be cleaned out again.
2. Flooding depths in August, 2018 reached about 3-feet at the culvert crossing on Lake Mendota Avenue.
3. Greenway brushing crews that worked in 2018/2019 left cut brush piles in the greenway.
4. When electrical crews do clearing in the greenway they leave brush piles as well. Power lines cross the greenway at Taychopera Drive (perpendicular to channel between Baker Avenue and Camelot Drive).
5. One resident expressed concern about the area where they live, which sits between the Stricker's / Mendota and Spring Harbor watershed areas (direct drainage to Lake Mendota). The resident asked if those flood issues be addressed by these studies. The City will work with their consultants to examine this divide and quantify flooding that happens in the area.
6. Residents think curbing on Baker Avenue and other streets would help keep water in the streets.



Photo 1: drop structure in channel above L. Mendota Drive



Photo 2: culvert above Lake Mendota Drive



Photo 3: Channel looking upstream from Lake Mendota Drive culvert



Photo 4: Channel & drop structure upstream from Lake Mendota Drive.

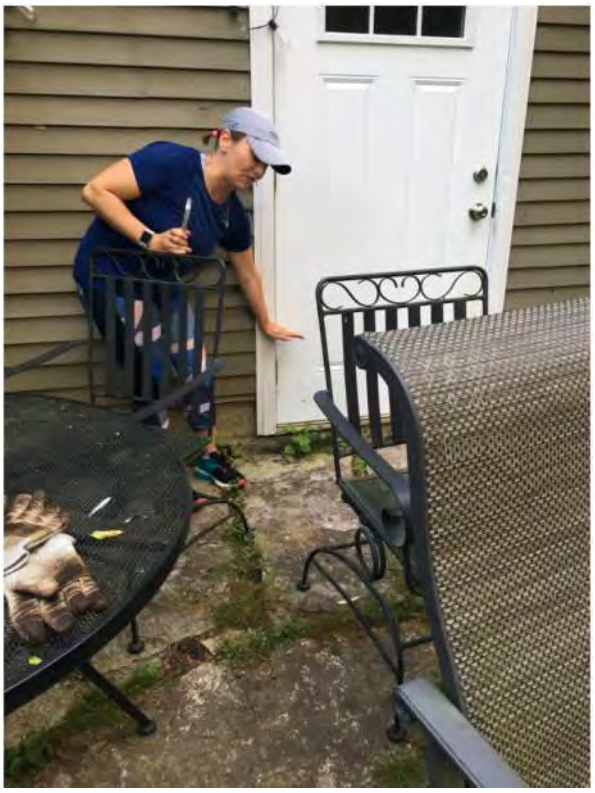

Photo 5: Flood elevation at 1840 Baker Ave. (corner of Baker and L. Mendota) Back of house.



Photo 6: Street inlets and side-yard swale to channel at 1729 Camelot Drive



Photo 7: Storm sewer daylight on Blanchard Drive (~ 100' west of Baker Ave.). Inlet is at corner of Baker and Blanchard. Another street inlet is ~ 75' downstream from this outlet. (photo taken on Blanchard looking toward Baker).

Baker Ave/Lake Mendota Focus Group

Strickers/Mendota Watershed Study

J. Bachhuber Notes
8/27/2019

Aug 27 2019 @ 6:00 pm

Marshall Park

Lake Mendota

THORSTRAND RD

Camelot Open Space

CAMELOT DR

BAKER AVE

LAUREL CREST

LAKE MENDOTA DR

NO STREET NAME

UNIVERSITY AVE

BLANCHARD ST

HICKORY DR

TAYCHOPERA RD

LAUREL CT

CAPITAL AVE

BAKER AVE

CAMUS LN

GREENING LN

JULIA ST

N

0 500 1,000 Feet

- Storm Sewer
- Storm Sewer Structures
- Private Pipes
- Private Structures
- Pond
- Greenway
- Pond Contours
- 2' Contours
- Meeting Location
- Focus Group Area
- Focus Group Request
- Reported Flooding Online

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Brown AND Caldwell

Date Checked	Checked By	Job Number	By	Date	Calc. No.	Sheet No.
JAB				8-27-19		

Project	Subject
Baker / Mendota	

References/Notes

- Brush in channel
- Parks co trimming ← Leave brush in Greenway
- Neighbors dump yard waste in Greenway
- Channel dug (~1992) : Baker + Blanchard
- Baker - needs curb + gutter

Jim Bachhuber

From: Striegl, Lauren <LStriegl@cityofmadison.com>
Sent: Wednesday, August 07, 2019 12:20 PM
To: Burger, Caroline; OBrien, Joanna; Jim Bachhuber; Mike Wegner
Subject: Focus Group Invitation - Longmeadow/Backbay Cir (Strickers/Mendota Watershed)
Attachments: Focus Groups -_Longmeadow_Backbay Cir.pdf

Hello,

The City of Madison would like to offer you the chance to set up a Flooding Focus Group meeting in your neighborhood. As you may recall, City of Madison Engineering Division hosted four (4) Watershed Study Public Informational Meetings in May and April of 2019. These meetings described the City's watershed study projects in the Spring Harbor, Stricker's/Mendota, Wingra West and Pheasant Branch watersheds. You are receiving this email because you signed up for a Flooding Focus Group meeting at one of the City of Madison's watershed study Public Informational Meetings (PIMs) in April or May 2019, or because you reported flooding through the City's website in one of our focus group areas. We used the information from both the focus group sign-ups and flood reporting forms to compile areas and groups for these more personalized Focus Group meetings. Based on your address, we have placed you in the Longmeadow/Backbay Cir Focus Group. Attached please find a map of that focus group's boundaries.

We would like to work with you to schedule these focus group meetings such that all interested people can attend! Please click on the link below and fill out the Doodle Poll with your availability. We understand that the poll is long and has many availability options, but if possible please click through and select **every** time slot option that works for you! We have many group meetings to schedule, and we appreciate your time and flexibility in setting these up.

Doodle poll link: https://doodle.com/poll/5qcvxvf3pckfdqsb

We anticipate that each of these focus group meetings will last approximately 1 hour. Most focus group meetings will be held outside, **rain or shine**, and take the form of a walk-and-talk meeting. If rain is predicted, please dress and/or accessorize appropriately. Focus group meetings will only be cancelled in the event of a weather emergency. We understand that standing and walking may not be possible for all attendees, so if you would like to request different accommodations, please reply to this email as soon as possible so that we can find and reserve an accessible meeting space. Once we find a date and time that works for everyone, we will look for a nearby meeting space. If you have a space in mind, we would love to know that too!

Lastly, this first round of focus group meetings will largely be information-gathering opportunities for the City and its consultants. While focus group facilitators will come to each meeting with general maps, it is not our intention to share or discuss detailed modeling results. Once modeling progresses further, the City will set up a second round of focus group meetings to discuss results and possible design solutions.

Please fill out the Doodle poll above by **Friday, August 9, 2019.** Thank you so much for your time and your willingness to assist the City with these watershed studies! If you have any questions, please contact me by phone or email as shown below.

For more information on your watershed study, please visit the City of Madison Flooding website, or the Strickers/Mendota Watershed Study website.

Thank you for your time.

Best,

Jim Bachhuber

From: Striegl, Lauren <LStriegl@cityofmadison.com>
Sent: Tuesday, August 20, 2019 10:14 AM
To: Burger, Caroline; OBrien, Joanna; Jim Bachhuber; Mike Wegner
Subject: RE: Focus Group Invitation - Longmeadow/Backbay Cir (Strickers/Mendota Watershed)
Attachments: WATERSHED FOCUS GROUPS Strickers Mendota.pdf; Focus Groups -_Longmeadow_Backbay Cir.pdf

Hello,

Based on responses to the Longmeadow/Backbay Cir Doodle poll, the City of Madison Engineering Division has organized the following Focus Group meeting for your neighborhood:

Focus Group Name: Longmeadow/Backbay Cir
Monday, September 9, 2019 from 12:00-1:00 pm
Meeting Location: Strickers Pond Pedestrian Path

Please note that the postcards that went out inviting residents to this focus groups listed the wrong day of the week. That error has been corrected in this email and a new postcard with the correction has been sent to residents.

Thank you to all who responded to the Doodle poll and helped us schedule this meeting. We tried to accommodate as many of you as possible, and apologize to those who we could not.

We are sending out postcards to notify your neighbors within the focus group area about the upcoming meeting so we hope to see you and your neighbors there! Please remember that the meeting will take place rain or shine, so dress and/or accessorize appropriately! Additionally, note that these Focus Groups will take us on or near City streets, so please be aware of your surroundings and walk or stand off the street whenever possible. Please contact us as soon as possible if you or someone you know require accommodations or a translator.

Attached please find a map of the meeting place location. Additionally, please find a document that describes our outreach efforts and these focus groups and provides resources for residents to learn about flooding. Please use this document to speak with your neighbors or others that you think might be interested in learning more about the City's efforts in this area!

If you have any questions, please contact me by phone or email. Thank you so much, and we look forward to seeing you at your neighborhood Focus Group meeting!

Best,

Lauren Striegl, PE
City of Madison - Engineering Division
210 Martin Luther King Jr. Blvd.
Madison, WI 53703
608-266-4094

From: Striegl, Lauren
Sent: Wednesday, August 07, 2019 12:20 PM
To: Burger, Caroline <CBurger@cityofmadison.com>; OBrien, Joanna <jobrien@cityofmadison.com>; Jim Bachhuber - Brown and Caldwell (jbachhuber@brwncald.com) <jbachhuber@brwncald.com>; Mike Wegner

(mwegner@BrwnCald.com) <mwegner@BrwnCald.com>
Subject: Focus Group Invitation - Longmeadow/Backbay Cir (Strickers/Mendota Watershed)

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Thank you for your time.

Best,

Lauren Striegl, PE
City of Madison - Engineering Division
210 Martin Luther King Jr. Blvd.
Madison, WI 53703
608-266-4094

Memorandum

8383 Greenway Blvd. # 600
Middleton, WI 53562

Date: April 9, 2020

Prepared for: City of Madison: Lauren Striegl, PE

Subject: Stricker's / Mendota Watershed –Longmeadow / Backbay Circle Focus Group Meeting Summary (Meeting Date: September 9, 2019)

Project No.: City of Madison: 8411, BC: 153393

From: Mike Wegner, PE

Copy: Doug Joachim, PE; Jim Bachhuber, PH

General Information

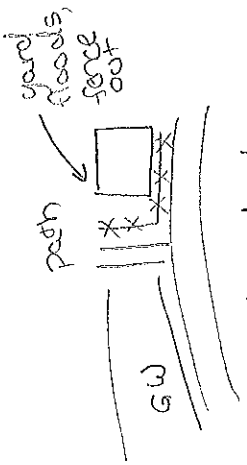
- Focus Group date: September 9, 2019
- Number of attendees: Approximately 15
- Facilitators: Jim Bachhuber, Lauren Striegl, Hannah Mohelnitzky, Alder Furman

Summary of Focus Group Discussion

1. Residents mentioned that water runs from condos (Quail Ridge Drive) through backyards to Longmeadow Drive.
2. The storm drain at the low-point in Longmeadow Drive near Gammon Road clogs routinely (at least 2 times per year). A resident attempts to clean inlets on both sides of street.
3. Water in the storm sewer that runs behind residents' houses parallel to Longmeadow exceeded the storm sewer capacity and ran in the swale during August 2018. Water came very close to houses and in many cases touched decks and/or retaining walls.
4. End of swale behind houses flooded during August 2018, and at least one house had water in the basement.
5. Several residents reported sinkholes immediately east of Stricker's Forebay.
6. Several residents reported old utility boxes/cables in yards that they want removed.
7. Residents expressed concern that children could enter storm sewer through beehive grate in swale behind houses.

L. Striegl field notes: Longmeadow/Backbay Focus Group (9/9/19)

- Coming from condos, Gammon Rd to swale in backyards
  - Backbay Cir
- Storm drain backs up a couple times a year
  - Neighbor cleans both sides
- End of swale is at a local depression



- 13 Backbay → water in basement
- 14 Backbay
- Condos (Quail Ridge) → lots of water coming to Longmeadow
- 7102 Longmeadow → no water in basement, water to deck 7-8" off deck
- Sumac ~~grew~~ grew up to light grass
- cables exposed for ~3 houses
- water to top of raised garden wall (7110 Longmeadow)
  - Halfway up the pale grass
  - ~ 30' wide by 5-6' deep
- Concern about kids getting through 6" tall opening

- Abandoned utility boxes
- sinkhole by 14 Backbay - TDS? still open

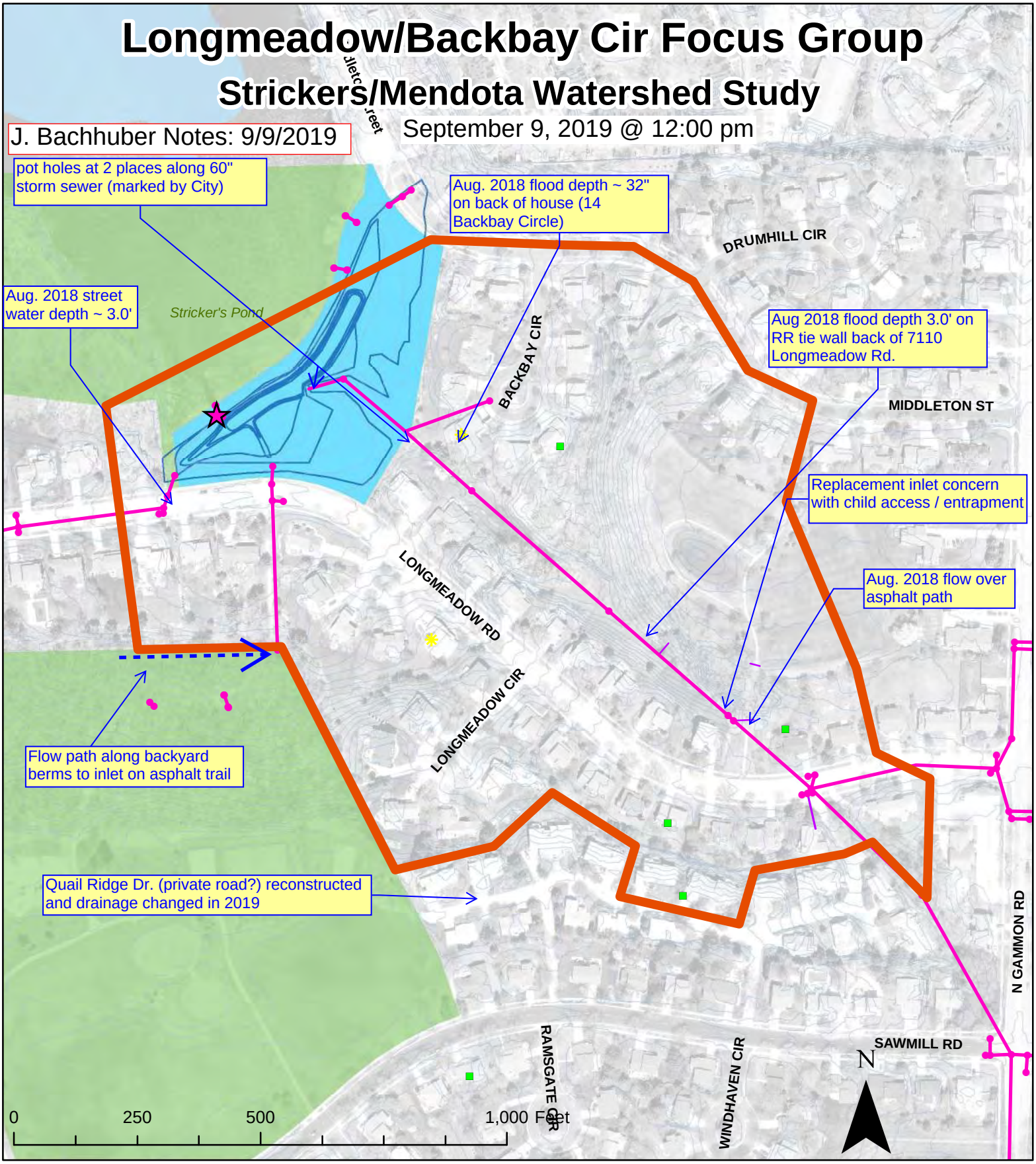
- 7217 Longmeadow
  - 2001 → no backflow preventer (2000/01)
    - water through bathtub
  - Put in backflow preventer
  - Sump pump - can run yr-round
  - Aug 2018 - lost power, no sump
    - Came out of backflow preventer
  - Two people working full-time

Longmeadow/Backbay Cir Focus Group

Strickers/Mendota Watershed Study

September 9, 2019 @ 12:00 pm

J. Bachhuber Notes: 9/9/2019



- Storm Sewer
- Storm Sewer Structures
- Private Pipes
- Private Structures
- Pond
- Greenway
- Pond Contours
- 2' Contours
- Meeting Location
- Focus Group Area
- Focus Group Request
- Reported Flooding Online

Document Path: F:\Encommon\STORM\Watershed Studies\GIS\MXDs\FocusGroup_Round1_FieldMaps.mxd Time: 8:22:41 AM Date: 8/26/2019

Photos from Longbeadow / Backbay Focus Group Meeting 9/19/2019





Photos from Longbeadow / Backbay Focus Group Meeting 9/19/2019





Photos from Longbeadow / Backbay Focus Group Meeting 9/19/2019



Appendix G: Peer Review #1 Summary

Peer Review Comments for Stricker's-Mendota Watershed
Peer Review #1
Date: 2019-12-04
By: AE2S (Amber Lefers, Linda Severson, Zach Magdol)

Review Comments	City Comments	Discussion	BC Response
Hydrology Review Comments			
Below are our review comments on the hydrologic analysis portion of the XP-SWMM model:			
1. Note that different subcatchment widths are used for the directly connected impervious area vs. the indirectly connected impervious area and pervious area. It appears that the basis for this difference is so that the subcatchment "length" is the same for the directly connected impervious area and the pervious area (with the indirectly connected impervious area set at the same width as the pervious area).	Note guidance at meeting; BC used approach in guidance	Noted	City and BC agreed to use this approach to model subcatchment width. This approach is consistent with the latest Modeling Guidance. BC will continue with approach used in the peer reviewed model version.
2. It appears that for the land use within the City of Middleton, only rooftops were accounted for in the impervious area calculations. We recommend that an estimate be made for driveways and streets so that the volume draining to the two ponds is fully accounted for.	Not mention at meeting; BC to update		BC agrees and will update impervious area calculations for the City of Middleton areas. Corresponding WinSLAMM standard land use files will be used to define the non-roof impervious areas.
3. It appears that both the water surface for Stricker's and Tiedeman's Ponds are included in the pervious portion of the subcatchment. Since rainfall directly on the water surface functions much more closely to impervious area, we recommend that open water be considered impervious surface.	Not mention at meeting; BC to update		BC agrees and will update impervious area calculations for the Stricker's' and Tiedemann's Pond subcatchments. Horton Infiltration parameters for HSG = W were included. It would be a more straight-forward approach to account for large waterbodies as impervious. BC will modify the approach.
4. It appears that for the impervious area subcatchments, Curve Number methodology is being used for computing runoff volume for impervious area. If CN value of 98 is being used, the total losses from a 3-inch rainfall is nearly 0.25 inches, which likely underestimates the total runoff potential from impervious area. We recommend that the modeling approach for impervious area be reviewed and modified as necessary.	To discuss at meeting	In Infiltration Parameters, CN was selected for impervious area. BC ran both ways and doesn't make a difference. BC may change for consistency.	Curve number methodology was not solely being used for computing runoff volume. It was being used for infiltration parameters for impervious areas (in lieu of Horton Infiltration). Based on testing there is no difference in runoff results. A follow-up comment on this item was in Peer Review #2. Upon investigation, it was not the CN infiltration parameters that was an issue. A default setting in XPSWMM has an evaporation value of 0.1-inches per day. It appears this creates the discrepancy identified by AE2S. For clarity the infiltration parameters for impervious areas will be changed to Horton, but this will not result in a difference in runoff. Eliminating the evaporation will result in a difference.
5. There are several areas where the subcatchments are crudely delineated with respect to the LiDAR topography. We suggest that these areas be refined given the City's investment in detailed LiDAR data and that the subcatchment modeling should reflect that investment.	Not mention at meeting; Amber to provide example offline; BC update if agree		BC reviewed the subcatchment divides and we have not found significant deviations from the subcatchment boundary and the available topographic data (LiDAR) and storm sewer system. If there are specific locations where deviations occur, we would appreciate having these identified and we will adjust accordingly.
6. We recommend that the overall detail of the subcatchment modeling be significantly increased to correspond to the Modeling Guidance standards for modeling all 18-inch pipes and larger (unless a good reason not to) and including smaller pipes where these are the only pipes that drain a certain area. See also 1D Hydraulics comments.	To discuss at meeting	BC will review and refine.	BC has updated subcatchments such that runoff is input at the upstream-most 18-inch pipe (with limited exceptions). With the noted adjustments, we believe this level of subcatchment detail meets the intended goals of the level of analysis requested by the City.

7. We recommend that as a general rule, subcatchments be routed to a surface node versus directly into the storm sewer, as that is not how runoff draining to and in the street functions.	Will be addressed in calibration model		Inlet capacity was added into the model. A new node, connected to the surface, and a link with a rating curve is used to connect to the storm sewer system to simulate inlet capacity.
8. There are areas where streets have very long runs before the storm sewer starts, one example of that being Sawmill Road west of Gammon Road. It is likely that the street does not meet current City standards for street drainage; however, the level of detail for the subcatchments cannot answer that question. We recommend that smaller subcatchments be delineated along roads similar to this so that future improvements can be evaluated and recommended.	Discuss at meeting. Previously agreed upon approach resulted in BC's approach being acceptable for the watershed studies.	As needed, subbasins are subdivided for further evaluation. If there is flooding upstream, there will be an capacity issue and water will back-up onto the street.	BC is applying runoff at nodes to represent inlets. We do not believe representing flow along the street upstream of inlets is warranted for purposes of this study.
1D Hydraulics PEER Review Comments			
1. Based on a spot check of the 1D network, it appears the following parameters are consistent with the modeling guidance: a. Loss coefficients for straight pipes and bends b. Inlet control codes c. Pipe roughness values d. Stage-area relationships	Not mention at meeting; OK		No comment necessary
2. We recommend that all trunkline 18-inch and larger pipes be activated in the model, as they are currently turned off in the model, to reflect the Modeling Guidance standards.	Discuss at meeting	Pipes that were turned off will be turned on and subcatchments will be added.	BC has activated these lengths of pipe in conjunction with subcatchment refinement. (See Hydrology Response #6)
3. The Modeling Guidance also outlines that smaller than 18-inch pipes should be included as well when a smaller pipe is the only pipe draining an area. We recommend that smaller than 18-inch pipes be added to the model where they are the trunkline storm sewer in a street.	Discuss at meeting	Meant to account for trunklines that are less than 18-inches. BC to review and revise.	BC has activated pipes less than 18-inches in diameter where they are included in the current model.
4. There appear to be several locations in the storm sewer system where downstream inverts are higher than upstream inverts. We recommend that these areas be investigated	Not discuss at meeting; BC check and respond		BC spot checked the modeling. Data is consistent with City provided elevations.
5. We recommend that inlets (in some way) be incorporated into the model, since the model as it currently is constructed, shows virtually no street flooding in the 2-year event, which drastically underpredicts the flooding extents that actually happen. Note that one of the deliverables for the Watershed Study is a 2-year flood inundation map, so the model needs to reasonably represent conditions for both small and large events. Further, once proposed solutions are developed, the current modeling approach would show zero inundation except for greenways and ponds.	Will be addressed in calibration model	When check inlet capacity box in XP-SWMM, model run times greatly increase. Ran scenarios to use inlet capacity feature and did not improve run time. Current proposal, runoff nodes will become surface runoff nodes linked to the 2D surface and will use rating curve for aggregated based in inlets in GIS data and HEC-22 equations. Will seal manhole downstream of the weir. Frontal flow.... Side flow is function of flow at particular inlet- BC has given each inlet the parameters for its inlet, then add rating curves together. Developed rating curves using various flows - not flow from subbasin. Once slope inlet is above half a depth of flow, capped above half a foot. Not capped on a sag.	Inlet capacity was added into the model. A new node, connected to the surface, and a link with a rating curve is used to connect to the storm sewer system to simulate inlet capacity.

6. While we recognize that the level of detail for the "Middleton" side of the Watershed Study is limited, there is one location where additional detail appears warranted. At the sag for the (currently inactivated) node ("T13099"), runoff draining to the downstream greenway in Madison will be limited by the storm sewer capacity versus draining unrestricted. Therefore, we recommend that the segment of Middleton storm sewer from the sag to the currently modeled node ("T13087") be added to the model network and the subwatersheds adjusted accordingly.	Discuss at meeting	Location is upstream in the system; BC included sewer from Middleton to Madison.	This point (T13099) is located significantly upstream from the City of Madison's Mendota-Grassman Greenway. BC has included storm sewer, a swale, a culvert under the railroad tracks, and a pond in the City of Middleton upstream of the City of Madison. We believe this provides adequate separation and does not represent an "unrestricted" condition. Additionally, the City of Middleton has limited invert elevation data associated with their GIS data.
7. The outfalls are modeled as "Link Spill Crest to 2D" versus set at the lake level referenced in the Modeling Guidance although it appears that outflow from these nodes occurs below the spill crest. We recommend the modeling approach for these outfalls be reviewed and changed if necessary.	Discuss at meeting	BC to check	BC reviewed and it appears this approach is providing accurate results. A fixed backwater of 851.1 is set for the outfall nodes in accordance with the Model Guidance.
8. If 1D-2D interface lines are used along open channels, we recommend additional nodes be added to the 1D portion of the system to provide a more accurate 1D HGL elevation for which the 2D grid uses to send flow back and forth between the 1D and 2D system.	Discuss at meeting	BC to review and refine	BC does not believe additional nodes are needed for accurate depiction at this time. This may be added during alternatives analysis if needed.
2D Hydraulics PEER Review Comments			
1. 1D/2D node inflow capture is turned off – therefore, exchange between surface and 1D network is not restrained by catch basin hydraulics.	Discuss at meeting	If not initiated, then assumes water can come into node based on overflow from grid. Using this inhibits flow into node. BC will review and revise accordingly.	Inlet capacity was added into the model as described previously. Where nodes are adjacent to inlet nodes the node is "sealed." Nodes that are in other areas (not near inlets) are restricted with the global 2D inflow capture setting. Note: This update was erroneously missed in the models for Peer Review #2 - it is now updated in the models.
2. We suggest that the grid orientation be set to zero or to an orientation that is perpendicular to the primary flow paths or provide a justification as to the orientation of "-8.202 degrees".	Discuss at meeting	Innovyze recommend aligning grid with general major flow path. BC will review and adjust accordingly. Reduces run time and 1D/2D stability error at point (x,y) - where theoretical corner of rectangular	The grid orientation will be set to zero. Due to the variety of flow path directions, it is not possible to set it perpendicular to the primary flow path. Note: This update was erroneously missed in the models for Peer Review #2 - it is now updated in the models.
3. While the 2D roughness values in the model are consistent with the latest modeling guidance, the roughness values in the model are more appropriate for sheet flow conditions at the inception of runoff (i.e. rain on grid) versus roughness appropriate for more open channel flow conditions such as street and greenway flow. We recommend that roughness values be adjusted to reflect engineering practice for roughness values used in open channel flow conditions. Note that these lower roughness values will increase velocities and may require model adjustment to provide a stable model.	Discuss at meeting	City will update guidance document once AE2S and BC reach out to 2D experts on how to assign 2D land use roughness for varying flow depths.	BC is open to discussion on this topic. BC will follow the modeling guidance if it is updated.
4. We recommend that the model duration be extended to cover most or the entire flood event duration.	Not mention at meeting; OK		BC agrees and will model the full flood event duration in the final existing conditions deliverable.
SPOT CHECK COMMENTS			
Based on a spot check of the model, it appears that the model could generally be replicated. As part of the existing conditions report preparation, we recommend that data sources, etc.	Not mention at meeting; OK		Agreed. No further comment necessary
OVERALL QUESTIONS TO BE ANSWERED			
Below are our assessments of the overall questions to be answered:			
1. In areas where there was deviation from the Model Guidance, is the reasoning			
a. At this point, documentation has not been provided to provide the justification for the following deviations from the modeling guidance:			
i. Storm sewer network to be modeled (18" and larger)			
ii. Watershed delineation with sufficient detail to meet the requirements of 8.a.i. and			

b. Two areas that technically conform to the current modeling guidance, but should be adjusted to conform to general standards of engineering practice:			
i. Impervious area calculations for the City of Middleton and including Stricker's and Tiedeman's Ponds in the impervious area calculations.			
ii. 2D land use roughness values that reflect open channel flow conditions (and not sheet flow).			

Appendix H: Calibration Information

Fig. H-1: Stricker's Forebay Rainfall (Aug 5-6 2019 Event)

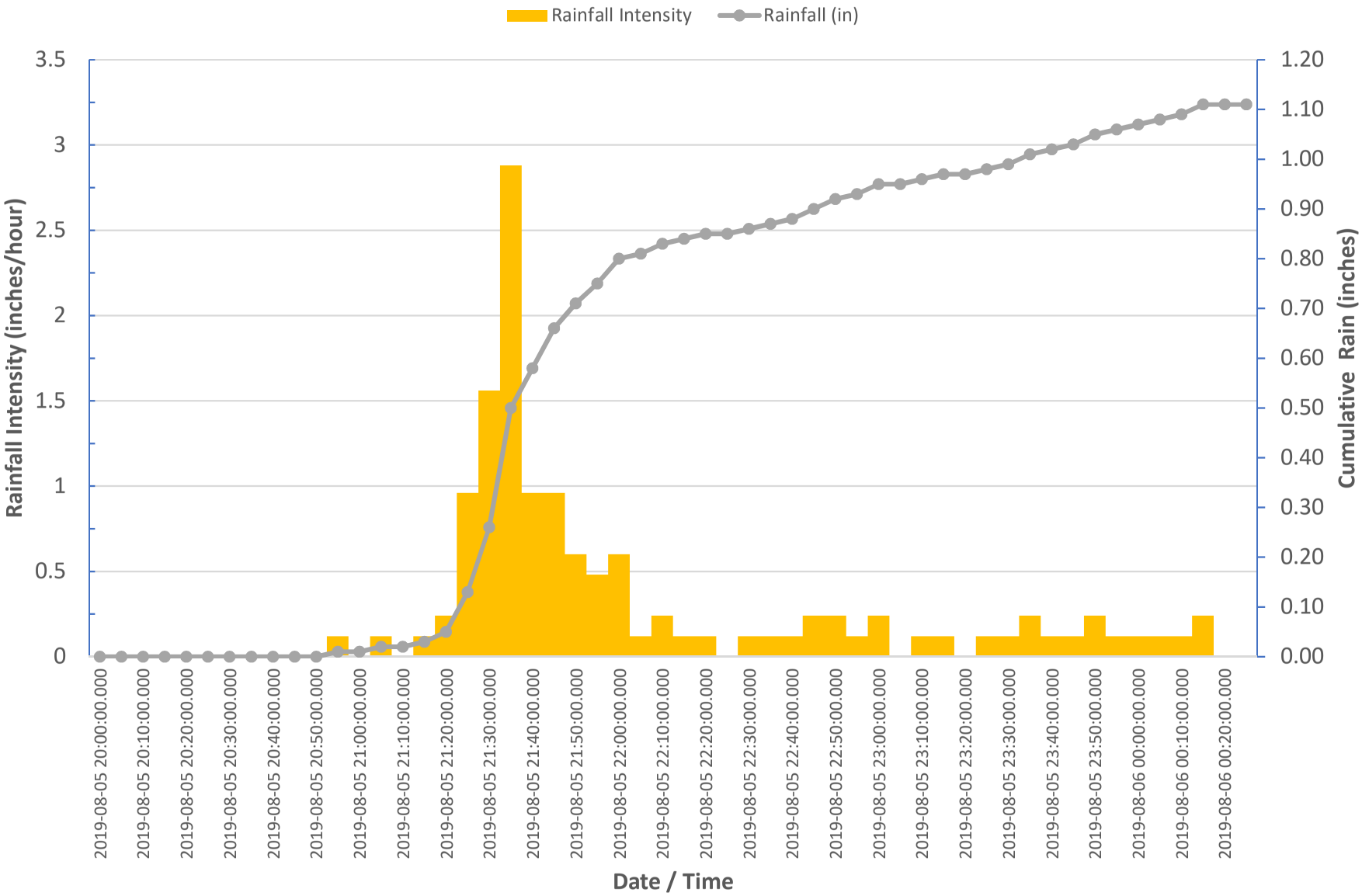


Fig. H-2: Stricker's Forebay Rainfall (Aug 11, 2019 Event)

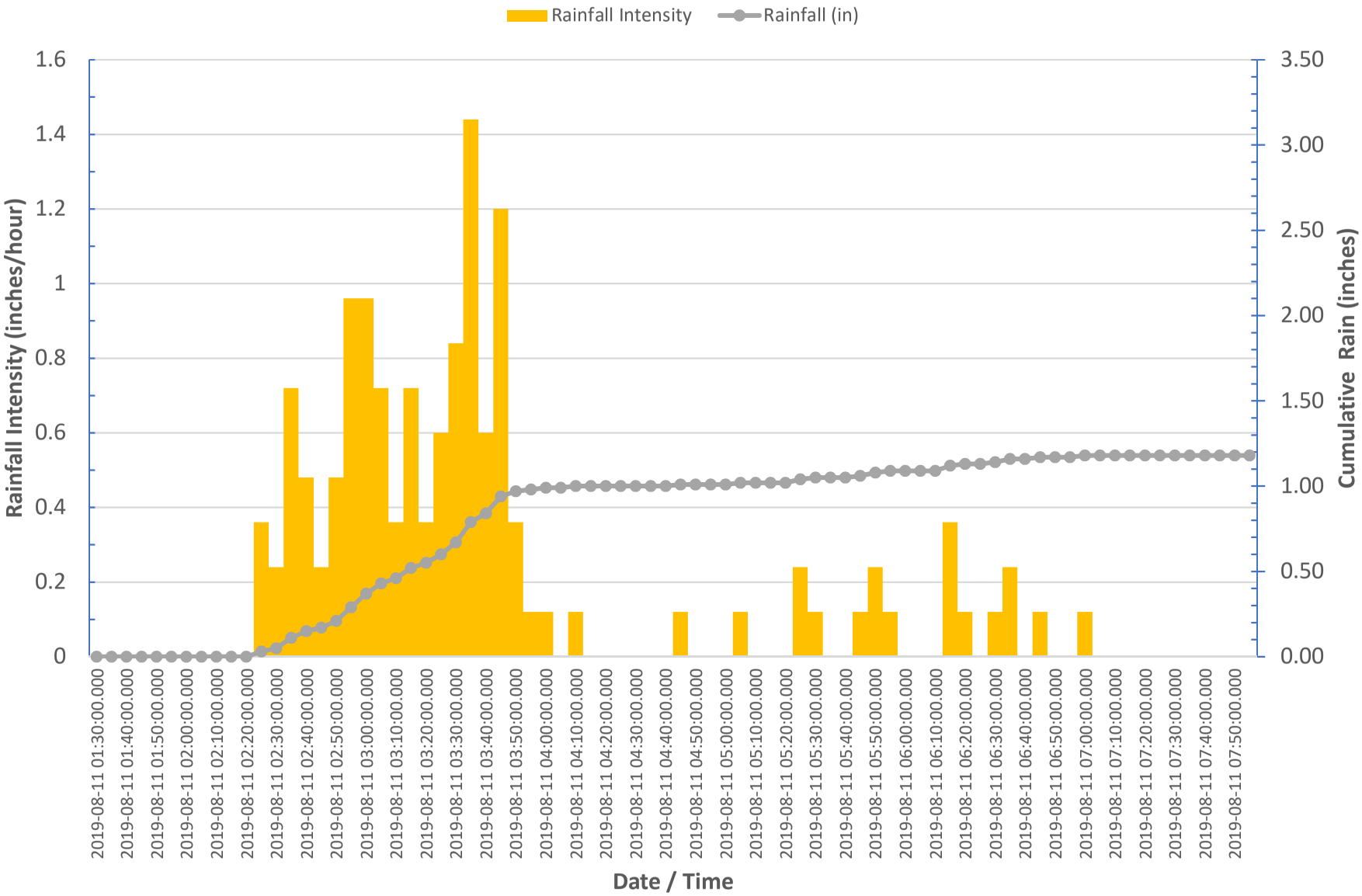
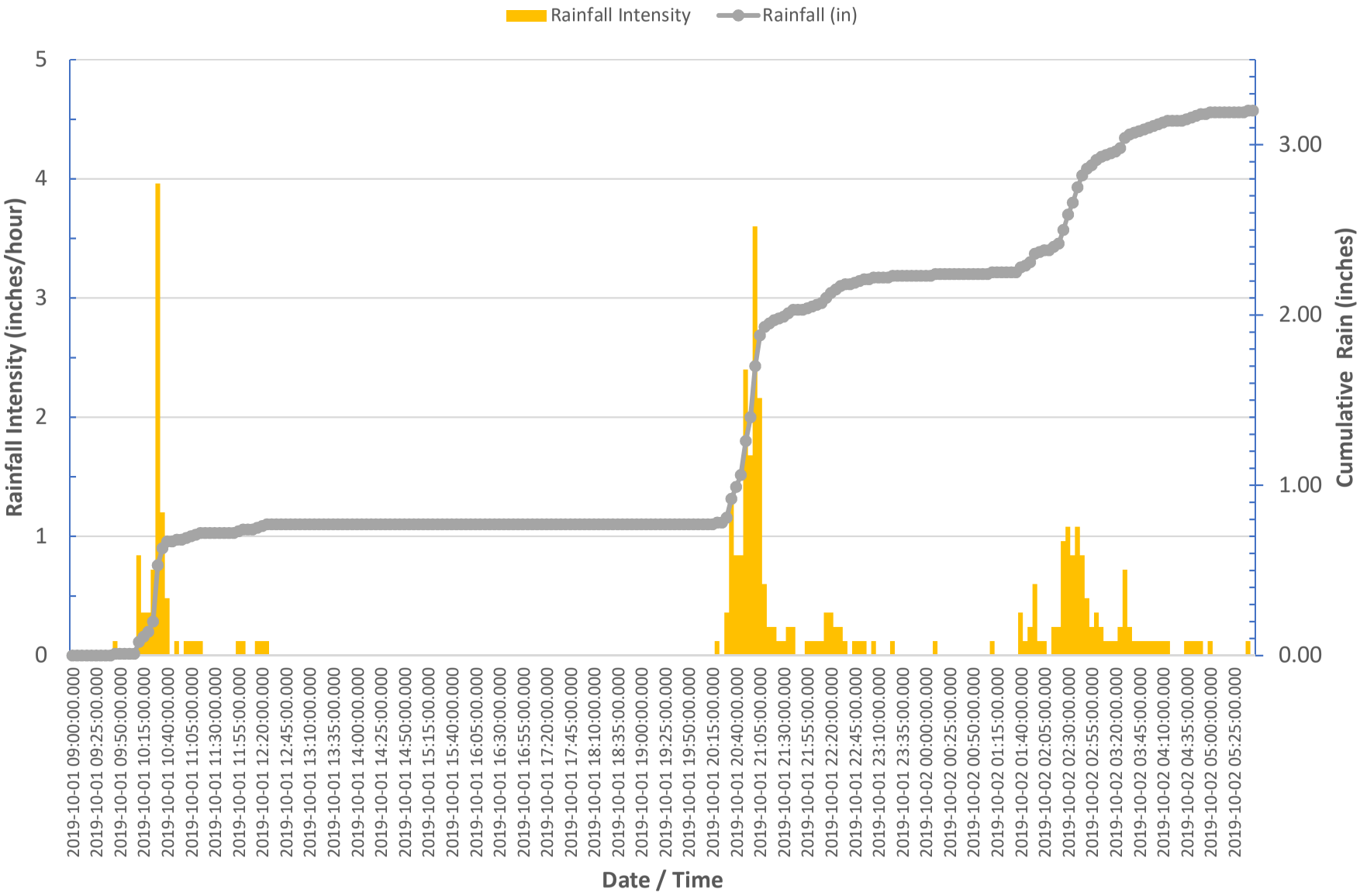


Fig. H-3: Stricker's Forebay Rainfall (Oct 1-2, 2019 Event)



Memorandum

8383 Greenway Blvd. # 600
Middleton, WI 53562

Date: April 10, 2020

Prepared for: City of Madison: Caroline Burger, PE, Env SP
Lauren Striegl, PE
Phil Gaebler, PE

Subject: Directly Connected Impervious Area Calculations – Stricker's / Mendota Watershed Study and Wingra West Watershed Study

Project No.: City of Madison: 8411/8412, BC: 153393/153394

From: Mike Wegner, PE

Copy: Doug Joachim, PE; Bryan Rogne, PE

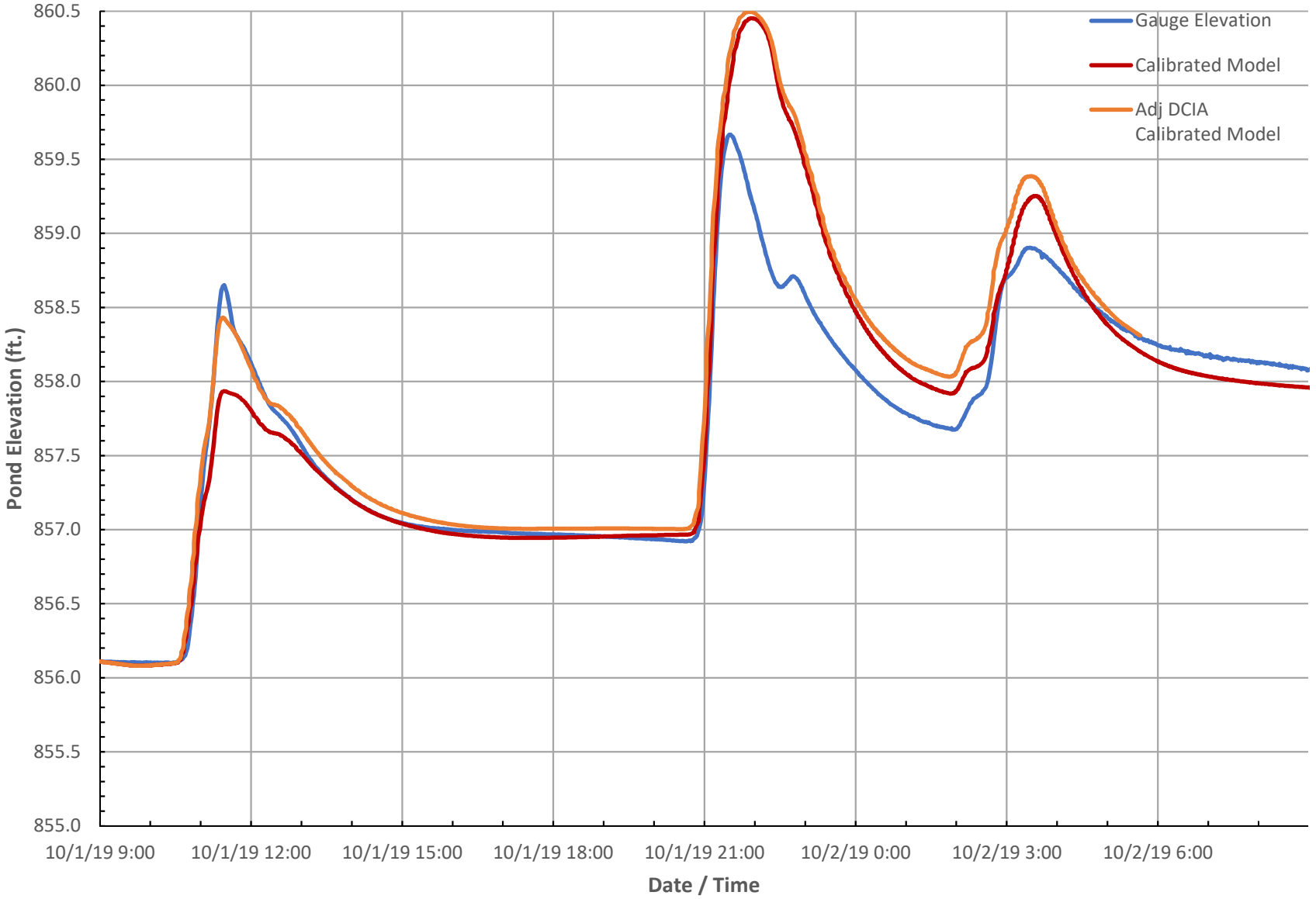
The initial existing conditions XPSWMM™ model constructed and the initial model calibration was conducted using directly connected impervious areas (DCIA) that were calculated with a methodology that was not consistent with the Modeling Guidance document. The DCIA calculations were updated to follow the Modeling Guidance. The Stricker's / Mendota Watershed XPSWMM model was executed for the calibration storm events and the design storm events. As a result of reviewing the results from the model runs, BC moved forward with using the DCIA values calculated in a methodology consistent with the Modeling Guidance. This selection was made based on:

- The purpose of this study is to evaluate flooding and large storm events. During the larger storm events (Oct 1-2, 2019 and the design storm events) that were analyzed there is minimal difference in results.
- Additionally, in some of the cases the results show a better calibration. Two specific instances are provided below.
    - Wingra West Watershed - Secret Pond: During the October 1, 2019 event the peak water surface elevation during the 1st peak of the storm is closer to the gauge value (see attached graph). This peak is likely driven by DCIA. With this elevation being matched more closely with the adjusted DCIA values this indicates that across the watershed the DCIA values are represented reasonably. This conclusion is drawn because Secret Pond is located at the downstream end of the watershed.
    - Stricker's / Mendota Watershed – Stricker's Pond: During the October 1, 2019 event the peak water surface elevation during the 1st peak of the storm, and the overall peak at the end of the storm is closer to the gauge value (see attached graph). Again, the 1st peak is likely driven by DCIA and this indicates that across the watershed the DCIA is represented reasonably. The match with the overall peak indicates the combination of all the model input parameters is representative.
- Based on the calibration effort completed, and the understanding of the watersheds that was gained, we believe that different calibration factors would be needed for smaller storms (such as the August calibration events) and larger storms (such as the October calibration

event). For the purposes of this study we are trying to identify a single set of parameters that can be used for large storm events.

- The adjusted DCIA values are consistent with the modeling guidance document.
- Other parameters adjusted during the calibration process are within acceptable ranges and are defensible.

Fig 14: Manitou Way (Secret) Pond
October 1 - 2, 2019 Storm Event



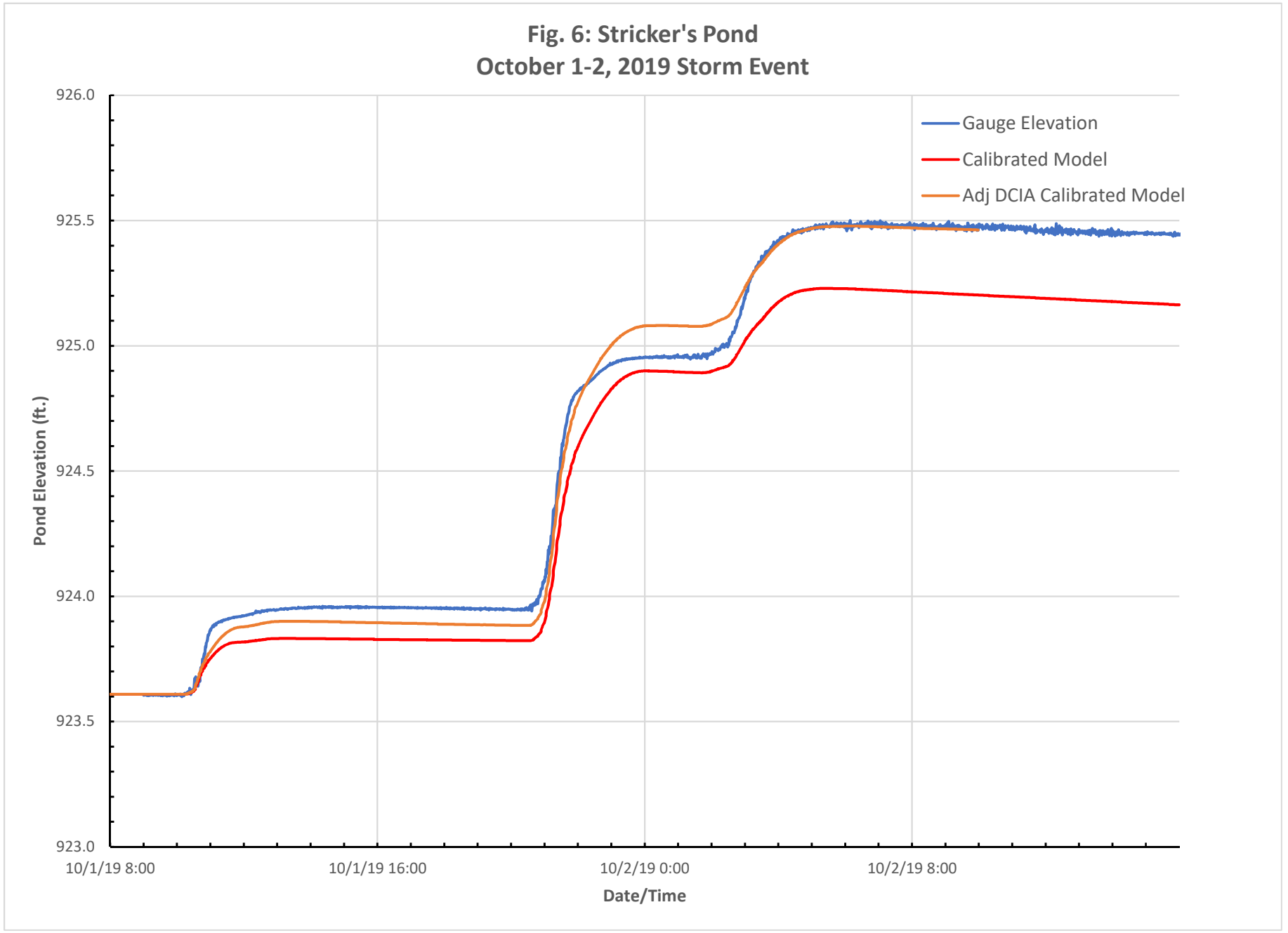


Fig. 6: Stricker's Pond
October 1-2, 2019 Storm Event
Gauge Elevation
Calibrated Model
Adj DCIA Calibrated Model
Pond Elevation (ft.)
926.0
925.5
925.0
924.5
924.0
923.5
923.0
10/1/19 8:00
10/1/19 16:00
10/2/19 0:00
10/2/19 8:00
Date/Time

Memorandum

8383 Greenway Blvd. # 600
Middleton, WI 53562

Date: January 22, 2020 (Updated: February 11, 2020)

Prepared for: City of Madison: Caroline Burger, PE, Env SP
Lauren Striegl, PE
Phil Gaebler, PE

Subject: Stricker's / Mendota Watershed – Existing Conditions Model Calibration
Project No.: City of Madison: 8411, BC: 153393

From: Mike Wegner, PE
Copy: Doug Joachim, PE; Bryan Rogne, PE; Jim Bachhuber, PH

Brown and Caldwell (BC) has calibrated the Stricker's / Mendota Watershed – Existing Conditions XPSWMM model. This memo provides an overview of our calibration process for use during peer review #2. As part of the calibration the Stricker's / Mendota Watershed – Existing Conditions XPSWMM™ model (Base Model) was used as the basis for creating the Strickers's / Mendota Watershed – Calibrated XPSWMM™ model (Calibrated Model).

Scope of Work and Limitations

The scope of work for the calibration effort is identified below.

> *Calibration will be attempted for no more than three (3) 2019-monitored storm events. The three (3) events will be selected by City, AE2S, and BC. For purposes of this project, the model will be considered to be calibrated if the overall average model bias for water surface elevations is within +/- 5% with reasonable effort made to minimize the largest absolute error while at the same time balancing that effort with the relative importance of the model results at each monitoring site location. The largest absolute error at each monitored location is defined as +/- 25 percent. It is understood that there may be some circumstances where calibration cannot be accomplished.*

For model calibration, the following rainfall events were selected:

- August 5th – 1.1- to 1.2-inches of rain, 3.5-hour duration.
- August 11th – 0.9- to 1.5-inches of rain, 4.5-hour duration.
- October 1st-2nd – 3.0- to 3.6-inches of rain, 19-hour duration.
  (NOTE: the range of rainfall for each storm reflects measurements at the rain gauges used in the modelling. Strickers Pond, Marshall Park Owen Park Spring Harbor, and Yellowstone (USGS).

The October storm event was the largest event that was successfully measured in 2019 at the relevant rain gauges. The October event (rain depth and duration) falls in the range of a 5- to 10-

year recurrence interval based on NOAA Atlas 14 Volume 8 Version 2 data. The overall goal of the study is to evaluate flooding, and consider mitigation of flooding, from large storm events.

The calibration process focused on identifying consistent model input parameters that provide reasonable model results for each of the three storm events in comparison to the measured values.

Monitoring Locations

There are five monitoring locations within the Stricker's / Mendota Watershed that were used as part of the calibration process.

1. Stricker's Pond Elevation (monitored by City, data obtained from Trimble Unity website)
2. Stricker's Pond Forebay Elevation (monitored by City, data obtained from Trimble Unity website)
3. Longmeadow Storm Sewer Flow (monitored by City, data obtained from Trimble Unity website)
4. Skyview Pond Elevation (monitored by City, data obtained from Trimble Unity website)
5. Grassman Pond Elevation (monitored by City, data obtained from Trimble Unity website)

Calibration Steps

As part of the model calibration process the following steps were taken:

1. The overall watershed was evaluated with various scenarios to assess the impact of modifications and compare the modeled results to the measured values. Both hydrologic and hydraulic factors were evaluated.
2. Odana Road / Hilltop Drive flow data was provided by the USGS. This data was not available at the start of the calibration process. This monitoring location is located in the West Wingra Watershed and the drainage area is an isolated medium density single family residential neighborhood with characteristics similar to many areas within the Stricker's / Mendota Watershed.
3. Calibration to the Odana Road / Hilltop Drive flow data was conducted.
4. Calibration parameters from Odana Road / Hilltop Drive were applied to the Strickers/Mendota watershed for areas of similar land use and soils.

Initial Calibration Considerations

As a result of the initial calibration process, and detailed study of the measured data, the following conclusions were made.

Longmeadow Storm Sewer Flow Data: The measured flow data from the Longmeadow storm sewer are suspected to be faulty for reasons summarized below and displayed on Figures 1, 2, and 3.

1. The peak flows measured by the gauge are much lower than expected, or what is simulated in the XPSWMM model. Peak flow data from the August 5th event (~ 1.1 inches over 3.5 hours) was less than 0.06 cfs whereas the modeled flow is over 45 cfs. The peak water surface level (stage) measured by the gauge during this storm was near 1.5 feet, which corresponds to a flow of approximately 80 cfs using Manning's equation for a free-flowing pipe of the same size, slope, and material. Additionally, the gauge only recorded two very short peaks that do not line up well with the actual duration of the storm event and do not appear realistic given what was recorded at the nearest rain gauge. Between these peaks both the stage and flow data returned to zero.
2. The same issues appear for the Longmeadow gauge during the August 11th and October 1st storms. The Longmeadow storm sewer flow data and stage data was thus not used for calibration.

Stricker's Pond Elevation: Measured pond elevation rise is minimal in the August 5th event (approximately 0.1 feet). The modeled results overestimated the water level rise by approximately 0.2 feet during this event, but due to the small rise in the gauge, the percentage difference is relatively high. Comparison of modeled to measured pond elevation results corresponded better for the August 11th event and the October 1st event (see Table 1 and Figures 4 –).

It is known that there is a valve that regulates outflow from Stricker's Pond to Tiedemann's Pond, but the exact configuration and operation of this valve is not known. The City of Middleton operates the valve. During each of the three measured storm events, the water level in Stricker's Pond declines slightly after the rainfalls end, which suggests the valve is open. The calibration models included the valve being open during the model simulation.

Stricker's Pond Forebay: The Stricker's Pond forebay is connected to Stricker's Pond via three 29-inch by 45-inch HERCP culverts. Gauge measurements show larger "spikes" in water surface elevation in the forebay during intense rainfall than would be expected given the number and size of connecting culverts, which suggests one or more of the culverts may have been clogged during the storm events. The impact of limiting flow through one or two of these culverts was analyzed during the calibration process. Allowing flow through two of the culverts for the Aug 5th and 11th events and through one culvert for the Oct 1st event resulted in the best match between modeled and recorded water surface elevations within the forebay (see Table 2 and Figures 7 - 9).

Skyview Pond: The Skyview Pond Gauge is located upstream of the dry pond outlet structure, making direct comparisons between modeled and measured results challenging. The ground surface measured by the gauge is at an elevation of 896.5, approximately 2.8-feet above the outlet structure's lowest invert of 893.7. In the August storm events the modeled elevation in the dry pond does not reach the ground surface elevation at the gauge. Thus, for the August events this, location was only considered for general shape and timing of flow through the pond (not the actual pond's water surface elevation).

During the October event the elevation in the pond rises such that the water surface is above the ground elevation at the gauge. During this event the elevation of the pond's water surface was directly compared to the water surface elevation at the gauge. Generally, the shape and timing of flow through the Skyview Pond matched well for each of the calibration events. During the October 1st event, the peak water level in the pond compared closely between the calibrated model and the gauge data (see Table 3 and Figures 10 - 12)

Grassman Pond: At Grassman Pond, modeled peak water surface elevations are higher than recorded values for both August events, but are within 0.2 feet of the measured values in absolute terms. During the October event, the measured results show a higher peak water surface elevation than was modeled. In the October event, gauge measurements indicate that the pond berm is overtopped by about 0.65-feet which is higher than would be expected without the impact of backwater effects. Because the downstream road elevation is lower than the berm, stormwater would have overtopped the road before causing backwater effects significant enough to explain the measured values. The reason for the high measurements is unclear. The outlet structure was modeled assuming various levels of clogging in the October 1st event to best replicate the measured record. While the modeled peak water surface elevation does not rise to the measured values, they are within 0.3-feet, or 10-percent, of the gauge measurements (see Table 4 and Figures 13 – 15).

Odana Road / Hilltop Drive Flow Gauge

A description of this gauge and the calibration process that was undertaken is included in the West Wingra Watershed – Existing Conditions Calibration memo. The hydrologic information collected as

part of the calibration for the Odana Road / Hilltop Drive flow gauge was used to select calibration parameters for the Sticker's / Mendota watershed (for areas of similar physical conditions).

Calibration Parameter Selection

The calibration parameters described in the previous section were combined in the watershed model and include the following:

1. Maximum infiltration rate for HSG C soils was increased to 3 inches/hour. For October 1st-2nd a partially saturated soil condition was used. The maximum infiltration rate for other soil groups was not modified.
2. The minimum infiltration rate for all soils was reduced to be equal to values listed in the XPSWMM help file and the SWMM reference manual.
3. The same width was used for each subcatchment. The width was calculated by dividing the total subbasin area by the delineated flow path length.
4. Rainfall depths of 0.01-inches that occurred over 5-minute or longer time periods at the start of rainfall events were eliminated (applicable to only the August 5th and October 1st-2nd events). This adjustment delays the initiation of the Horton Infiltration decay curve.
5. The outlets from Stricker's Forebay and Grassman Pond were modified to assume partial clogging.
6. The valve connecting Stricker's Pond to Tiedemann Pond was assumed to be open during the Aug 5th and Aug 11th events.

Comparison of Simulated Results to Monitored Data

The calibrated results from Stricker's Pond, Stricker's Forebay, Skyview Pond, and Grassman Pond are shown in Tables 1 through 4. For reasons previously mentioned, calibration to the Longmeadow flow gauge was not conducted. Graphs attached to this memo also show the calibrated results compared to the monitored data.

Table 1. Strickers Pond Calibration Results – Pond Level (ft.)

	Peak Pond Level (ft.)		
	8/5/2019 Storm	8/11/2019 Storm	10/1/2019 Storm
Starting Pond Level	923.6	923.6	923.6
Gauge Peak Pond Level	923.7	923.8	925.5
Modeled Peak Pond Level	924.0	924.0	925.5
Absolute Difference (ft.)	+0.3	+0.2	0.0
% Difference (calculated based on increase in pond level)	264%	95%	-1%

Table 2. Strickers Forebay Calibration Results – Pond Level (ft.)

	Peak Pond Level (ft.)		
	8/5/2019 Storm	8/11/2019 Storm	10/1/2019 Storm
Starting Pond Level	923.6	923.6	923.6
Gauge Peak Pond Level	924.1	923.9	926.6
Modeled Peak Pond Level	924.5	924.3	926.6

Absolute Difference (ft.)	+0.4	+0.4	+0.1
% Difference (calculated based on increase in pond level)	74%	105%	3%

Table 3. Skyview Pond Calibration Results – Pond Level (ft.)

	Peak Pond Level (ft.)		
	8/5/2019 Storm	8/11/2019 Storm	10/1/2019 Storm
Starting Gauge Level	896.5	896.5	896.5
Gauge Peak Pond Level	897.7	897.2	899.6
Starting Pond Level	893.7	893.7	893.7
Modeled Peak Pond Level	895.7	895.0	900.1
Absolute Difference in Peak WSE (ft.)	N/A	N/A	+0.5
% Difference (calculated based on peak WSE)	N/A	N/A	9%

Table 4. Grassman Pond Calibration Results – Pond Level (ft.)

	Peak Pond Level (ft.)		
	8/5/2019 Storm	8/11/2019 Storm	10/1/2019 Storm
Starting Pond Level	884.3	884.4	884.6
Gauge Peak Pond Level	885.6	885.6	887.9
Modeled Peak Pond Level	886.1	885.9	887.7
Absolute Difference (ft.)	+0.4	+0.4	-0.3
% Difference (calculated based on increase in pond level)	33%	31%	-9%

It is important to consider the absolute difference between modeled and measured peak WSEs in addition to the relative difference. During the August 5th event, the calibrated model predicted a peak WSE nearly 260% higher than was measured at the gauge. However, the absolute difference between these two values is only 0.3 feet (3.5-inches).

Overall, the average percent difference at the four measurement locations is 109% for the August 5th event, 81% for the August 11th event, and 0% for the October 1st event. However, the largest absolute difference in peak WSE at any measured location is 0.5 feet (6-inches).

Fig. 1: Longmeadow Flow Gauge Response (Aug 5-6 2019 Event)

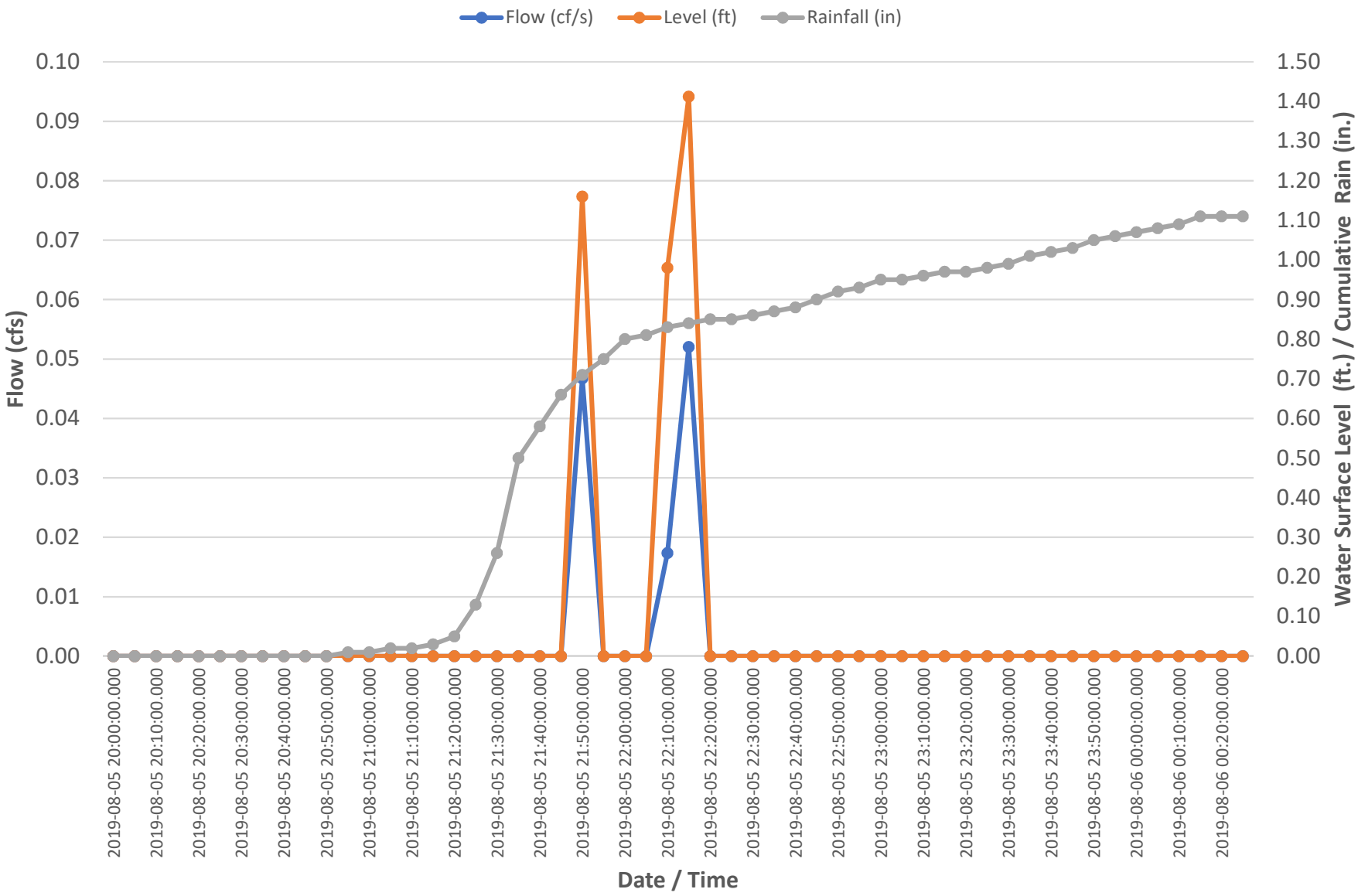


Fig 2: Longmeadow Flow Gauge Response (Aug 11, 2019 Event)

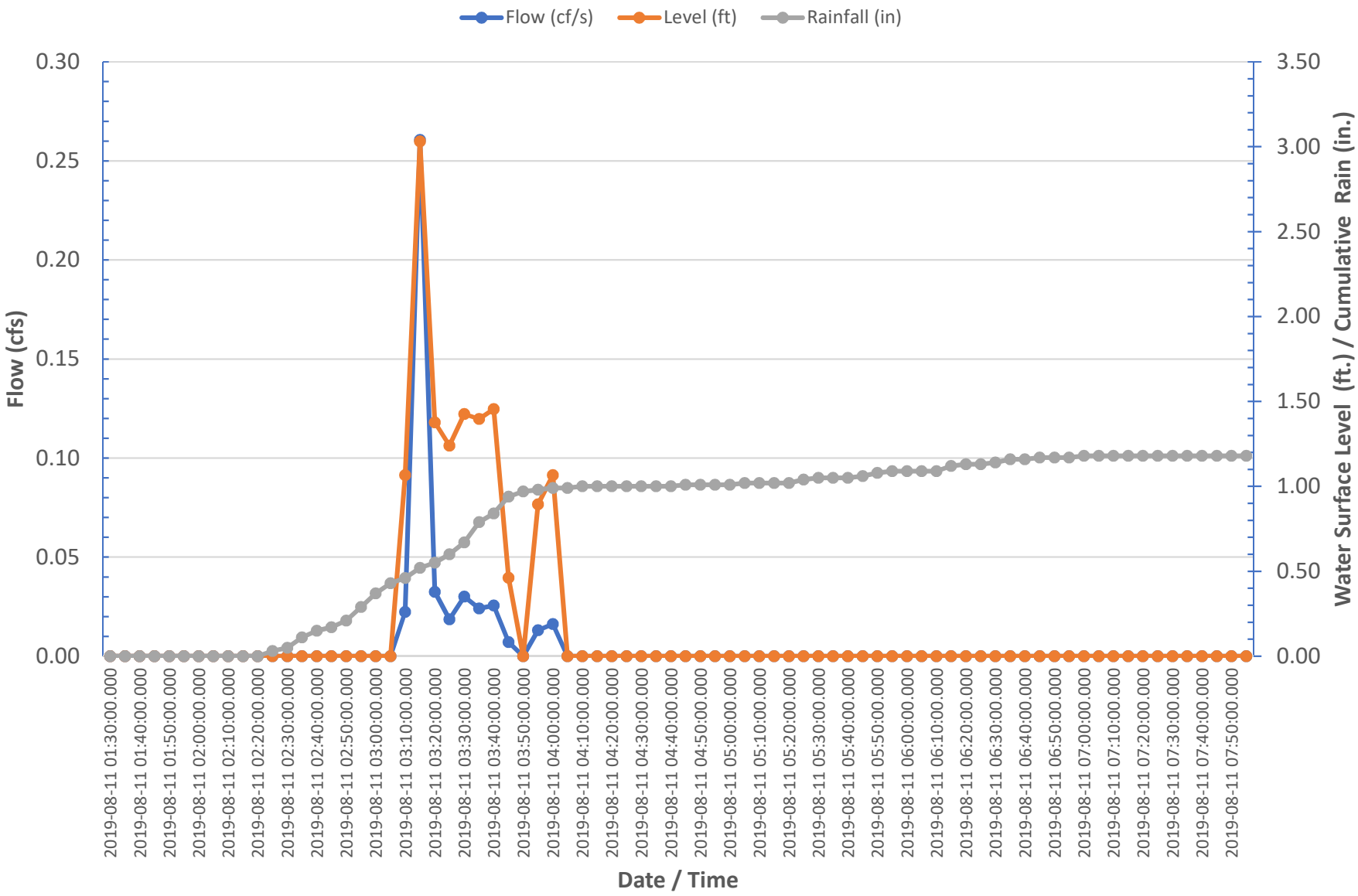
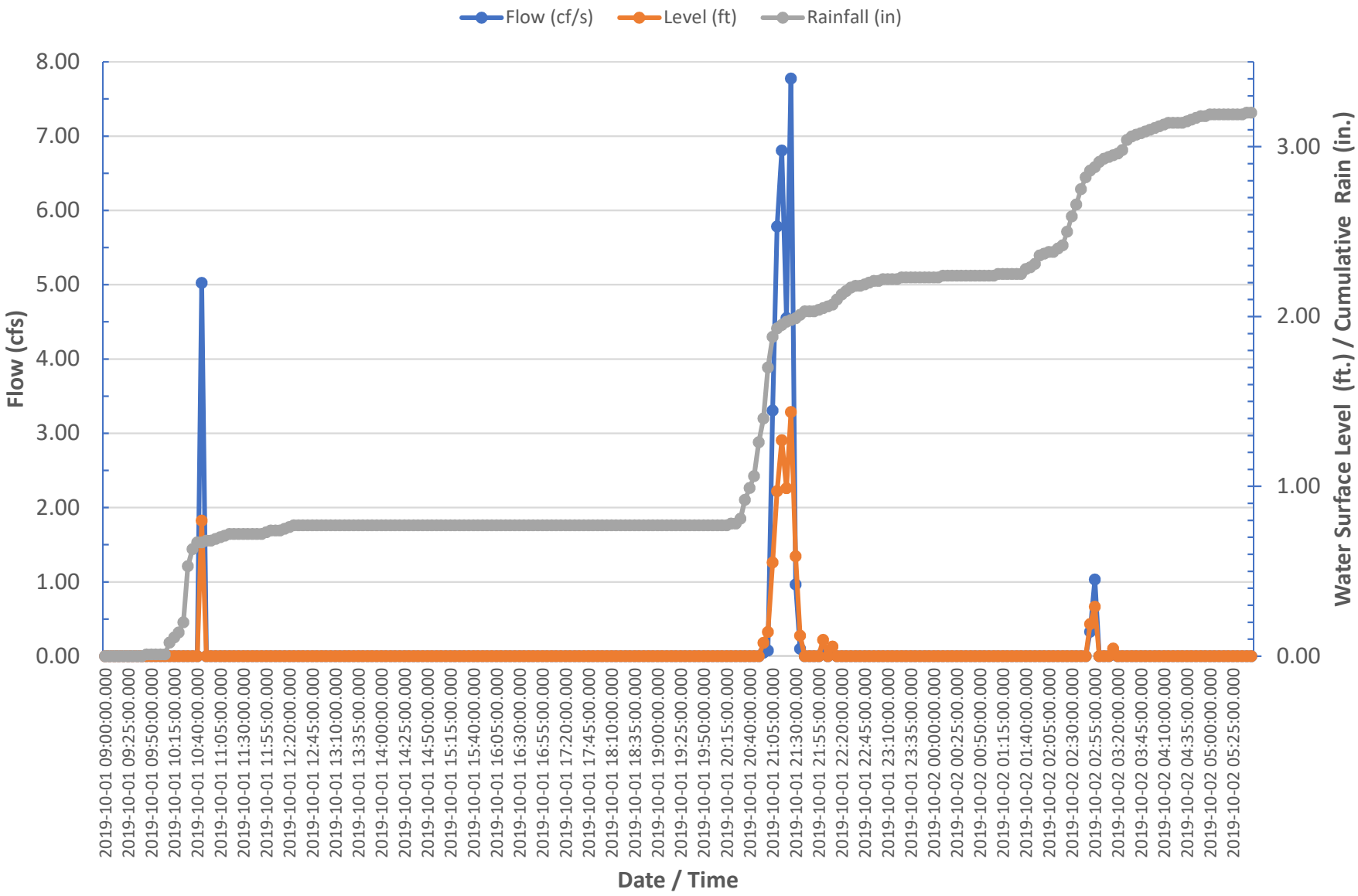


Fig. 3: Longmeadow Flow Gauge Response
(Oct 1-2, 2019 Event)



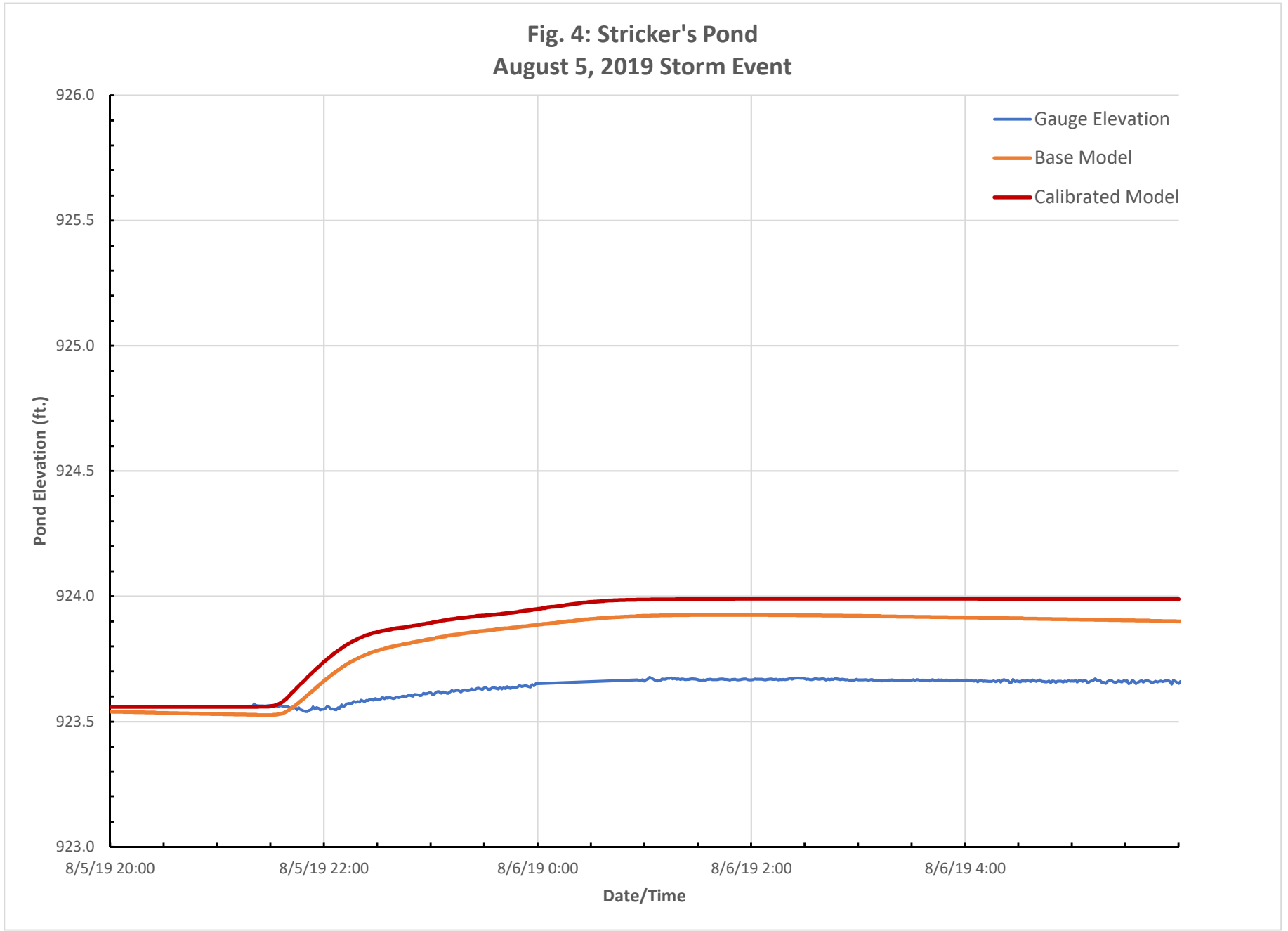


Fig. 4: Stricker's Pond
August 5, 2019 Storm Event
926.0
925.5
925.0
924.5
924.0
923.5
923.0
Pond Elevation (ft.)
8/5/19 20:00
8/5/19 22:00
8/6/19 0:00
8/6/19 2:00
8/6/19 4:00
Date/Time
Gauge Elevation
Base Model
Calibrated Model

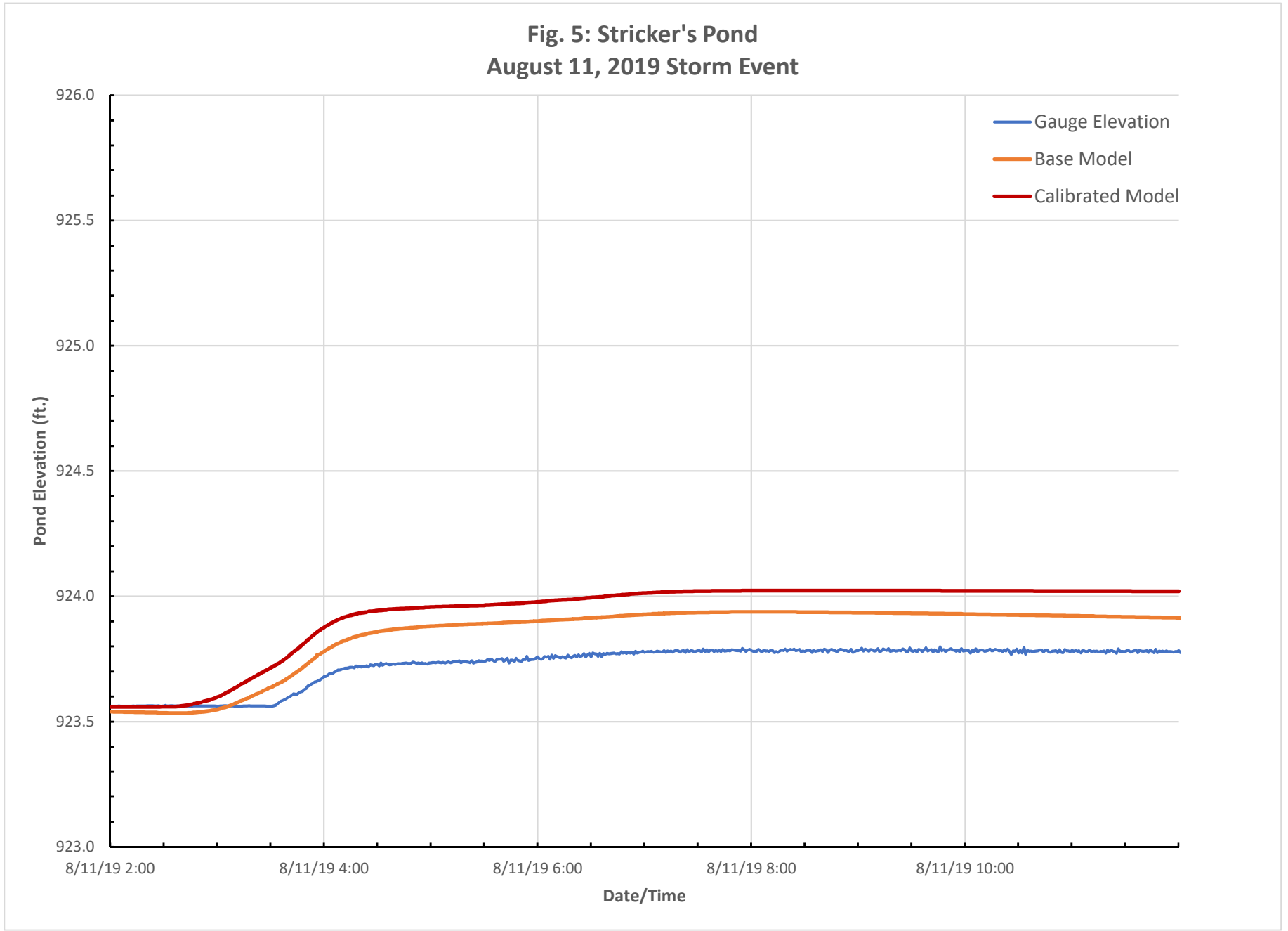


Fig. 5: Stricker's Pond
August 11, 2019 Storm Event
926.0
925.5
925.0
924.5
924.0
923.5
923.0
Pond Elevation (ft.)
8/11/19 2:00
8/11/19 4:00
8/11/19 6:00
8/11/19 8:00
8/11/19 10:00
Date/Time
Gauge Elevation
Base Model
Calibrated Model

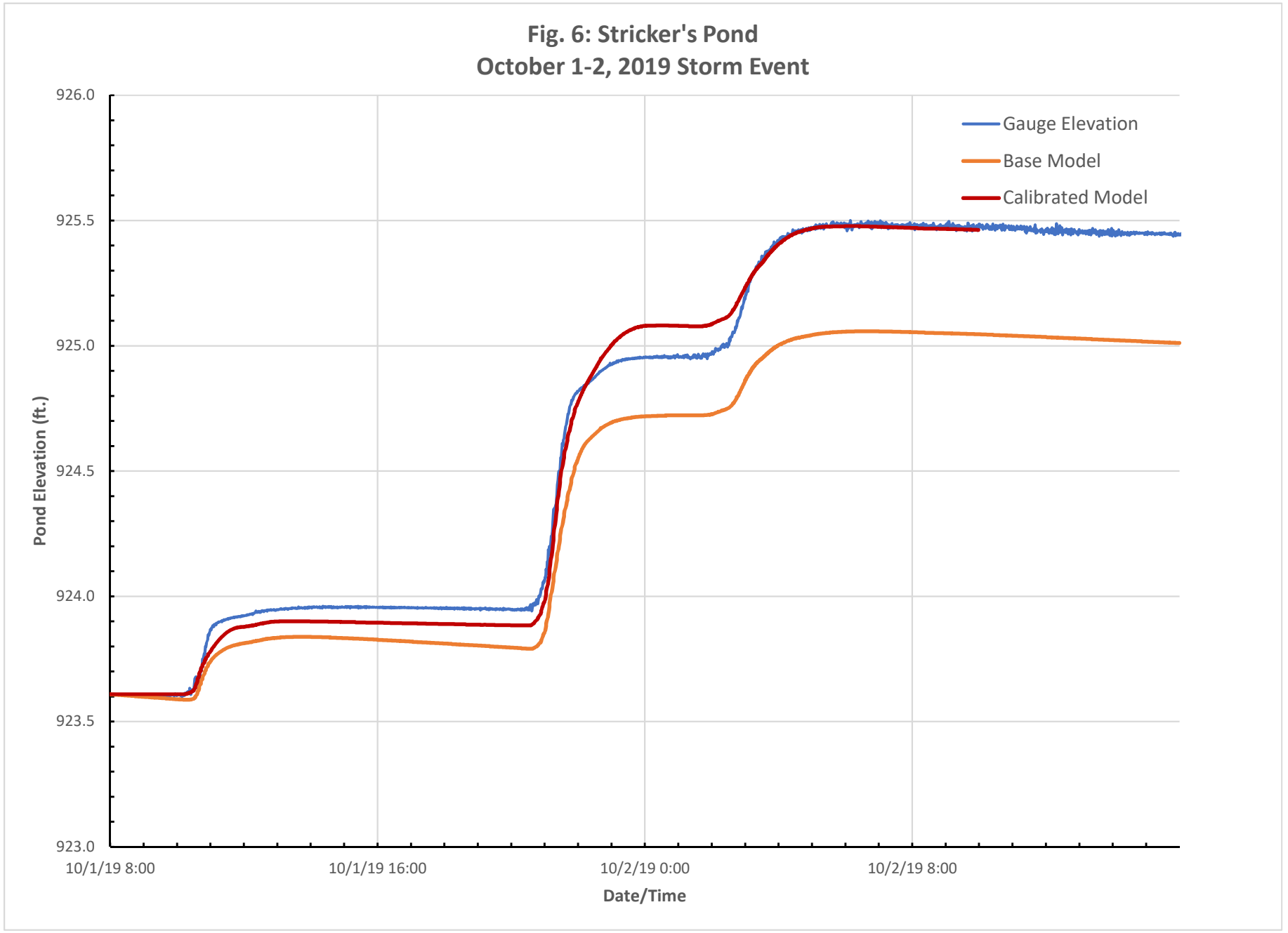


Fig. 6: Stricker's Pond
October 1-2, 2019 Storm Event
Gauge Elevation
Base Model
Calibrated Model
Pond Elevation (ft.)
926.0
925.5
925.0
924.5
924.0
923.5
923.0
10/1/19 8:00
10/1/19 16:00
10/2/19 0:00
10/2/19 8:00
Date/Time

Fig. 7: Stricker's Forebay
August 5, 2019 Storm Event

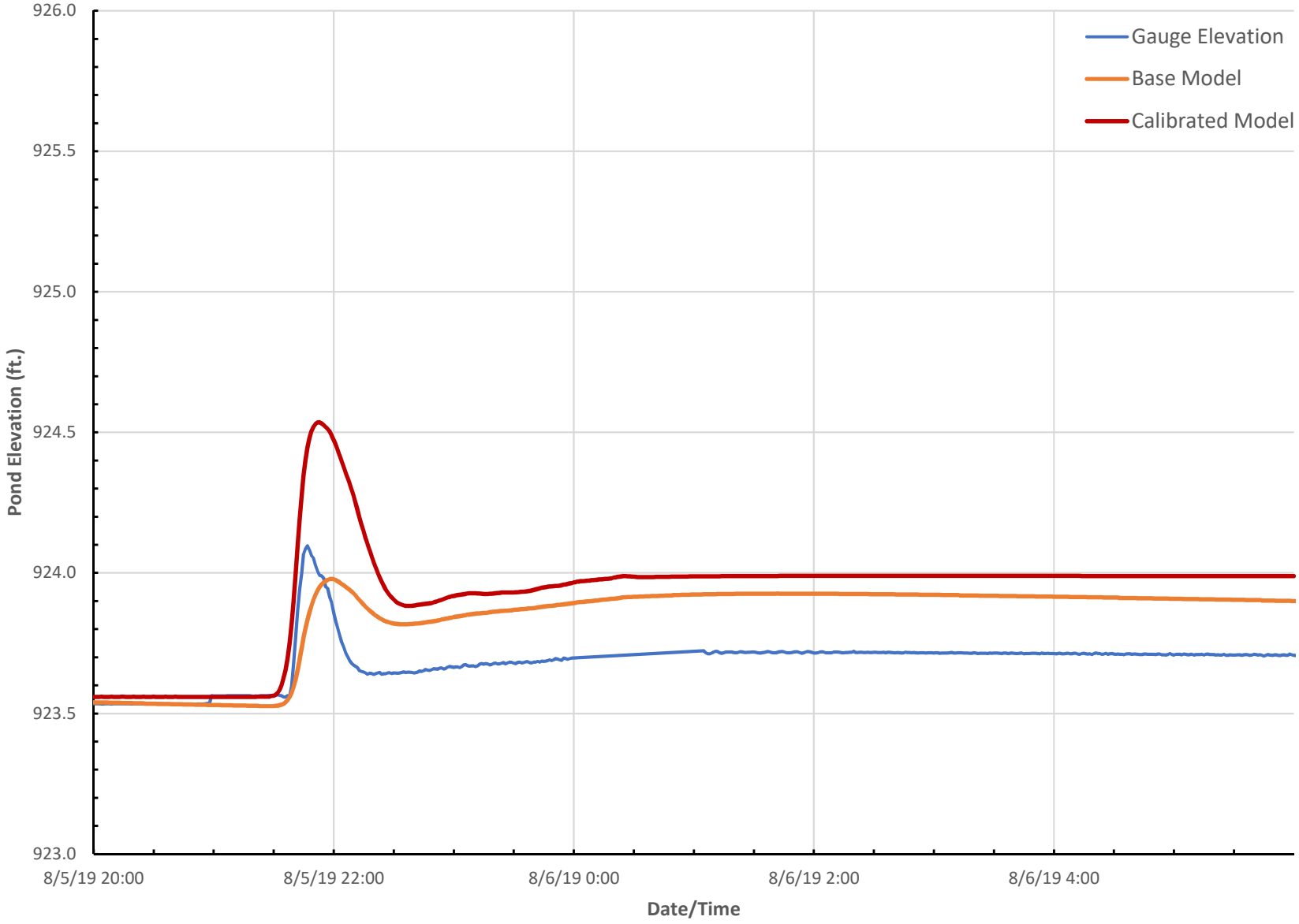


Fig. 8: Stricker's Forebay
August 11, 2019 Storm Event

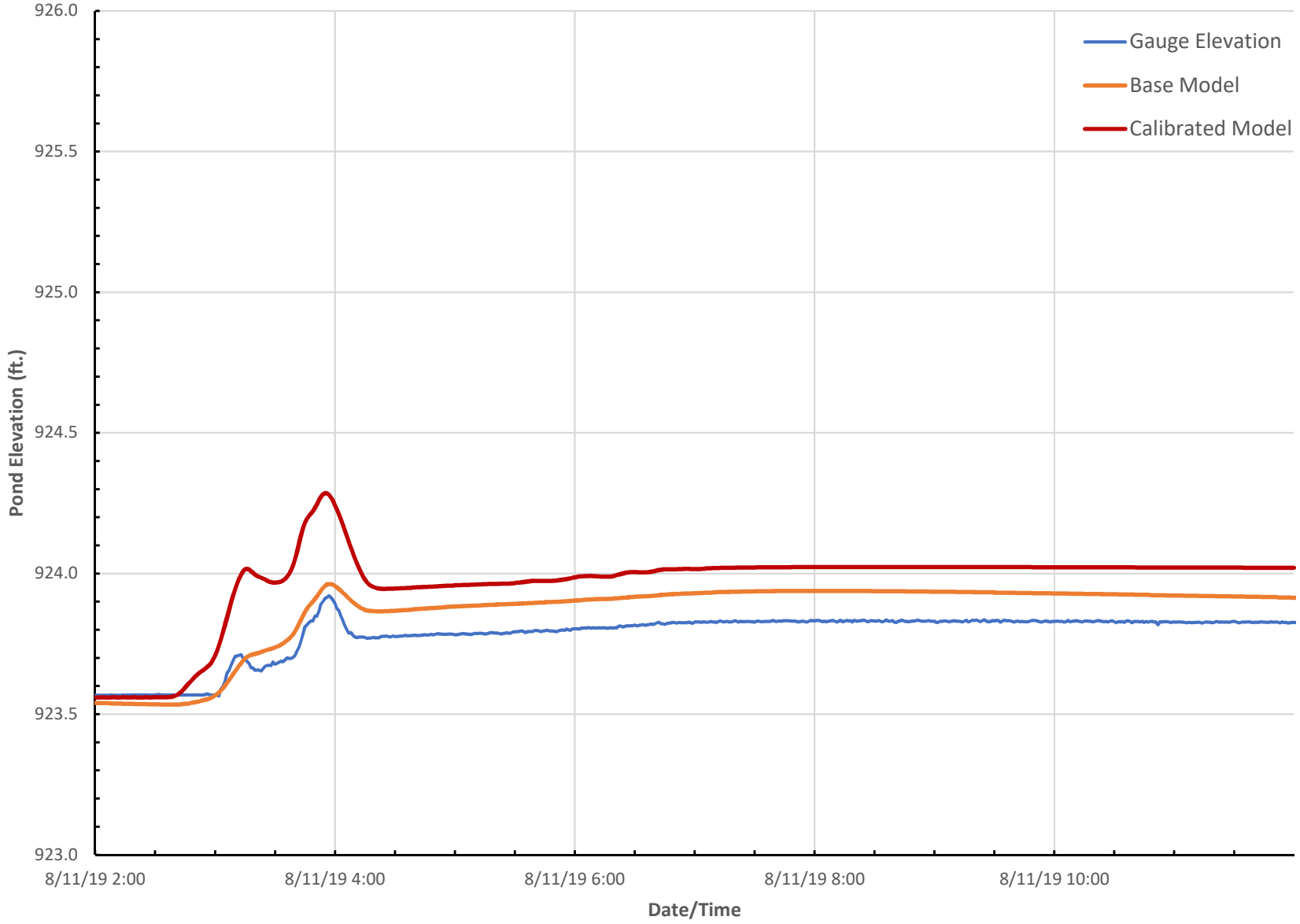


Fig. 9: Stricker's Forebay
October 1-2, 2019 Storm Event

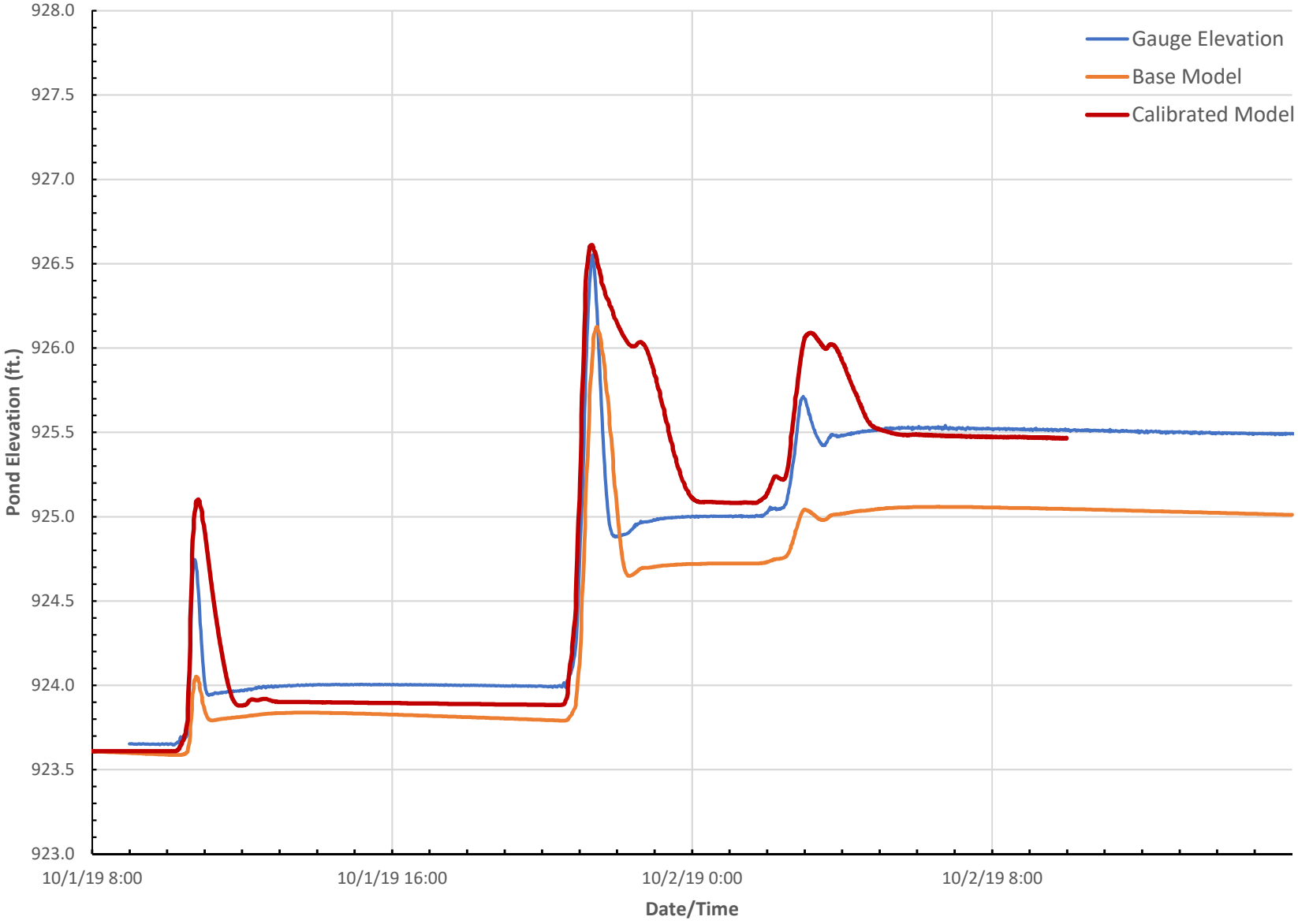


Fig. 10: Skyview Pond
August 5, 2019 Storm Event

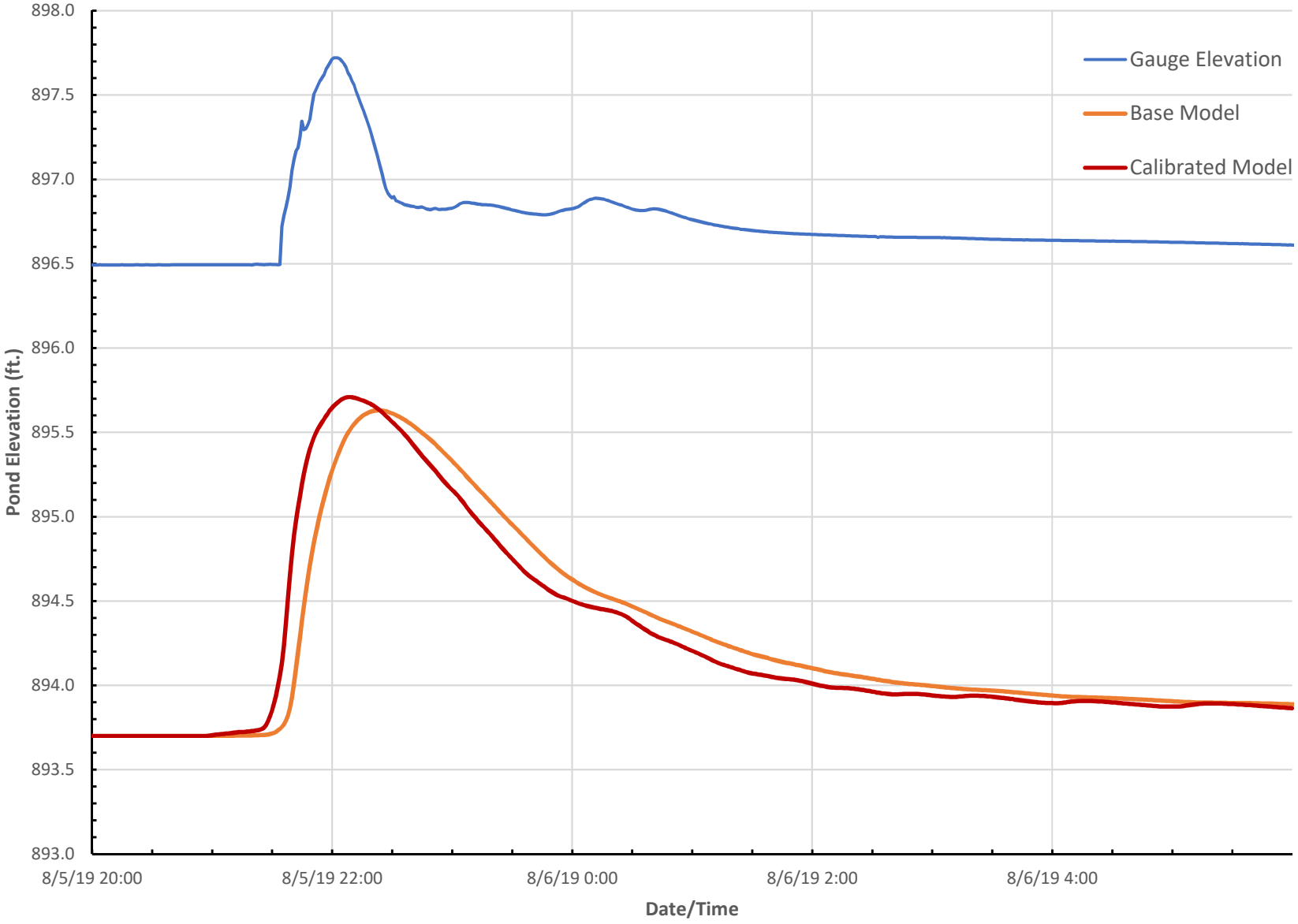


Fig. 11: Skyview Pond
August 11, 2019 Storm Event

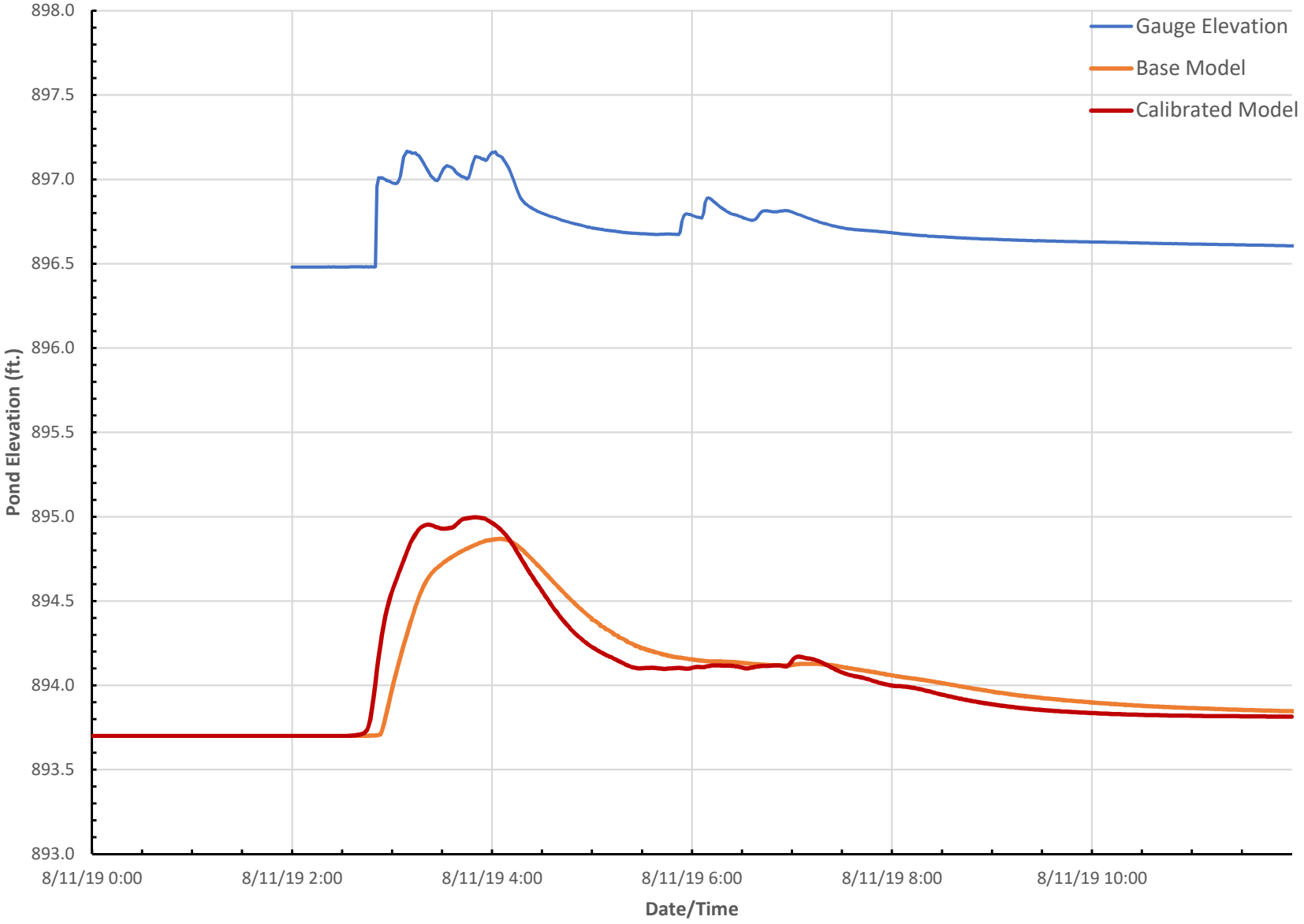


Fig. 12: Skyview Pond
October 1-2, 2019 Storm Event

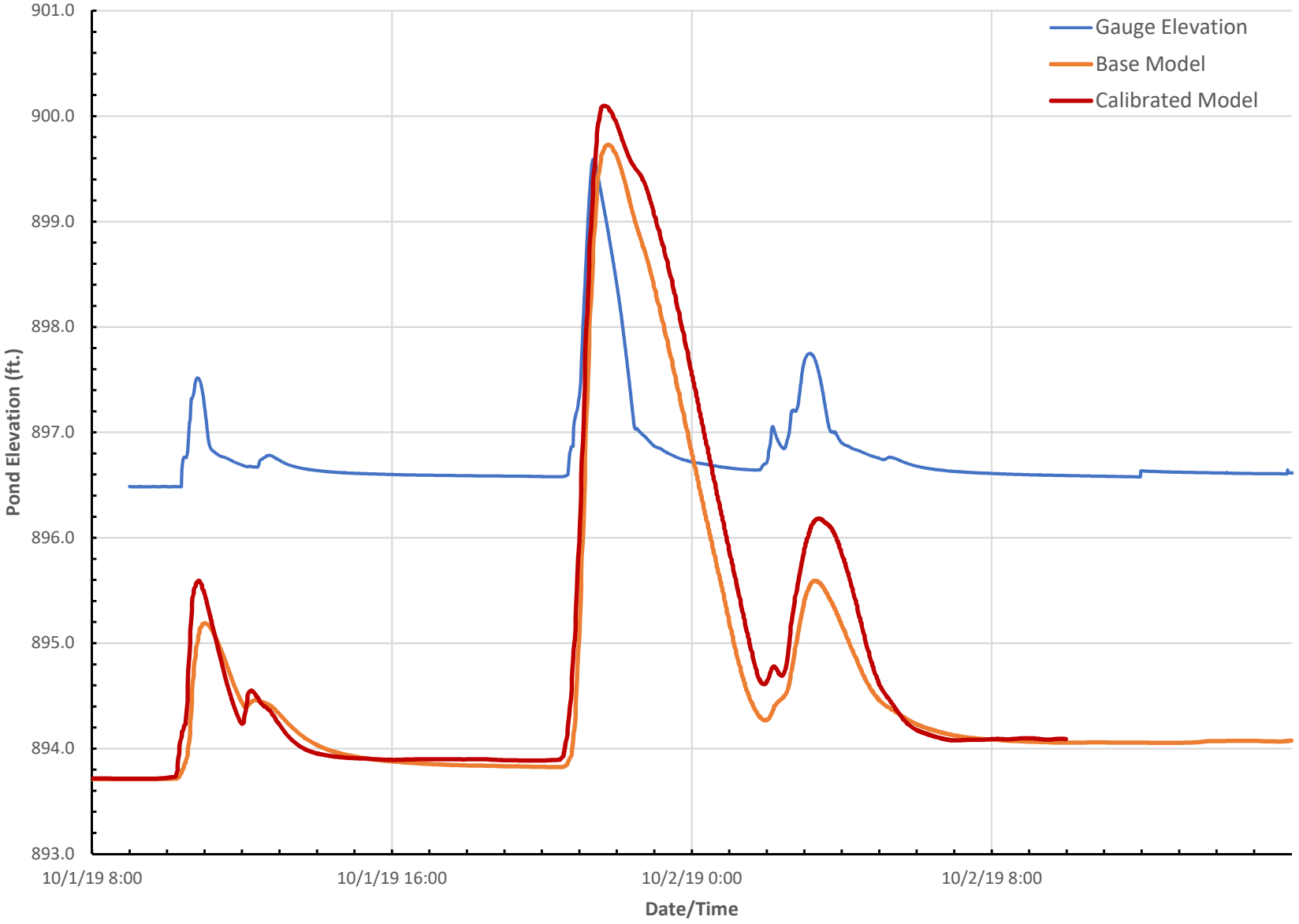


Fig. 13: Grassman Pond
August 5, 2019 Storm Event

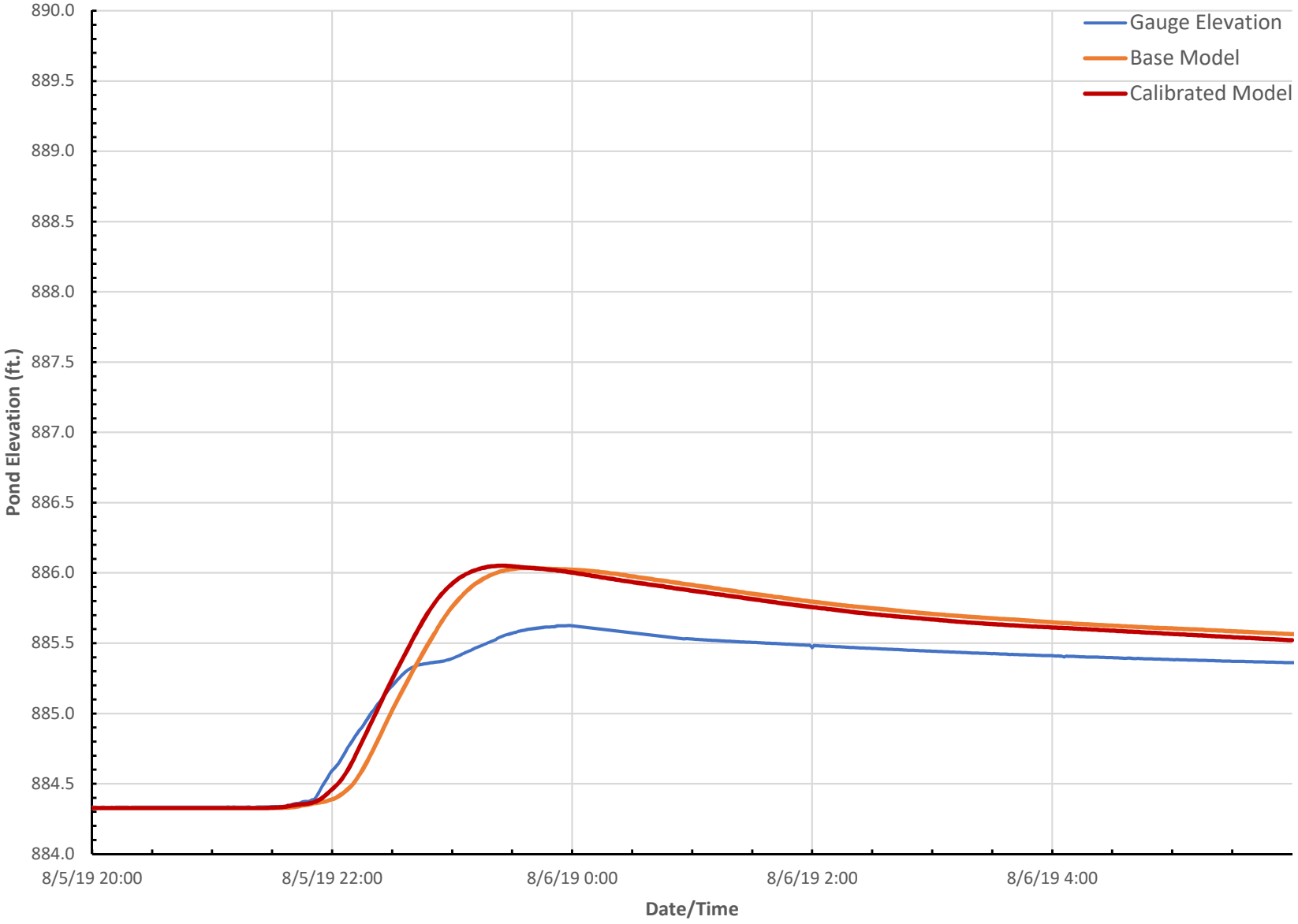


Fig. 14: Grassman Pond
August 11, 2019 Storm Event

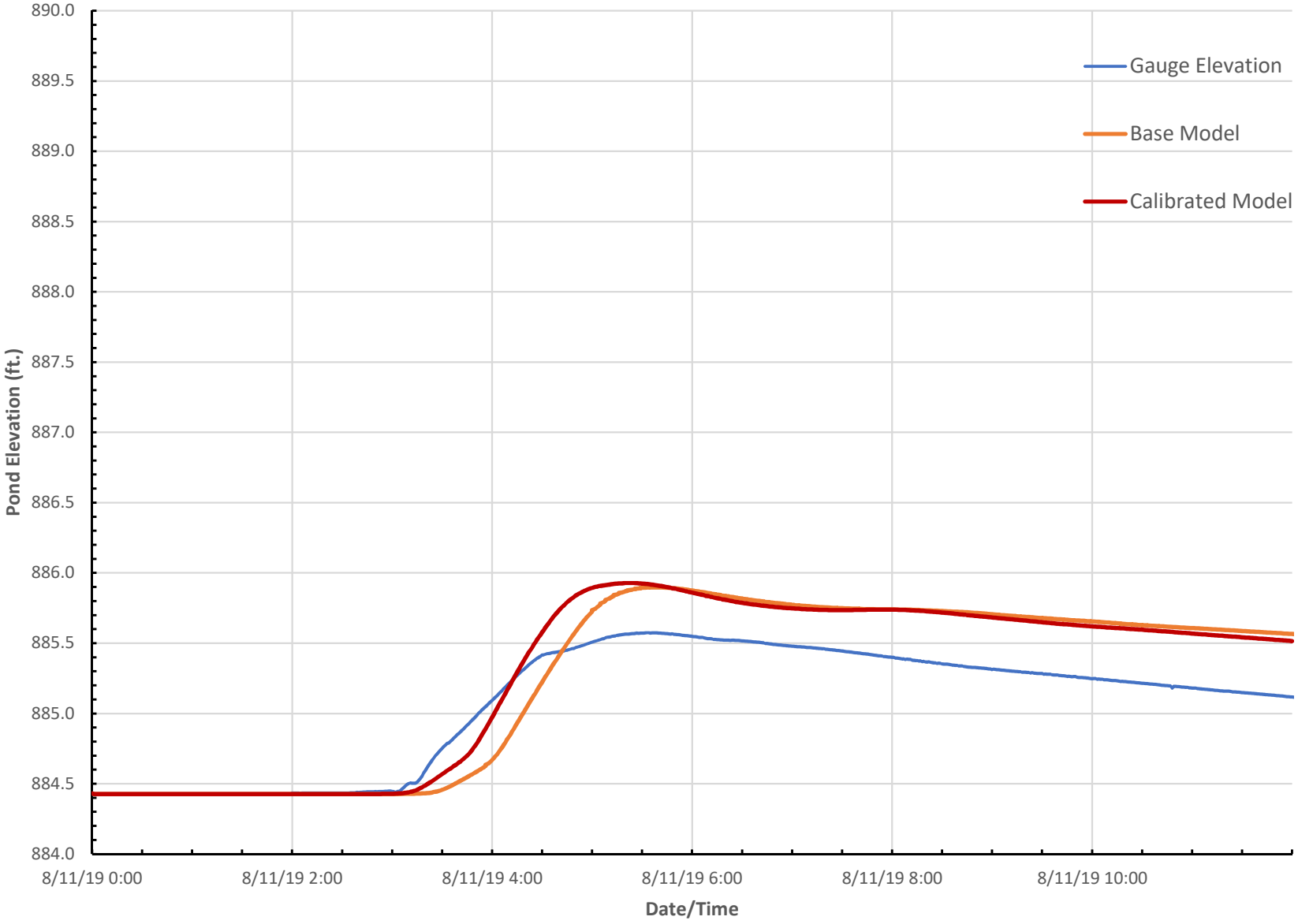
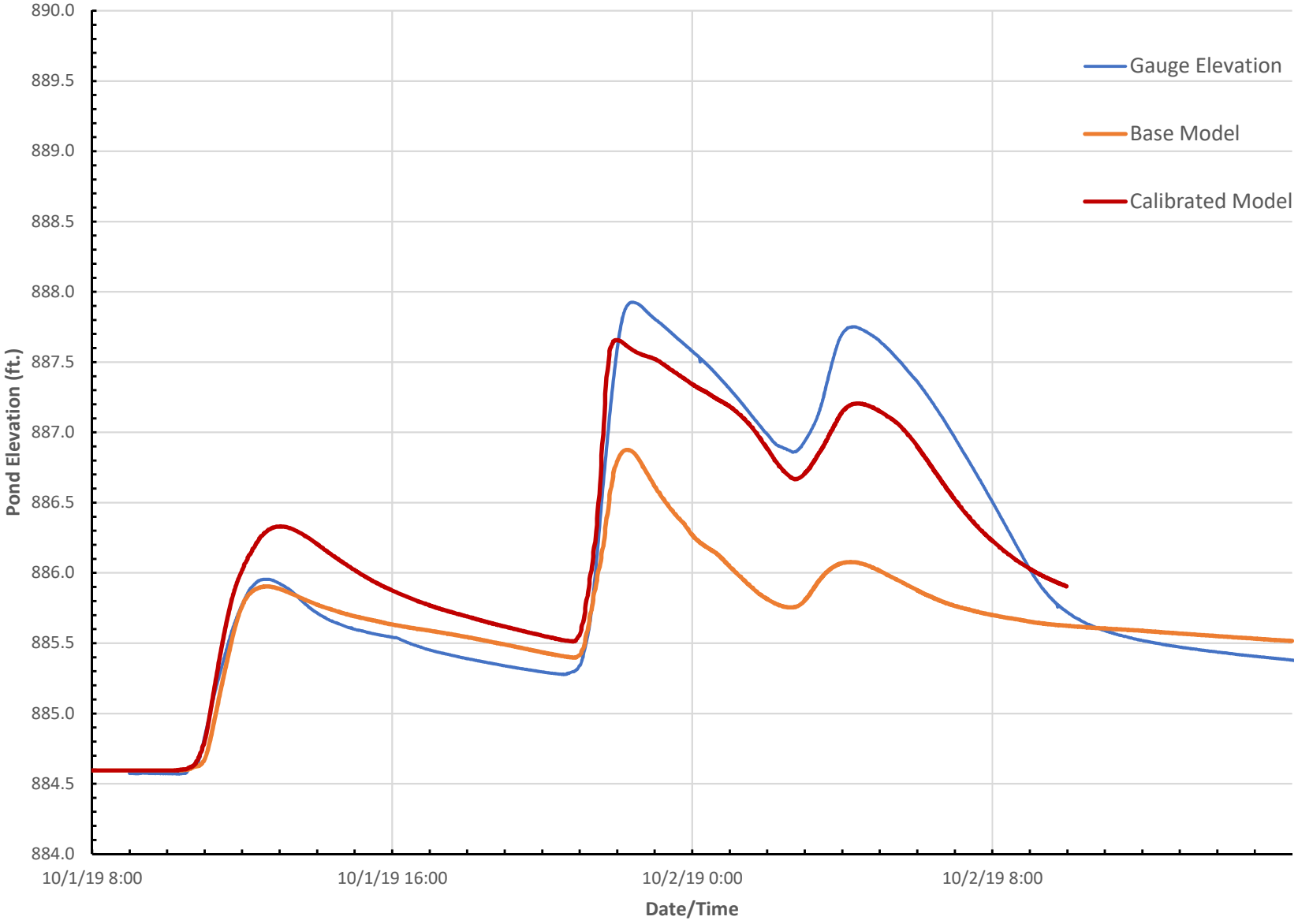


Fig. 15: Grassman Pond
October 1-2, 2019 Storm Event



Appendix I: Peer Review #2 Summary

Peer Review Comments for Stricker's-Mendota Watershed
Peer Review #2
Date: 2020-02-05
By: AE2S (Amber Lefers, Linda Severson)

Review Comments	**BC Response**
Hydrology Review Comments	
Below are our review comments on the hydrologic analysis portion of the XP-SWMM model:	
Carry-over recommendations	
1. It appears that for the impervious area subcatchments, Curve Number methodology is being used for computing runoff volume for 75% of the impervious area (25% is set as "zero depression storage"). We performed a separate spreadsheet calculation and confirmed that the model is indeed using Curve Number methodology, which is confirmed by the 1D .out file, which lists all impervious subcatchments as using "Curve Number". The CN approach underpredicts runoff volume compared to the Modeling Guidance. For example, the October 1 storm had a rainfall depth of 3.25 inches. The Modeling Guidance would result in a runoff depth of 3.20 inches (0.05 inches of depressional storage) from directly connected impervious area, whereas the model is computing just over 3.1 inches – which is a depression storage more similar to pervious surfaces rather than impervious surface. We recommend that the modeling approach be switched to be consistent with the Modeling Guidance and to avoid mixing and matching runoff modeling approaches. See pdf of memo for screenshots of XP-SWMM output documenting computations.	This comment was first provided as part of Peer Review #1. Curve number methodology was not solely being used for computing runoff volume. It was being used for infiltration parameters for impervious areas (in lieu of Horton Infiltration). Based on testing there is no difference in runoff results. A follow-up comment on this item was in Peer Review #2. Upon investigation, it was not the CN infiltration parameters that was an issue. A default setting in XPSWMM has an evaporation value of 0.1-inches per day. It appears this creates the discrepancy identified by AE2S. For clarity the infiltration parameters for impervious areas will be changed to Horton, but this will not result in a difference in runoff. Eliminating the evaporation will result in a difference.
2. Although the detail of the hydraulic pipe networks has been modified to include all 18" pipes and larger, the corresponding subcatchments are sometimes routed downstream of the updated network-leaving these sections effectively inactive (see example below). We recommend splitting the subcatchment at the upstream node and modeling the most upstream set of inlets. See pdf of memo for screenshot of XP-SWMM model framework documenting an example.	For the majority of pipe network there are subwatersheds located at the upstream-most node. There were a minor number of outliers where the subwatershed to the upstream most point would be significantly smaller that other subwatersheds in the network.
Carry-over Suggestions	
1. There are several areas where the subcatchments are crudely delineated with respect to the LiDAR topography. We suggest that these areas be refined given the City's investment in detailed LiDAR data and that the subcatchment modeling should reflect that investment.	BC reviewed the subcatchment divides and we have not found significant deviations from the subcatchment boundary and the available topographic data (LiDAR) and storm sewer system. If there are specific locations where deviations occur, we would appreciate having these identified and we will adjust accordingly.
2. There are areas where streets have very long runs before the storm sewer starts, one example of that being Sawmill Road west of Gammon Road. It is likely that the street does not meet current City standards for street drainage; however, the level of detail for the subcatchments cannot answer that question. We recommend that smaller subcatchments be delineated along roads similar to this so that future improvements can be evaluated and recommended.	BC is applying runoff at nodes to represent inlets. We do not believe representing flow along the street upstream of inlets is warranted for purposes of this study.
1D Hydraulics Peer Review Comments	
Based on a spot check of the 1D network, it appears parameters are consistent with the modeling guidance.	

Peer Review Comments for Stricker's-Mendota Watershed
Peer Review #2
Date: 2020-02-05
By: AE2S (Amber Lefers, Linda Severson)

Review Comments	**BC Response**
2D Hydraulics Peer Review Comments	
Below are our review comments on the 2D hydraulic analysis portion of the XP-SWMM model:	
Carry-over recommendations	
1. 1D/2D node inflow capture is turned off – therefore, exchange between surface and 1D network is not restrained by catch basin hydraulics. We recommend using either global 2d inflow capture (similar to what is done for West Wingra) or sealing the storm sewer junctions as opposed to having the rim linked to the 2D surface with no inflow capture set, as this approach allows the entire 10-foot by 10-foot grid cell that contains the node to send water back and forth between the storm sewer and the surface. The current approach causes gaps in the flood inundation along roadways that in all likelihood does not occur in reality. See pdf of memo for screenshot of example.	A global 2D inflow capture is now applied.
2. While the 2D roughness values in the model are consistent with the latest modeling guidance, the roughness values in the model are more appropriate for sheet flow conditions at the inception of runoff (i.e. rain on grid) versus roughness appropriate for more open channel flow conditions such as street and greenway flow. We recommend that roughness values be adjusted to reflect engineering practice for roughness values used in open channel flow conditions. Note that these lower roughness values will increase velocities and may require model adjustment to provide a stable model.	BC is open to discussion on this topic. BC will follow the modeling guidance if it is updated.
Carry-over suggestions	
1. We suggest that the grid orientation be set to zero or to an orientation that is perpendicular to the primary flow paths or provide a justification as to the orientation of "-8.202 degrees".	Grid orientation is changed to zero.
Calibration Peer Review Comments	
Below are our review comments related to the calibration event:	
1. We agree with your assessment that the Longmeadow flow data appears suspect and should not be used for model calibration. However, what is unclear is whether the stage data itself is also suspect, or whether the depth in the storm sewer could be used to calibrate that portion of the model.	The stage data also appears unrealiable. During the middle of storm events the stage drops to zero. Additionally, the stage data does not line up well with the actual duration of storm events.
2. For Sky View pond, assuming the depth bounce at the outlet is equivalent to the depth bounce at the level logger assumes that the channel has the same capacity as the pond outlet. We suggest modeling this storage area in 2D and adding an orphan 2D node (link invert to 2D) at the location of the level logger for a more direct comparison between the model and the monitoring data. However, we do not know if this is practical depending on exactly where the level logger is located relative to the outlet.	The depth bounce is not being compared between the pond modeling and the gauge data. Only the elevation is being compared during the Oct 1 storm event. The relative shape and timing is being compared also. It is believed that modeling the pond in 2D will not provide any additional value.
3. Notwithstanding how the hydrology and 2D model review comments could affect calibration, it appears that the model represents the physical conditions in the watershed to a sufficient degree to provide a useful tool for making decisions about future improvements.	

Appendix J: City Agency Meeting Notes

Watershed Study Agency Meetings

Round 1

City Engineer (Rob) – 11/4/2020

Mayor's Office (Christie) – 11/19/2020

PWI – 12/3/2020

All Agencies – 12/14/2020

Individual Agencies -

Water Utility – 1/4/2021

- Larson, Alan alarson@madisonwater.org
- Belshaw, Jeff JBelshaw@madisonwater.org
- Braselton, Peter PBraselton@madisonwater.org
- Holmgren, Peter PHolmgren@madisonwater.org
- Miess, Kelly kmiess@madisonwater.org
- Renaud, David DRenaud@madisonwater.org
- Wiederhoeft, Adam awiederhoeft@madisonwater.org

Meeting summary sent 1/6/2020

Follow-up email on 2/9/2021
"Wisconsin Administrative Code, Chapter NR 811.12 (5) (d) 6 requires a minimum setback of 400 feet from a well and storm water retention or detention pond. I request that the contours of the planned pond expansion not encroach on this required 400-foot buffer between the well and pond. This restriction would require an estimated 300' X 200' exclusion in the northeast corner of the parcel. Please note these modifications are being requested in addition to the clay liner already recommended for the expanded pond. These requests are to mitigation potential future water quality impacts (sustained increases in chloride and sodium) that are already observed at Well 16."

City of Madison Parks – 1/12/2021

- Freiwald, Ann AFreiwald@cityofmadison.com
- Knepp, Eric eknepp@cityofmadison.com
- Laschinger, Lisa llaschinger@cityofmadison.com
- Genin, Greg GGenin@cityofmadison.com
- Lerner, Sarah slerner@cityofmadison.com
- Close, Sarah SClose@cityofmadison.com
- Kane, Kathleen kkane@cityofmadison.com
- Stelljes, Corey cstelljes@cityofmadison.com
- Sturm, Michael msturm@cityofmadison.com

Meeting summary sent 1/14/2021

City of Madison Fire Department – 1/12/2021

- Denise DeSerio (sets up meeting – prefers 8:30 am Tuesday briefing time)
- Jerome Buechner
- Tracy Burrus
- Christopher Carbon
- Nicole Marie Hall
- Michael Popovich
- Arthur Price
- Edwin Ruckriegel
- Che Stedman
- Julie Trimbell
- Timothy Mrowiec
- Liza Tatar
- Steven Davis
- Scott Bavery
- Paul Ripp
- Cynthia Schuster

Meeting summary sent 1/12/2021

City of Madison Metro

- Timothy Sobota
- Drew Beck
- Crystal Martin

Email feedback – 12/15/2020

Metro Transit does not have specific concerns or feedback, for the three initial watershed study areas.

Metro Transit does have existing property infrastructure (West Transfer Point bus facility) on the NW corner of S Whitney & Tokay – and may have future infrastructure along the Mineral Point Road corridor, related to Bus Rapid Transit (including parcels near the S Rosa and S Junction intersection areas).

Metro Transit did pilot the use of permeable bus passenger boarding pad surface treatments (i.e. "shall be firm, stable, and slip resistant", between curb and sidewalk), as part of the Toepfer Avenue reconstruction project – and does not foresee any issues at this time with expanded use of this material (versus concrete), as may be needed by storm water terrace treatment demands.



City of Madison Planning – Provided vocal feedback during 12/14/2020 agency meeting; followed up with email 12/17/2020

1. University Research Park: Is there a way that the "Tokay West" stormwater improvements in URP (between 5801 and 5901 Research Park Blvd) could be done to preserve the possibility of a future Rosa Road connection to Tokay? The connection is no longer part of current BRT planning, but we are trying to create more connectivity to and through URP, and that is a major connection. URP is on board with the idea.
2. Odana Golf Course: as the golf course pond expansion is considered can anything be done to, at a minimum, not make it more difficult to create a bike path connection from Whitney Way to the SW path along the north side of the Beltline? Ideally any pond improvements could help facilitate that future connection, but ultimately it will likely take WisDOT involvement and funding to make that connection happen.
3. West Towne ponds: We're looking at a potential bike path extension from the existing Beltline underpass at Grand Canyon north to Mineral Point Road. An option to avoid seven driveways would be to take the path along the border between the West Towne pond property and the businesses to the east. Is there any room to make that option feasible as the improvements to the ponds are considered?

City of Madison Operations – email feedback 12/21/2020

What would OPS be responsible for relating to each reconstruction project (I assume most projects would be performed by contractors,) is this broken down to what OPS would be responsible for vs. contractor? When discussing installing thousands of feet of box culvert near/under high volume roads, expanding ponds, and upsizing large runs of storm pipe, maintenance is always a concern, as well as how this would affect our other utilities.

What would be the maintenance expectations for structures, cleaning, televising, mowing, grate clearing etc. going forward?

City of Madison Streets/Forestry – meeting on 1/27/2021

Marla Eddy
Charlie Romines

Bryan Johnson
Craig Klinke

No comments on proposed solutions.

Transportation Engineering – email feedback 1/12/2021

Yang Tao
Renee Calloway
Thomas Lynch
Thomas Mohr
Mark Winter
Scott Kerr

Traffic Engineering does not have concerns at this time and a meeting is not necessary for now.

One of TE team members discussed with Greg on the potential idea to add storm water management system under bike path and bike lanes, and we do understand that it may or may not be feasible due to added cost and other challenges.

City of Madison Street Design – email feedback 1/13/2021

Chris Petykowski
James Wolf
Christy Bachmann

Only comment I have is to continue coordinating with us to delay our street projects if needed (such as Old Middleton). Janet has been doing a good with that.

Meeting with Water Utility about Proposed Flood Control Projects from Spring Harbor, Stricker's/Mendota, and Wingra West Watershed Studies
January 4, 2021

Engineering and the Water Utility met via Zoom on January 4, 2021 to discuss comments and concerns about the proposed flood control projects for the Spring Harbor, Stricker's/Mendota, and the Wingra West watershed studies.

Attendees included:

- Jeff Belshaw, Water Utility
- Peter Braselton, Water Utility
- Caroline Burger, Engineering
- Greg Fries, Engineering
- Phil Gaebler, Engineering
- Peter Holmgren, Water Utility
- Alan Larson, Water Utility
- Kelly Miess, Water Utility
- Jojo O'Brien, Engineering
- David Renaud, Water Utility
- Janet Schmidt, Engineering
- Lauren Striegl, Engineering
- Adam Wiederhoeft, Water Utility

The following was discussed:

- Currently the Water Utility owns a land asset near Garner Park. The land is being held for a future, potential well. There is a potential the future well may include the reduction of the footprint of the current Garner Park Pond. The proposed watershed study solution for Garner Park Pond was removed from the selected alternatives early in the proposed solutions analysis. Therefore, Engineering has no plans to impact the Water Utility-owned land near Garner Park.
- Engineering will be including the wellhead protection zones on the mapping for the proposed solutions. Engineering understands that any flood control measures within the wellhead protection zones will need to be reviewed by Water Utility for impact on their well. Additionally, stormwater ponds in these areas will need to be lined to prevent infiltration of stormwater into the groundwater.
- Engineering is currently piloting a distributed green infrastructure program. Stormwater measures that purposely infiltrate stormwater (outside wellhead protection zones) create concerns for Water Utility infrastructure. In general:
    - Pervious sidewalks are okay because they are not located above a water main
    - Pervious terraces are okay (for the most part), also, because they are not located above a water main.
    - Pervious pavement causes concern because it is directly above the water mains; water main has clearance requirements that must be met when constructing water main. Water main in these areas may need to be reconstructed, thus adding additional costs to projects in areas where the water main was not planned to be reconstructed.
- Engineering is planning to reconstruct many of the greenway crossings in the watersheds to meet flood program goals. Many times, water main can be near these crossings. Large water main near these crossings can be costly to reconstruct. Engineering will reach out to the Water Utility for cost estimates for these components.
- A spreadsheet is included with this meeting summary listing the flood control measures for Water Utility staff to comment on

Meeting with Madison Fire Department about Proposed Flood Control Projects from Spring Harbor, Stricker's/Mendota, and Wingra West Watershed Studies
January 4, 2021

Engineering and the Madison Fire Department met via Zoom on January 12, 2021 to discuss comments and concerns about the proposed flood control projects for the Spring Harbor, Stricker's/Mendota, and the Wingra West watershed studies.

Invited Attendees:

- Scott Bravery, MFD
- Jerome Buechner, MFD
- Caroline Burger, Engineering
- Tracy Burrus, MFD
- Christopher Carbon, MFD
- Steven Davis, MFD
- Denise DeSerio, MFD
- Greg Fries, Engineering
- Phil Gaebler, Engineering
- Sarah Lerner, Engineering
- Nicole Marie Hall, MFD
- Timothy Mrowiec, MFD
- Jojo O'Brien, Engineering
- Michael Popovich, MFD
- Arthur Price, MFD
- Paul Ripp, MFD
- Edwin Ruckriegel, MFD
- Janet Schmidt, Engineering
- Cynthia Schuster, MFD
- Lauren Striegl, Engineering
- Liza Tatar, MFD
- Julie Trimbell, MFD

The following was discussed:

- Engineering presented the power point presentation describing how the studies are carried out and gave an overview of the proposed solutions for each watershed.
- MFD asked if there are solutions where purchasing of property will be more cost-effective that constructing/reconstructing infrastructure to reduce the property flooding. Engineering has started the process to evaluation that, but the process is in its infancy. Once Engineering has a proposed process, they will share it with interested agencies in the City.
- MFD asked about cooperation with communities that border the City of Madison regarding flooding and flood reduction. As Engineering starts a study, it contacts the adjacent communities that could be affected. To date, the City of Middleton, Town of Middleton, Village of Shorewood Hills, and the City of Fitchburg could be affected by current watershed studies. Engineering has met with City of Middleton representatives and has meetings scheduled with Village of Shorewood representatives. The Town of Middleton has been very cooperative regarding providing data for areas that discharge into the City Madison. No impacts are currently projected for the City of Fitchburg.
- Engineering asked if MFD is okay with pervious pavement being used in the Fire Lanes; recent discussions with Developers indicate they are looking at that to help meet stormwater requirements. Engineering will contact Bill Sullivan from MFD to understand the equipment needs regarding aerial ladder pad loadings.
- MFD asked for an update on marking street signs to indicate water depth during storm events. Engineering has been discussing various approaches. Now that Engineering has a key hire on board, they will be using the inundation mapping generated during the watershed studies to identify areas to pilot a program. Engineering will keep MFD updated on the progress of this effort.

- Engineering asked who handles the contract where cars are towed after flood events. Madison Police Department administers that contract. Engineering will reach out to the contacts given for that information.
- MFD did not raise any red flags during the meeting regarding the proposed solutions presented. MFD should reach out to Engineering if something arises so the concern can be accounted for in the solution(s).

Meeting with Planning about Proposed Flood Control Projects from Spring Harbor, Stricker's/Mendota, and Wingra West Watershed Studies
January 15, 2021

Engineering and the Planning Division met via Zoom on January 14, 2021 to discuss comments and concerns about the proposed flood control projects for the Spring Harbor, Stricker's/Mendota, and the Wingra West watershed studies.

Invited Attendees:

- Heather Bailey, Planning
- Sherry BonDurant, Planning
- Zia Brucaya, Planning
- Caroline Burger, Engineering
- Julie Cleveland, Planning
- Rebecca Cnare, Planning
- Breana Collins, Planning
- Patrick Empey, Planning
- Ruth Ethington, Planning
- Kevin Firchow, Planning
- Greg Fries, Engineering
- William Fruhling, Planning
- Phil Gaebler, Engineering
- Janine Glaeser, Planning
- Brian Grady, Planning
- Jeffrey Greger, Planning
- Lauren Heiser-Ertel, Planning
- Colleen Hoesly, Planning
- William Holloway, Planning
- Linda Horvath, Planning
- Ryan Jonely, Planning
- David Kanning, Planning
- Kirstie Laatsch, Planning
- Sarah Lerner, Engineering
- Benjamin Lyman, Planning
- Urvashi Martin, Planning
- Daniel McAuliffe, Planning
- Jojo O'Brien, Engineering
- Timothy Parks, Planning
- Sydney Prusak, Planning
- Angela Puerta, Planning
- Colin Punt, Planning
- William Schaefer, Planning
- Janet Schmidt, Engineering
- Daniel Seidensticker, Planning
- Heather Stouder, Planning
- Lauren Striegl, Engineering
- Jule Stroick, Planning
- Chris Wells, Planning
- Karin Wolf, Planning
- Benjamin Zellers, Planning

The following was discussed:

- Engineering gave a brief overview of the timing of the studies, the existing conditions inundation mapping, and the draft proposed solutions for the first three watersheds
- An example of project issues and coordination was described regarding the Research Park Southwest Detention pond Improvements and the proposed BRT route.
- Planning asked how areas that are outside the current City of Madison Boundary but may be incorporated into the City or may be impacted by the studies are accounted for. There are generally three main categories and they are accounted for differently:
    - Developed municipalities (e.g. City of Middleton) that discharge stormwater into a City of Madison watershed: For these areas, stormwater is evaluated and routed to City of Madison infrastructure, but inundation mapping is not created for these areas and proposed solutions are not developed
    - Developed municipalities (e.g. Village of Shorewood Hills) where the City of Madison discharges stormwater to them: For these areas, the adjacent communities are brought into the watershed study project team and coordination meetings occur throughout the duration of the watershed study

    - Municipalities that will be annexed: These areas are modeled in the same manner as the areas inside the current City of Madison municipal boundary. Inundation mapping will be created and proposed solutions will be developed.
- One of the outcomes of these studies is to determine where existing developed land needs to be purchased or undeveloped land needs to be reserved for stormwater infrastructure.
- The currently adopted stormwater ordinance and its impact on development was discussed. The ordinance:
    - Allows the City to require developers to meeting watershed-specific goals. Engineering is not going to enforce that, unless a situation necessitates it, at this time.
    - Requires developers account for the existing unintended detention on their site. Engineering is enforcing that at this time.
    - Requires developers to manage up to the 200-year (.5% change) event. Engineering is going to enforce that at this time.
- Engineering is going to start determining where land needs to be reserved for future stormwater infrastructure.
- The inundation mapping will provide target low building openings for areas of infill development (e.g. Westgate Mall)
- A preview of the inundation mapping ArcOnline was given. The tool shows the watershed study schedule, existing conditions inundation mapping, and links the watersheds to the watershed study website for each project.
    - Jojo will work with Pat Empey to determine if additional tools can be added to help make the tool more intuitive.

Meeting with Parks about Proposed Flood Control Projects from Spring Harbor, Stricker's/Mendota, and Wingra West Watershed Studies
January 12, 2021

Engineering and the Parks met via Zoom on January 11, 2021 to discuss comments and concerns about the proposed flood control projects for the Spring Harbor, Stricker's/Mendota, and the Wingra West watershed studies.

Attendees included:

- Caroline Burger, Engineering
- Sarah Close, Parks
- Ann Freidwald, Parks
- Greg Fries, Engineering
- Phil Gaebler, Engineering
- Kathleen Kane, Parks
- Eric Knepp, Parks
- Lisa Laschinger, Parks
- Sarah Lerner, Engineering/Parks
- Jojo O'Brien, Engineering
- Janet Schmidt, Engineering
- Corey Stelljes, Parks
- Lauren Striegl, Engineering
- Michael Sturm, Parks

The following was discussed:

Spring Harbor Watershed

- West Towne Ponds
    - The City has a contract with the 56ers for use of the soccer fields. Loss of any soccer fields in the City is a concern; therefore coordination with stakeholders should occur to understand impacts.
    - Other than the soccer use, Parks did not have concerns
- Owen Park Drainage Swale and Adjacent Flood Wall
    - Parks is supportive of the project
    - There are mature trees along the swale that should be avoided if possible
    - Parks requested that bike path connectivity be explored from Inner Drive through the Southern Park of Owen Park and to the connecting bike paths
    - Eric provided contact names for residents that Engineering could work with in the neighborhood
- Glen Oak Hills Park
    - Parks asked what dry detention would look like and requested that detention be graded to provide more of a natural, meandering channel with areas to explore nature-based play as much as possible
    - There are numerous mature trees in the park and potential detention footprint
    - Parks is not opposed to the project but understands there will be concern regarding mature tree removal

Stricker's/Mendota Watershed

- Stricker's Park
    - Engineering should coordinate with Parks regarding the proposed grading for the project; there may be desires to modify the existing grading over the proposed relief pipe

Wingra West Watershed

- Orchard Ridge Valley Park
    - Park does not have a lot of recreational value and pond expansion could enhance the City of Madison
    - The park is marshy, inaccessible, and has no amenities, therefore it seem like a good fit for a flood control infrastructure
    - The park could benefit from turf walking trails or raised trail/boardwalk
    - Parks has had complaints from neighbors regarding wet pond overtopping
    - Eric: park does not have a high recreational value. Pond could enhance the value of the park (maybe?) or would enhance the City of Madison
- Odana Hills Park & Golf Course
    - Coordination is needed so that the project is mutually beneficial; if the project can be designed to be mutually beneficial, Parks can provide support and help with coordination
    - Eric would like to be involved in the coordination
    - Tree impacts will be minimal
    - The current footprint shown would impact the cross country ski trail
    - The current footprint shown would impact the routing and playability of the golf course
        - Hole 15 (Par 5) is frequently soggy and failing; revised drainage could improve the hole.
        - The 13th green and T box for 16 hole would be impacted
        - Clients need to get to T from each hole to the fairway (without swimming through the pond)
    - The outlet by the channel is an area that is not in play
    - Engineering should set up a meeting with Eric, Theran Steindl, and Ryan Brinza to go over potential grading/pond footprints
- Chippewa Dr/Cherokee Dr Improved Conveyance
    - Parks indicated the plan seems favorable
    - The improved conveyance will help keep the playground in the park from flooding
    - The historic steps in the park are at risk from existing flooding; the conveyance improvements will help protect the stairs by redirecting the runoff
    - Forestry should be coordinated with regarding the street trees

Parks recommended that the improvements for Odana Hills Golf Course should be prioritized first. There is an option for private funding that could cost-share the construction of the improvements.

Prior to public input meetings, it is recommended that Engineering intentionally reach out to the Board of Parks Commissioners (BPC) via email to let them know proposed plan. Indicate we look forward to talking to the public so we can bring all that feedback to BPC.

If Parks has other projects in planning that would mesh well with flood reduction projects, please reach out to Engineering so we can coordinate.

A spreadsheet is included with this meeting summary listing the flood control measures for Parks staff to provide comment on

Meeting with Parks – Golf Course - about Proposed Flood Control Projects from Wingra West Watershed Study – Odana Hills Golf Course Ponds
February 3, 2021

Engineering and the Parks met via Zoom on January 11, 2021 to discuss comments and concerns about the proposed flood control projects for the Spring Harbor, Stricker's/Mendota, and the Wingra West watershed studies.

Attendees included:

- Ryan Brinza, Parks
- Caroline Burger, Engineering
- Ann Freidwald, Parks
- Greg Fries, Engineering
- Phil Gaebler, Engineering
- Eric Knepp, Parks
- Janet Schmidt, Engineering
- Theran Steindl, Parks

The following was discussed:

- Engineering showed proposed solutions
- Golf Course Pond
    - Parks originally thought of increasing Golf Course Pond to shape shown except for west part of pond
    - Need new bridge
    - Move pump station for golf course irrigation
    - Review cart paths and possibly modify
    - Narrow channel so that golfing over the hole is available to most golfer
    - Archaeological site on Hole 5?
    - Could expand pond into wet part of Hole 12
    - Construct forward tee for Hole 16?
- Odana Hills Park & Golf Course
    - Will level be as high in proposed conditions?
    - City pursue removal of weirs
        - Negotiate agreement with WDNR for MG&E infiltration system
    - Shift south side of the pond a little more to the north to not impact fairway as much
- Use excavated material to fill low areas in golf course
    - Build up fairway for Hole 15 – pond level has increased since MGE put in weirs
    - Would want the material scraped off the top for excavation rather than soil deeper in excavation
- Drain area – Golf Course has plans to address drainage to make it more efficient
- Bike path along Beltline?
    - Run parallel to Beltline
- Relief pipe
    - Runs thru irrigation lines which would need repair
    - Construction of pipe could cause issues with golf course due to hole closure during construction and restoration
    - Perhaps build retention pond near bike path instead of running water across golf course
- Engineering can provide scaled figure and Ryan and Theran can measure golf shots
- Are there areas of the golf course that could have water only during large events but not permanent standing water?

Appendix K: Peer Review #3 Summary

Peer Review Comments for Stricker's-Mendota Watershed
Peer Review #3
Date: 2021-03-30
By: AE2S (Amber Lefers, Linda Severson)

Local Improvement Peer Review Comments	**BC Response**
Below are our review comments on the local improvements portion of the XP-SWMM model:	
Recommendations	
1. There are several locations where there are long runs of street flow prior to reaching the current extents of the storm sewer system. One example is Sawmill Road west of Gammon Road. We recommend that the subcatchment be split and storm sewer extended to reflect the need to extend storm sewer past its current extent in order to meet the 25-Year criterion.	This circumstance was discussed as part of earlier peer reviews. BC is applying runoff at the existing storm sewer system. We do not believe representing flow upstream of the existing inlets is warranted for purposes of this study. If future, roadway improvements are done, storm sewer could be extended and sized at that time.
2. A brief review of a few of the "inlets" indicated some considerable instability in the 100-year event. Two examples are 1) AS2647-002_IC and 2) IN2648-024_IC. We recommend that the model be reviewed and the modeling approach or timestep be adjusted to remove the instability.	Reduced weir lengths from 50' to 10' which has eliminated the instabilities in these locations.
3. It appears that there is a small section of storm sewer in Harvest Hills Road that is left as existing with upstream capacity improvements. It also appears that the pipe size reduces. For practicality, we recommend the upstream pipe size is maintained.	Adjusted these pipe sizes in this area to allow a natural size progression from upstream to downstream. This did not significantly impact results.
4. Suggestion / Note: Proposed storm sewer uses a roughness coefficient of 0.014, which is within the standard engineering guidance for concrete pipe; however, slightly rougher than the City's modeling guidance.	Reduced roughness coefficients from 0.014 to 0.013 as needed to meet City modeling guidance.
Regional Improvement Peer Review Comments	
Below are our review comments on Regional Improvements portion of the XP-SWMM model:	
Stricker's Pond Outlet	
1. No modeling approach / design comments.	
2. No additional ideas on potential alternatives beyond what were looked at.	
Tiedeman Pond Outlet	
1. From a costing standpoint, we have significant constructability / RR permitting concerns given the railroad cut, particularly east of Stonefield. Recommend that costing either consider a pumping station or significantly increasing the unit costs for the storm sewer construction. (Note: We recognize this is discussed in the ppt.)	BC agrees that this improvement will be challenging to implement. Historically a gravity outlet option was discussed and was evaluated as a aspect of this study. The concept is very preliminary and would need to be further evaluated regarding route, construction methodology, and other project aspects.
Mendota-Grassman Greenway, University Avenue, and Lake Mendota Drive	

Peer Review Comments for Stricker's-Mendota Watershed
Peer Review #3
Date: 2021-03-30
By: AE2S (Amber Lefers, Linda Severson)

Local Improvement Peer Review Comments	**BC Response**
1. The 1D links for the greenway appear to be 120 feet wide edge-to-edge, but the ineffective 2D flow area is about 55 feet wide. Based on the depths, the width of the inundated 1D cross section seems to match the 2D ineffective area in most areas, but in link 3046-025_3046-025_02, the inundated widths appear to be quite different (1D link inundated width is wider than 2D ineffective flow area), which could double count storage. We recommend the widths of the ineffective flow areas be reviewed to provide consistency between the 1D and 2D portions of the model.	BC reviewed this area and agrees there was some "double counting" of storage. 1D channel width has been adjusted to eliminate this.
2. The roughness value for the low-flow channel and the overbanks is 0.025, likely corresponding to riprapping both the channel and overbanks. It is unclear if that is the City's intent, and this could create permitability issues if the entire greenway is riprapped. We recommend that the roughness be reviewed and adjusted as needed. Further, riprap size affects roughness values, and given the shallow depths through the corridor, additional investigation on roughness vs. riprap size may be warranted to ensure that the modeled design functions as intended.	BC has increased the roughness outside the low flow channel from 0.025 to 0.03 to reflect a vegetated condition.
3. The PowerPoint presentation indicates the pipe is a 72" RCP. The model has an 84" RCP. We recommend confirming that the size in the model is correct.	BC has reviewed the proposed culvert size. The PowerPoint size was incorrect. BC recommends a 84" culvert be installed in this location.
4. For the proposed University Avenue additional pipe, an inlet control code for 18 to 33.7 degree wingwall flares is for a box culvert, not a circular pipe. We recommend using the inlet control code that corresponds to a circular pipe (likely the square headwall, which also corresponds to a standard FES), in case the pipe is in inlet control.	BC has adjusted the proposed circular 84" pipe inlet control to address this concern. This did not significantly impact model results.
5. Cost Consideration: There is an existing sanitary sewer line that runs underneath the west side of the box culvert apron endwall. With the proposed 72" that is 3 feet lower than the existing box, there may be constructability / cost issues with cover over the sanitary sewer.	It is agreed that construction will be challenging. The alternatives evaluation indicated the culvert needed to be replaced, or a relief sewer added in order to meet flood goals. Constructability and cost issues should be further considered in design.
6. Cost Consideration: Cost should consider the numerous wet, electrical, and fiber optic utilities that run through University Avenue.	See above.
7. Suggestion / Note: Proposed culverts use a roughness coefficient of 0.014, which is within the standard engineering guidance for concrete pipe; however, slightly rougher than the City's modeling guidance.	As above, BC has reviewed roughness coefficients and reduced from 0.014 to 0.013 to meet City modeling guidance.
Longmeadow Relief Sewer	

Peer Review Comments for Stricker's-Mendota Watershed
Peer Review #3
Date: 2021-03-30
By: AE2S (Amber Lefers, Linda Severson)

Local Improvement Peer Review Comments	BC Response
1. Based on the xptin, it appears that there may be cover concerns for the relief sewer from Harvest Hill to Sawmill Road. Adding another junction and having a variable slope will likely be sufficient, although may reduce capacity for the shallower sloped section.	BC has added a second junction to this length of pipe and adjusted slopes to meet cover requirements. This did not significantly impact model results.
2. Suggestion / Note: Proposed storm sewer uses a roughness coefficient of 0.014, which is within the standard engineering guidance for concrete pipe; however, slightly rougher than the City's modeling guidance.	As above, BC has reviewed roughness coefficients and reduced from 0.014 to 0.013 to meet City modeling guidance.
3. No additional ideas on potential alternatives beyond what were looked at.	

Appendix L: Proposed Conditions Flooding Depth and Duration Results

Table L-1
Proposed Conditions Flooding Results
Stricker's / Mendota Watershed Study Report, City of Madison, WI

Point	XP-SWMM Node	Location	Flood Elevation	50% Chance Storm				20% Chance Storm				10% Chance Storm				4% Chance Storm				2% Chance Storm				1% Chance Storm				0.2% Chance Storm				Back to Back Storm			
				Peak WSE	Flood Depth (feet)	Flooding Duration (hours)		Peak WSE	Flood Depth (feet)	Flooding Duration (hours)		Peak WSE	Flood Depth (feet)	Flooding Duration (hours)		Peak WSE	Flood Depth (feet)	Flooding Duration (hours)		Peak WSE	Flood Depth (feet)	Flooding Duration (hours)		Peak WSE	Flood Depth (feet)	Flooding Duration (hours)		Peak WSE	Flood Depth (feet)	Flooding Duration (hours)		Peak WSE	Flood Depth (feet)	Flooding Duration (hours)	
1	3244-003_01-3244-003	Mendota Greenway - Upstream Side of Lake Mendota Greenway	858.4	854.1	-4.3	0.0		855.0	-3.4	0.0		855.6	-2.8	0.0		856.5	-1.9	0.0		857.0	-1.4	0.0		857.7	-0.7	0.0		859.5	1.1	0.7		858.4	0.0	0.1	
2	GR3244-003_02	Mendota Greenway - Between Lake Mendota Drive & University Avenue	863.8	861.8	-2.0	0.0		862.2	-1.6	0.0		862.4	-1.4	0.0		862.7	-1.1	0.0		862.9	-0.9	0.0		863.1	-0.7	0.0		863.5	-0.3	0.0		863.2	-0.6	0.0	
3	SM_GW_05	Mendota Greenway - Upstream Side of University Avenue Culvert	874.4	867.7	-6.7	0.0		868.4	-6.0	0.0		869.6	-4.8	0.0		870.5	-3.9	0.0		870.9	-3.5	0.0		871.3	-3.1	0.0		872.1	-2.3	0.0		871.6	-2.8	0.0	
4	HD3046-025_01	Mendota Greenway - Between University Avenue & Old Middleton Road	871.0	868.6	-2.4	0.0		869.0	-2.0	0.0		869.7	-1.3	0.0		870.5	-0.5	0.0		870.9	-0.1	0.0		871.3	0.3	0.5		872.1	1.1	1.1		871.6	0.6	1.3	
5	ME03-A-0039-K-005	Northwest end of Julia Court	877.3	874.7	-2.7	0.0		875.8	-1.5	0.0		876.6	-0.8	0.0		877.5	0.1	0.1		877.8	0.4	0.3		878.0	0.7	0.5		878.4	1.1	0.7		878.1	0.7	0.9	
6	PD_3046-006	Grassman Pond	887.2	887.8	0.6	11.6	**	888.0	0.8	11.7	**	888.1	0.9	11.8	**	888.2	1.0	11.9	**	888.2	1.0	12.0	**	888.3	1.1	12.1	**	888.4	1.2	12.5	**	888.3	1.1	24.0	***
7	GR_2946-016	Skyview Pond	898.7	900.4	1.7	3.1		900.7	2.0	11.9	**	900.9	2.2	11.9	**	901.6	2.8	12.0	**	902.0	3.3	12.0	**	902.6	3.9	12.1	**	903.9	5.2	12.3	**	903.1	4.4	0.0	***
8	AS2947-002	Highland Avenue Low-Point - South of Skyline Drive	965.1	959.7	-5.3	0.0		960.2	-4.8	0.0		960.7	-4.4	0.0		961.3	-3.7	0.0		961.7	-3.3	0.0		962.3	-2.8	0.0		966.3	1.3	0.3		962.4	-2.7	0.0	
9	IN2949-010	North End of Blue Ridge Parkway - North of Appalachian Way	1009.7	1004.1	-5.6	0.0		1004.6	-5.1	0.0		1005.1	-4.5	0.0		1009.4	-0.2	0.0		1010.8	1.1	0.3		1011.1	1.4	0.4		1011.5	1.8	0.8		1011.1	1.5	0.0	
10	AS3245-002	Intersection of Capital Drive & Lake Mendota Drive	859.1	853.6	-5.5	0.0		853.9	-5.2	0.0		854.2	-4.9	0.0		854.7	-4.3	0.0		855.4	-3.6	0.0		856.6	-2.5	0.0		858.6	-0.4	0.0		856.8	-2.3	0.0	
11	TIEDEMANN_POND	Tiedemann Pond	915.6	912.2	-3.4	0.0		912.6	-3.0	0.0		912.9	-2.7	0.0		913.3	-2.3	0.0		913.5	-2.1	0.0		914.0	-1.6	0.0		916.1	0.5	7.1	**	919.4	3.8	11.4	***
12	STRICKERS_POND	Stricker's Pond	926.7	924.6	-2.1	0.0		925.3	-1.4	0.0		925.9	-0.8	0.0		926.8	0.1	4.4		927.5	0.8	10.8	**	928.3	1.6	11.2	**	929.8	3.1	11.6	**	931.0	4.3	23.1	***
13	PD_2046-021	Stricker's Pond Fore-Bay	927.9	926.6	-1.3	0.0		926.9	-1.0	0.0		927.2	-0.7	0.0		927.4	-0.5	0.0		927.5	-0.4	0.0		928.3	0.4	10.2	**	929.8	1.9	11.3	**	931.0	3.1	22.2	***
14	ME04-A-0406-H-000	Longmeadow Road Low-Point - Near Stricker's Pond	927.6	927.0	-0.6	0.0		928.0	0.4	0.3		928.5	0.9	0.5		928.9	1.3	0.7		929.1	1.5	0.8		929.2	1.6	12.1	**	929.8	2.2	12.2	**	931.1	3.5	24.0	***
15	ME04-A-0014-H-000	Westfield Road Low-Point - Between Apple Hill Circle & Tramore Trail	953.4	948.6	-4.8	0.0		948.9	-4.5	0.0		949.1	-4.2	0.0		949.4	-3.9	0.0		949.6	-3.8	0.0		949.8	-3.6	0.0		953.3	-0.1	0.0		949.9	-3.5	0.0	
16	ME04-A-0015-H-001	Intersection of Longmeadow Road & Quail Ridge Drive	960.2	953.1	-7.0	0.0		953.8	-6.4	0.0		954.5	-5.7	0.0		959.7	-0.5	0.0		960.6	0.5	0.2		961.0	0.8	0.4		963.2	3.1	1.1		961.4	1.2	0.9	
17	ME04-A-0013-H-002	Gammon Road Low-Point - Between Longmeadow Road & Stone Glen Road	965.8	962.5	-3.3	0.0		962.8	-3.0	0.0		963.1	-2.6	0.0		966.3	0.5	0.1		966.6	0.9	0.3		966.9	1.1	0.5		967.9	2.1	1.5		966.9	1.2	1.2	
18	AS2648-006	Intersection of Gammon Road & Harvest Hill Road	998.4	994.1	-4.4	0.0		994.4	-4.0	0.0		994.7	-3.8	0.0		995.0	-3.5	0.0		995.1	-3.3	0.0		995.3	-3.1	0.0		995.4	-3.0	0.0		995.3	-3.1	0.0	
19	ME04-A-0015-H-005	Harvest Hill Road - Between Strathfield Circle & Morningdale Circle	985.2	980.5	-4.7	0.0		980.9	-4.3	0.0		981.2	-3.9	0.0		983.7	-1.4	0.0		984.8	-0.4	0.0		985.7	0.5	0.4		987.3	2.1	0.8		985.9	0.7	0.0	
20	ME04-A-0015-H-009	Intersection of Gammon Road & Old Sauk Road	1010.9	1004.9	-6.0	0.0		1005.3	-5.6	0.0		1005.6	-5.3	0.0		1006.2	-4.8	0.0		1007.6	-3.4	0.0		1009.3	-1.6	0.0		1011.7	0.8	0.2		1009.4	-1.5	0.0	
21	ME04-A-0015-H-010	Intersection of Harvest Hill Road & Pebble Beach Drive	1004.3	998.7	-5.7	0.0		999.6	-4.8	0.0		1001.0	-3.4	0.0		1004.8	0.5	0.1		1005.0	0.7	0.3		1005.6	1.3	0.6		1006.7	2.3	0.9		1005.8	1.4	1.2	
22	PD_2847-023	Stonefield Pond	979.8	978.1	-1.7	0.0		978.9	-0.9	0.0		979.4	-0.4	0.0		980.0	0.2	0.8		980.2	0.4	1.4		980.5	0.7	1.8		980.9	1.1	2.5		980.6	0.8	3.8	
23	ME04-A-0029-H-004	Intersection of Pebble Beach Drive & Sauk Ridge Trail	976.6	975.9	-0.7	0.0		976.6	0.0	0.1		976.9	0.4	0.6		977.4	0.8	1.7		977.6	1.0	2.1		977.8	1.2	2.5		978.1	1.6	3.1		977.8	1.3	5.1	
24	T14006	City of Middleton - Stricker's Pond Inlet Sewer - Westfield Road	928.9	930.1	1.2	0.5		930.7	1.9	1.5		931.1	2.3	2.1		931.6	2.7	2.2		931.9	3.0	2.0		932.1	3.2	2.3		932.5	3.6	12.3	**	932.1	3.2	15.0	***
25	T14087	City of Middleton - Stricker's Pond Inlet Sewer - Voss Parkway	927.7	925.5	-2.3	0.0		926.6	-1.1	0.0		927.7	0.0	0.0		928.2	0.5	0.2		929.0	1.2	4.3		929.6	1.9	12.0	**	930.5	2.8	12.1	**	930.9	3.2	23.9	***

**The model runtime was 24-hours. Flooding above the identified flood elevation continues at the end of the model runtime.
***The model runtime was 24-hours. Flooding above the identified flood elevation continues at the end of the model runtime.

Appendix M: 0.2% Chance Storm Event Pipe Enlargement Summary

Table M-1
0.2% Chance Storm Pipe Enhancement Summary
Stricker's/Mendota Watershed Study Report, City of Madison, WI

	Existing Conditions		Proposed Conditions		0.2% Chance Enhanced Conditions	
Link Name	Pipe Size	Peak Flow Rate - 0.2% Chance Storm Event	Pipe Size	Peak Flow Rate - 0.2% Chance Storm Event	Pipe Size	Peak Flow Rate - 0.2% Chance Storm Event
SM_GW_05_SM_GW_04	6x10	639.9	6x10	351.6	6x10	185.8
Link409.1	N/A	N/A	60	327.3	5x5	413.5
Link410.1	N/A	N/A	60	327.3	5x5	414.8
Link411.1	N/A	N/A	48x76	397.3	5x5	469.4
1047.1	N/A	N/A	60	328.3	5x5	366.2
1047.1.2	N/A	N/A	60	327.6	5x5	413.6
Link410.1.1	N/A	N/A	48x76	397.3	5x5	469.4
Link410.1.1.1	N/A	N/A	48x76	397.3	5x5	469.4
2447-006_2447-003	15	-1.9	15	-2.3	15	-2.3
2447-007_2447-006	15	-1.6	15	-1.9	15	-1.9
2447-008_2447-007	15	-1.0	15	-1.2	15	-1.2
2546-008_2546-009	18	2.4	18	27.6	18	14.8
2645-002_2545-002	18	-2.0	18	-2.6	18	-2.6
2646-010_2646-011	18	16.3	18	15.7	18	16.9
2646-011_2646-006	21	27.0	21	33.9	21	33.8
2646-015_2646-003	18	37.0	18	54.5	18	-8.4
2747-002_T13059MAD	24	25.4	24	26.9	24	27.1
2747-006_2747-005	36	32.5	36	-33.4	36	-27.4
2747-007_2747-006	30	31.8	30	-33.4	30	-27.6
2749-002_2749-003	18	-2.7	18	-1.5	18	-0.5
2749-003_2649-006	18	-3.4	18	-7.2	18	-0.8
2749-004_2749-007	18	14.3	18	19.4	18	19.9
2749-042_BC_JCT_3	18	0.0	18	0.0	18	0.0
2749-043_2749-042	18	0.0	18	0.0	18	0.0
2749-047_2749-046	18	18.6	18	19.9	18	19.9
2847-001_2747-002	24	23.1	24	24.0	24	24.0
2847-006_2847-001	24	19.7	24	19.9	24	19.9
2847-007_2847-006	24	22.8	24	22.3	24	22.3
2847-009_2847-017	24	30.8	24	31.5	24	31.5
2847-012_2847-009	24	14.6	24	12.6	24	12.6
2847-013_2847-012	19x30	13.1	19x30	12.9	19x30	12.9
2847-014_2847-013	18	13.3	18	13.3	18	13.3
2847-018_2847-014	18	22.7	18	22.6	18	22.6
2848-001_2847-018	15	0.0	15	0.0	15	0.0
2848-002_2848-001	15	0.0	15	0.0	15	0.0
2850-003_2850-004	15	-5.8	15	9.0	15	-3.5
2850-005_2850-003	15	-3.5	15	-2.3	15	-1.6
2850-010_2849-013	18	-1.6	18	-4.1	18	-3.5
2850-015_2850-004	18	12.8	18	16.8	18	-7.6
2944-013_2944-014	18	20.0	18	20.0	18	20.0
3044-001_3045-003	18	-3.2	18	-3.6	18	0.3
3044-003_3044-001	18	-1.1	18	-0.7	18	0.0
3044-030_3044-023	24	12.0	24	12.1	24	12.1
3044-033_3044-030	24	12.1	24	12.0	24	12.0
3045-013_BC_JCT_7	36	8.5	36	7.5	36	7.5
3045-015_3045-016	18	23.7	18	23.8	18	23.8
3045-017_3045-015	15	14.9	15	14.9	15	14.9
3045-020_3045-017	15	15.4	15	15.6	15	15.6
3045-023_3045-020	15	0.0	15	0.0	15	0.0
3045-024_3045-023	15	0.0	15	0.0	15	0.0
3045-026_3045-024	12	0.0	12	0.0	12	0.0
3045-028_3045-026	12	0.0	12	0.0	12	0.0
3046-003_3046-004	66	250.4	66	288.7	66	301.1
3046-010_3046-011	19x30	28.7	19x30	29.4	19x30	29.4
3046-010_3046-021	14x23	28.3	14x23	27.6	14x23	27.6

Table M-1
0.2% Chance Storm Pipe Enhancement Summary
Stricker's/Mendota Watershed Study Report, City of Madison, WI

	Existing Conditions		Proposed Conditions		0.2% Chance Enhanced Conditions	
Link Name	Pipe Size	Peak Flow Rate - 0.2% Chance Storm Event	Pipe Size	Peak Flow Rate - 0.2% Chance Storm Event	Pipe Size	Peak Flow Rate - 0.2% Chance Storm Event
3046-012_3046-010	14x23	6.9	14x23	-2.5	14x23	-2.7
3046-014_3046-010	24x38	55.7	24x38	57.1	24x38	57.1
3046-018_3046-014	24	17.8	24	34.7	24	34.7
3046-019_3046-018	24	11.4	24	34.9	24	34.9
3046-021_BC_JCT_7	36	31.1	36	30.5	36	30.4
3046-022_3046-021	12	4.0	12	4.1	12	4.1
3046-024_3045-013	12	8.0	12	7.6	12	7.6
3046-025_BC_JCT_7	4x12	554.5	4x12	573.4	4x12	578.9
3144-006_3244-006	48	88.9	48	88.9	48	88.9
3145-028_3145-030	42	98.8	42	138.5	42	145.4
3145-030_3145-031	42	98.7	42	138.5	42	145.4
3145-031_3145-035	42	98.7	42	138.5	42	145.4
3145-036_3145-028	24	38.3	24	37.6	24	35.9
3145-040_3145-036	24	25.2	24	26.0	24	26.0
3145-043_3145-040	24	25.0	24	25.8	24	25.8
3145-048_3145-043	24	25.2	24	25.7	24	25.7
3146-013_3046-019	24	8.8	24	34.8	24	34.8
3246-004_3246-016	18	-0.3	18	1.9	18	2.0
3246-009_3245-004	24	40.2	24	44.1	24	47.5
3246-014_3246-023	18	0.0	18	-1.3	18	-1.2
3246-016_3246-019	18	1.8	18	3.8	18	3.9
3246-019_3246-020	24	4.0	24	9.3	24	9.3
3246-020_3246-009	24	50.0	24	55.3	24	55.3
3246-023_3246-024	18	-0.1	18	2.5	18	2.4
3246-024_3246-019	24	1.6	24	5.8	24	5.6
3246-025_3246-024	24	0.6	24	1.4	24	1.3
3246-027_3246-025	24	0.2	24	0.5	24	0.5
BC_JCT_16_BC_JCT_15	18	-6.7	18	-11.6	18	-10.3
BC_JCT_3_2749-002	18	0.0	18	0.0	18	0.0
BC_JCT_7_3046-026	4x12	528.1	4x12	546.2	4x12	552.4
IN2847-012_AE2847-022	14x23	13.9	14x23	14.6	14x23	14.6
IN3146-003_IN3146-004	14x23	5.3	14x23	5.3	14x23	5.3
IN3146-004_IN3146-006	12	5.2	12	5.2	12	5.2
IN3146-006_AE3146-009	15	8.4	15	8.4	15	8.4
Link433	N/A	N/A	36	38.7	36	38.3
Link335	12	8.3	12	9.3	12	9.4
Link423	N/A	N/A	36	38.7	36	38.3
Link424	N/A	N/A	36	38.7	36	38.3
Link425	N/A	N/A	36	38.7	36	38.3
Link426	N/A	N/A	36	38.7	36	38.3
Link427	N/A	N/A	36	38.7	36	38.3
Link428	N/A	N/A	36	38.7	36	38.3
Link429	N/A	N/A	36	38.7	36	38.3
Link430	N/A	N/A	36	38.7	36	38.3
Link432	N/A	N/A	36	38.7	36	38.3
Link434	N/A	N/A	24	23.2	24	23.3
Link435	N/A	N/A	24	23.0	24	23.2
Link436	N/A	N/A	24	25.4	24	25.8
Link437	N/A	N/A	24	34.7	24	33.2
Link438	N/A	N/A	24	32.5	24	32.6
2646-009_2646-003	42	80.2	48	112.0	4x4	125.0
2646-006_2646-009	21	29.8	30	43.2	30	34.8
2747-005_2647-004	36	43.1	36	67.9	48	103.8
2647-004_2646-009	42	43.9	48	67.8	48	103.9
2646-003_2646-018	48	235.7	48	235.7	5x5	509.4

Table M-1
0.2% Chance Storm Pipe Enhancement Summary
Stricker's/Mendota Watershed Study Report, City of Madison, WI

	Existing Conditions		Proposed Conditions		0.2% Chance Enhanced Conditions	
Link Name	Pipe Size	Peak Flow Rate - 0.2% Chance Storm Event	Pipe Size	Peak Flow Rate - 0.2% Chance Storm Event	Pipe Size	Peak Flow Rate - 0.2% Chance Storm Event
2646-018_2646-004	48	259.8	48	259.8	5x5	509.0
2647-001_2646-003	48	175.8	48	181.3	5x5	397.7
2649-006_2649-002	21	27.8	21	30.5	3x3	108.9
2649-002_2649-001	21	16.7	21	38.1	3x3	77.9
2648-006_2648-002	42	148.2	42	107.6	4x4	140.8
2648-001_2647-003	48	159.2	48	145.6	5x5	326.8
2647-003_2647-002	48	157.6	48	138.9	5x5	322.9
2647-002_2647-001	48	188.6	48	195.8	5x5	405.4
2648-002_2648-001	42	163.1	42	107.6	4x4	141.0
BC_JCT_15_2648-001	18	13.4	24	38.4	24	51.6
2950-006_2950-005	30	37.8	36	68.1	36	80.3
2950-020_2950-006	24	32.2	30	62.2	30	71.5
2950-024_2950-023	18	13.4	36	40.8	36	44.4
2950-027_2950-025	15	10.6	24	40.4	24	44.1
2950-025_2950-024	18	13.3	36	40.7	36	44.5
Link440	NA	NA	42	101.3	42	77.5
2749-046_2749-009	36	64.1	54	155.1	5x5	258.9
2749-024_2749-013	30	30.1	42	71.3	42	96.8
2849-001_2749-024	38x60	55.5	42	65.0	42	89.5
2949-002_2949-012	27	46.6	48	207.3	5x5	363.2
2949-010_2948-005	27	45.2	48	188.8	5x5	364.1
2947-004_2946-005	36	129.4	48	342.2	4x4	473.0
2546-001_2546-002	21	11.4	30	80.7	3x3	143.6
2546-002_2546-003	24x38	26.8	30	55.3	3x3	98.8
2545-001_BC_JCT_1	60	157.3	60	157.3	3-6x8	601.1
2546-003_2546-005	30	40.8	36	52.8	3x3	66.5
2646-001_BC_JCT_2	48	226.8	48	226.8	2-5x5	599.9
BC_JCT_2_2545-001	48	157.3	48	157.3	2-6x6	601.6
2646-005_2646-001	48	224.8	48	224.8	5x5	505.1
3045-003_3044-004	18	11.1	24	26.0	4x4	43.0
3044-004_3044-002	19x30	27.8	29x45	65.1	4x4	89.9
2946-004_2946-003	36	118.6	48	302.0	4x4	390.0
2946-003_2946-014	36	99.5	48	244.5	4x4	316.5
2946-014_2946-006	36	107.9	48	216.4	4x4	268.0
2749-018_2749-017	30	56.4	60	182.0	5x5	227.2
2749-017_2749-005	30	56.4	48	182.0	5x5	225.8
2749-005_2749-007	30	44.2	48	115.1	5x5	219.3
2749-007_2749-046	36	60.3	48	135.4	5x5	239.4
2848-012_2848-011	18	16.4	24	37.1	24	37.2
2848-011_2848-009	18	13.3	27	31.1	27	32.8
2848-007_2848-006	18	16.9	30	30.3	30	32.1
2848-006_2848-004	24	22.0	30	28.7	30	32.9
2749-009_2749-013	36	45.5	54	110.8	5x5	160.4
2749-027_2749-033	42	78.4	60	232.3	5x5	298.3
2749-033_2748-001	34x53	74.4	60	239.8	5x5	299.7
2748-001_2748-004	34x53	95.5	60	296.8	5x5	360.8
2848-009_2848-007	18	13.3	30	30.9	30	32.5
2849-013_2849-012	18	8.2	24	23.7	24	25.6
2849-012_2749-035	24	-14.8	30	23.6	30	25.4
2749-035_2749-018	36	54.8	60	182.1	5x5	227.5
BC_JCT_4_BC_JCT_5	36	60.1	48	237.5	5x5	400.2
2947-002_2947-003	36	93.9	48	342.2	4x4	449.7
2948-004_2948-001	30	47.5	54	189.1	5x5	344.5
2948-005_2948-004	30	49.4	48	189.0	5x5	347.9
2546-009_2546-019	18	30.2	36	110.9	36	111.0

Table M-1
0.2% Chance Storm Pipe Enhancement Summary
Stricker's/Mendota Watershed Study Report, City of Madison, WI

	Existing Conditions		Proposed Conditions		0.2% Chance Enhanced Conditions	
Link Name	Pipe Size	Peak Flow Rate - 0.2% Chance Storm Event	Pipe Size	Peak Flow Rate - 0.2% Chance Storm Event	Pipe Size	Peak Flow Rate - 0.2% Chance Storm Event
2546-019_2546-010	30	77.9	42	179.3	42	201.9
2546-010_2546-011	30	73.5	42	179.4	4x4	202.8
2546-011_2546-020	36	89.7	43x68	179.5	4x4	203.0
2546-020_2546-015	36	87.4	43x68	183.5	4x4	174.3
2446-012_2446-008	21	25.3	30	76.8	30	76.4
2446-008_2446-011	24	27.3	36	80.4	36	83.7
2446-011_2546-009	24	25.9	36	82.3	36	88.5
2649-001_2648-007	24	34.5	36	107.6	3x3	140.2
2648-007_2648-006	24	35.0	36	107.6	3x3	140.8
2648-005_2648-003	30	32.1	42	87.7	4x4	157.9
2749-013_2749-027	42	72.4	60	202.5	5x5	267.2
2948-001_2948-002	33	52.5	60	239.6	6x6	406.9
2948-002_BC_JCT_4	33	59.5	54	239.2	5x5	400.2
BC_JCT_6_2947-002	36	65.1	48	344.8	5x5	511.6
2947-013_BC_JCT_6	36	63.7	48	344.9	5x5	512.2
BC_JCT_5_2947-013	36	60.5	48	237.6	5x5	400.0
2947-003_2947-004	36	91.2	48	342.2	4x4	455.4
2949-012_2949-010	27	43.7	48	187.7	5x5	363.4
2446-007_2446-012	21	17.1	24	44.3	24	44.3
2446-013_2446-012	15	9.5	30	38.3	30	38.5
2446-014_2446-013	15	8.7	24	33.0	24	33.0
2446-020_2446-014	15	8.7	24	33.6	24	33.5
2446-021_2446-020	15	8.6	24	33.8	24	33.8
2447-003_2446-021	15	8.2	24	34.0	24	34.0
3044-013_3044-002	24	47.5	24	50.2	3x3	95.6
3044-019_3044-013	24	44.4	24	48.2	36	95.5
3044-022_3044-019	24	41.8	24	44.8	3x3	95.2
3044-023_3044-022	24	40.3	24	44.3	3x3	96.7
2648-024_2648-005	24	30.4	42	116.3	4x4	157.9
2648-017_2648-024	18	16.5	42	71.1	42	112.0
2648-016_2648-017	18	14.2	42	71.6	42	98.6
2748-004_2748-006	34x53	102.1	60	314.2	5x5	362.5
BC_JCT_8_2648-016	18	12.6	36	72.0	36	89.1
2648-003_2648-001	30	33.2	42	97.8	4x4	196.1
2946-005_2946-004	36	131.8	48	342.2	4x4	467.2
2646-004_2646-005	48	272.7	48	272.7	5x5	507.8
2950-022_2950-004	30	-23.3	36	52.5	36	48.7
2950-004_2950-005	30	-30.6	42	53.7	4x4	49.3
2850-004_2950-021	24	19.5	36	51.4	36	48.8
2950-023_2949-002	30	53.9	48	172.8	5x5	274.3
2950-021_2950-022	30	19.6	36	51.9	36	48.7
2950-005_2950-023	30	42.9	60	141.1	5x5	234.3
3145-020_3145-023	30	56.4	42	109.2	4x4	185.8
3245-001_3245-002	30	46.3	38x60	183.7	4x4	200.8
3245-005_BC_JCT_9	36	73.0	48x76	261.5	5x5	277.4
3044-037_3145-018	30	56.4	36	109.2	4x4	185.5
3044-002_3044-036	30	56.4	48	109.4	4x4	185.6
3244-003_3244-002	2-48	196.0	2-4x8	884.1	2-4x10	1036.8
3245-002_3245-005	36	64.5	38x60	223.7	4x4	239.8
3044-036_3044-037	30	56.4	48	109.2	4x4	186.0
3145-018_3145-019	30	56.4	36	109.2	4x4	185.6
3145-019_3145-020	30	56.1	36	109.2	4x4	185.7
3145-023_3145-024	30	51.3	42	107.3	4x4	162.5
3145-024_3145-025	30	60.5	42	106.6	42	110.1
3145-025_3145-028	30	60.5	42	106.6	42	110.6

Table M-1
0.2% Chance Storm Pipe Enhancement Summary
Stricker's/Mendota Watershed Study Report, City of Madison, WI

	Existing Conditions		Proposed Conditions		0.2% Chance Enhanced Conditions	
Link Name	Pipe Size	Peak Flow Rate - 0.2% Chance Storm Event	Pipe Size	Peak Flow Rate - 0.2% Chance Storm Event	Pipe Size	Peak Flow Rate - 0.2% Chance Storm Event
3245-003_3245-001	24	26.0	32x49	103.8	4x4	124.8
3245-004_BC_JCT_11	24	26.7	30	43.5	30	46.9
2648-030_BC_JCT_8	18	11.8	36	72.3	36	85.6
BC_JCT_12_2648-030	18	7.8	24	24.6	24	29.1
BC_JCT_13_BC_JCT_12	18	9.1	24	24.7	24	25.3
BC_JCT_14_BC_JCT_13	18	10.3	24	24.7	24	25.4
BC_JCT_11_3245-003	24	14.1	30	42.8	30	47.1
SM_GW_05_SM_GW_04	6x10	639.9	84	379.2	7x12	574.4
GR3244-002_BC_JCT_17	Open	548.1	Open	940.6	Open	1037.0
SM_GW_04_3244-003_02	Open	259.4	Open	823.6	Open	881.1
3046-025_3046-025_01	Open	185.7	Open	576.3	Open	581.5
3046-025_3046-025_01.1	N/A	N/A	Open	646.6	Open	658.4
3046-025_3046-025_01.2	N/A	N/A	Open	625.9	Open	658.4
3046-025_3046-025_01.3	N/A	N/A	Open	576.3	Open	581.6
SM_GW_04_3244-003_01	Open	272.2	Open	949.4	Open	1051.8
SM_GW_04_3244-003_01.1.1	N/A	N/A	Open	948.8	Open	1050.9
3046-025_3046-025_02	Open	334.8	Open	725.7	Open	760.8
3046-025_SM_GW)05	Open	273.0	Open	719.8	Open	751.1
IN3146-011_AS3146-010	14x23	7.2	14x23	15.8	2x2	56.2
AS3146-010_IN3146-003	14x23	15.0	14x23	17.7	2x2	58.0
Link412.1	N/A	N/A	60	-63.6	60	-72.5
IN3045-009_GR3045-010	18	3.4	18	3.4	4x4	117.6
Link409	N/A	N/A	15	0.0	2x2	59.9
Link408	N/A	N/A	15	0.0	2x2	59.9
Link407	N/A	N/A	15	0.0	2x2	58.3
Link415	N/A	N/A	24	0.0	3x3	60.7
Link414.1	N/A	N/A	18	0.0	3x3	60.5
Link414	N/A	N/A	18	0.0	3x3	60.3
Link413.1	N/A	N/A	18	0.0	3x3	60.3
Link413	N/A	N/A	18	0.0	3x3	60.4
Link412	N/A	N/A	15	0.0	3x3	60.0
Link411	N/A	N/A	15	0.0	3x3	60.0
Link410	N/A	N/A	15	0.0	2x2	59.9
2848-004_2849-005	48	80.9	36	64.1	36	72.6
2849-005_2849-001	38x60	79.9	42	69.9	42	76.7
PONWOOD_2747-007	30	-39.7	30	-33.4	30	-27.7
SM_GW_06_3046-026	Open	509.9	Open	510.3	Open	516.0
SM_GW_09_SM_GW_06	30	27.7	30	27.6	30	27.7
SM_GW_16_SM_GW_12	12	7.9	12	7.4	12	7.4
SM_GW_17_SM_GW_13	12	8.0	12	7.4	12	7.4
SM_GW_18_SM_GW_14	12	8.1	12	7.5	12	7.5
SM_GW_19_SM_GW_15	12	8.0	12	7.5	12	7.5
SM_GW_27_SM_GW_24	30	0.0	30	0.0	30	0.0
StrickForebayCulvs	N/A	N/A	29x45	66.0	29x45	67.1
SM_GW_28_SM_GW_25	30	0.0	30	0.0	30	0.0
SM_GW_29_SM_GW_26	30	0.0	30	0.0	30	0.0

Appendix N: Cost Estimates

Table N-1
Conceptual Cost Estimate - Longmeadow Relief Sewer
Stricker's/Mendota Watershed Study, Madison, WI

Item #	Item	Quantity	Unit	"Average" Unit Cost	Revised Unit Cost	Cost	Reason for Adjustment
10701	TRAFFIC CONTROL	1	LUMP SUM	$ 10,000	$ 25,000	$ 25,000	Increased because of work on Gammon Road.
10911	MOBILIZATION	1	LUMP SUM	$ 145,000	$ 72,545	$ 72,545	Adjusted to be 5% of other bid items.
21092	TERRACE RESTORATION	2,090	S.Y.	$ 5	N/A	$ 10,450	
40381	REMOVE AND REPLACE CONCRETE CURB & GUTTER, MACHINE PLACED - RESURFACING	990	L.F.	$ 15	N/A	$ 14,850	
50301	8 INCH PVC SANITARY SEWER PIPE	940	L.F.	$ 155	N/A	$ 145,700	
50302	10 INCH PVC SANITARY SEWER PIPE	280	L.F.	$ 200	N/A	$ 56,000	
50225	UTILITY TRENCH PATCH TYPE III	1,220	T.F.	$ 55	N/A	$ 67,100	
50225B	UTILITY TRENCH PATCH TYPE III - GREATER THAN 48"	990	T.F.	$ 100	N/A	$ 99,000	
50413	60 INCH TYPE I RCP STORM SEWER PIPE	1,680	L.F.	$ 250	N/A	$ 420,000	
50425	48 INCH X 76 INCH TYPE I HERCP STORM SEWER PIPE	1,360	L.F.	$ 380	N/A	$ 516,800	
50488	48 INCH X 76 INCH HERCP AE	1	EACH	$ 4,500	N/A	$ 4,500	
50628	48 INCH X 76 INCH HERCP AE GATE	1	EACH	$ 3,500	N/A	$ 3,500	
50701	4' DIA. SANITARY SAS	8	EACH	$ 4,500	N/A	$ 36,000	
50726	6'X6' STORM SAS	8	EACH	$ 9,500	N/A	$ 76,000	
SM1	EROSION CONTROL	1	LUMP SUM	$ 25,000	N/A	$ 25,000	
SM2	SITE DEWATERING / STORM CONTROL	1	LUMP SUM	$ 50,000	N/A	$ 50,000	
SM10	UTILITY CONFLICT ALLOWANCE	1	LUMP SUM	128,000	N/A	$ 128,000	
				Subtotal		**$ 1,751,000**	

Subtotal		**$ 1,751,000**	
Contingency	**25%**	**$ 438,000**	
Design	**10%**	**$ 176,000**	
Total		**$ 2,365,000**	
Land Acquisition		**$ -**	
Wetland Mitigation			
Total Total		**$ 2,365,000**	

Table N-2
Conceptual Cost Estimate - Mendota Greenway (Old Middleton Rd to University Ave Segment)
Stricker's/Mendota Watershed Study, Madison, WI

Item #	Item	Quantity	Unit	"Average" Unit Cost	Revised Unit Cost	Cost	Reason for Adjustment
10701	TRAFFIC CONTROL	1	LUMP SUM	$ 10,000	N/A	$ 10,000	
10911	MOBILIZATION	1	LUMP SUM	$ 145,000	$ 101,870	$ 101,870	Adjusted to be 10% of other bid items.
20101	EXCAVATION CUT	4,260	C.Y.	$ 25	N/A	$ 106,500	
20221	TOPSOIL	13,360	S.Y.	$ 9.50	N/A	$ 126,920	
20227	LIGHT RIPRAP - GLACIAL FIELD STONE	610	C.Y.	$ 160	N/A	$ 97,600	
20235	HEAVY RIPRAP - GLACIAL FIELD STONE	146	C.Y.	$ 160	N/A	$ 23,360	
20704	INFILTRATION SEEDING	13,360	S.Y.	$ 3	N/A	$ 40,080	
21073	EROSION MATTING, CLASS II, TYPE C - ORGANIC	13,360	S.Y.	$ 3.50	N/A	$ 46,760	
50476	84 INCH RCP AE	2	EACH	$ 5,600	N/A	$ 11,200	
SM1	EROSION CONTROL	1	LUMP SUM	$ 25,000	N/A	$ 25,000	
SM2	SITE DEWATERING / STORM CONTROL	1	LUMP SUM	$ 50,000	N/A	$ 50,000	
SM4	CLEARING & GRUBBING	2	ACRE	$ 15,000	N/A	$ 35,279	
SM5	ACCESS ROAD	1,025	L.F.	$ 40	N/A	$ 41,000	
SM7	84" STORM SEWER - TRENCHLESS INSTALLATION	150	L.F.	$ 1,800	N/A	$ 270,000	
SM7A	84" TRENCHLESS INSTALLATION - BORE PIT	2	EACH	$ 60,000	N/A	$ 120,000	
SM10	UTILITY CONFLICT ALLOWANCE	1	LUMP SUM	15,000	N/A	$ 15,000	
				Subtotal		**$ 1,121,000**	
				Contingency	**25%**	**$ 281,000**	
				Design	**10%**	**$ 113,000**	
				Total		**$ 1,515,000**	
				Land Acquisition		**$ -**	
				Wetland Mitigation	$80,000 per Acre	**$ 164,000**	Assume 1.7:1 mitigation ratio, Area of wetlands from wetland delineation
				Total Total		**$ 1,679,000**	

Table N-3
Conceptual Cost Estimate - Mendota Greenway (University Ave to Camelot Dr Segment)
Stricker's/Mendota Watershed Study, Madison, WI

Item #	Item	Quantity	Unit	"Average" Unit Cost	Revised Unit Cost	Cost	Reason for Adjustment
10701	TRAFFIC CONTROL	1	LUMP SUM	$ 10,000	N/A	$ 10,000	
10911	MOBILIZATION	1	LUMP SUM	$ 145,000	$ 98,409	$ 98,409	Adjusted to be 10% of other bid items.
20101	EXCAVATION CUT	5,860	C.Y.	$ 25	N/A	$ 146,500	
20221	TOPSOIL	7,700	S.Y.	$ 9.50	N/A	$ 73,150	
20227	LIGHT RIPRAP - GLACIAL FIELD STONE	630	C.Y.	$ 160	N/A	$ 100,800	
20235	HEAVY RIPRAP - GLACIAL FIELD STONE	226	C.Y.	$ 160	N/A	$ 36,160	
20704	INFILTRATION SEEDING	7,700	S.Y.	$ 3	N/A	$ 23,100	
21073	EROSION MATTING, CLASS II, TYPE C - ORGANIC	7,700	S.Y.	$ 3.50	N/A	$ 26,950	
50225C	UTILITY TRENCH PATCH TYPE III - BOX CULVERT	260	T.F.	$ 120	N/A	$ 31,200	
SM1	EROSION CONTROL	1	LUMP SUM	$ 25,000	N/A	$ 25,000	
SM2	SITE DEWATERING / STORM CONTROL	1	LUMP SUM	$ 50,000	N/A	$ 50,000	
SM3	4'X8' BOX CULVERT	260	L.F.	$ 1,200	N/A	$ 312,000	
SM4	CLEARING & GRUBBING	1	ACRE	$ 15,000	N/A	$ 22,231	
SM5	ACCESS ROAD	1,050	L.F.	$ 40	N/A	$ 42,000	
SM8	DUAL 4'X8' BOX CULVERT WINGWALLS	2	EACH	$ 35,000	N/A	$ 70,000	
SM10	UTILITY CONFLICT ALLOWANCE	1	LUMP SUM	15,000	N/A	$ 15,000	
				Subtotal		**$ 1,083,000**	
				Contingency	**25%**	**$ 271,000**	
				Design	**10%**	**$ 109,000**	
				Total		**$ 1,463,000**	
				Land Acquisition		**$ -**	
				Wetland Mitigation	$80,000 per Acre	**$ 48,000**	Assume 1.7:1 mitigation ratio, Area of wetlands from wetland delineation
				Total Total		**$ 1,511,000**	

Table N-4
Conceptual Cost Estimate - Stricker's Pond Outlet
Stricker's/Mendota Watershed Study, Madison, WI

Item #	Item	Quantity	Unit	"Average" Unit Cost	Revised Unit Cost	Cost	Reason for Adjustment
10701	TRAFFIC CONTROL	1	LUMP SUM	$ 10,000	N/A	$ 10,000	
10911	MOBILIZATION	1	LUMP SUM	$ 145,000	$ 34,544	$ 34,544	Adjusted to be 10% of other bid items.
21092	TERRACE RESTORATION	120	S.Y.	$ 5	N/A	$ 600	
40381	REMOVE AND REPLACE CONCRETE CURB & GUTTER, MACHINE PLACED - RESURFACING	204	L.F.	$ 15	N/A	$ 3,060	
50225	UTILITY TRENCH PATCH TYPE III	1,101	T.F.	$ 55	N/A	$ 60,555	
50405	24 INCH TYPE I RCP STORM SEWER PIPE	1,101	L.F.	$ 125	N/A	$ 137,625	
50465	24 INCH RCP AE	2	EACH	$ 1,100	N/A	$ 2,200	
50605	24 INCH RCP AE GATE	1	EACH	$ 900	N/A	$ 900	
50724	4'X4' STORM SAS	3	EACH	$ 5,500	N/A	$ 16,500	
50726	6'X6' STORM SAS	2	EACH	$ 9,500	N/A	$ 19,000	
SM1	EROSION CONTROL	1	LUMP SUM	$ 25,000	N/A	$ 25,000	
SM2	SITE DEWATERING / STORM CONTROL	1	LUMP SUM	$ 50,000	N/A	$ 50,000	
SM9	24" GATE VALVE	1	EACH	$ 20,000	N/A	$ 20,000	
				Subtotal		**$ 380,000**	
				Contingency	**25%**	**$ 95,000**	
				Design	**10%**	**$ 38,000**	
				Total		**$ 513,000**	
				Land Acquisition		**$ -**	
				Wetland Mitigation			
				Total Total		**$ 513,000**	

Table N-5
Conceptual Cost Estimate - Tiedeman's Pond Outlet
Stricker's/Mendota Watershed Study, Madison, WI

Item #	Item	Quantity	Unit	"Average" Unit Cost	Revised Unit Cost	Cost	Reason for Adjustment
10701	TRAFFIC CONTROL	1	LUMP SUM	$ 10,000	N/A	$ 10,000	
10911	MOBILIZATION	1	LUMP SUM	$ 145,000	$ 281,150	$ 281,150	Adjusted to be 5% of other bid items.
21092	TERRACE RESTORATION	6,930	S.Y.	$ 5	N/A	$ 34,650	
50225A	UTILITY TRENCH PATCH TYPE III - 24" TO 48"	280	T.F.	$ 75	N/A	$ 21,000	
50409	36 INCH TYPE I RCP STORM SEWER PIPE	480	L.F.	$ 175	N/A	$ 84,000	
50468	36 INCH RCP AE	2	EACH	$ 2,000	N/A	$ 4,000	
50608	36 INCH RCP AE GATE	2	EACH	$ 1,500	N/A	$ 3,000	
50726	6'X6' STORM SAS	9	EACH	$ 9,500	$ 19,000	$ 171,000	Increased cost because of depth of pipe.
SM1	EROSION CONTROL	1	LUMP SUM	$ 25,000	N/A	$ 25,000	
SM2	SITE DEWATERING / STORM CONTROL	1	LUMP SUM	$ 50,000	N/A	$ 50,000	
SM6	36" STORM SEWER - TRENCHLESS INSTALLATION	4,060	L.F.	$ 1,000	$ 1,200	$ 4,872,000	Increased cost because of difficulty of access.
SM6A	36" TRENCHLESS INSTALLATION - BORE PIT	9	EACH	$ 40,000	N/A	$ 360,000	
SM10	UTILITY CONFLICT ALLOWANCE	1	LUMP SUM	23,000	N/A	$ 23,000	
				Subtotal		**$ 5,939,000**	
				Contingency	**25%**	**$ 1,485,000**	
				Design	**10%**	**$ 594,000**	
				Total		**$ 8,018,000**	
				Land Acquisition		**$ -**	
				Wetland Mitigation			
				Total Total		**$ 8,018,000**	

Appendix O: Public Comment

Stricker's/Mendota Public Comment
February 4, 2022 – March 4, 2022

Comment #1

Thank you for letting the public participate in your flood mitigation strategies. Madisonians have diverse and varied expertise, and I'm glad that we're encouraged to share our ideas for your consideration.

After watching your presentations and reading through your documents, I noticed a predominance of traditional engineering solutions to flooding (excavating retention ponds, constructing berms, clearing forested areas, etc.)

In some cases, these types of engineering solutions are great. For example, West Towne Mall Pond (making it much bigger and deeper) and Gettle Ave (increasing the size of the underground stormwater sewer). Please implement these first. They will help reduce flooding, without harming our quality forested areas.

I have a couple additional strategies that would be both effective at reducing stormwater runoff flooding as well as be popular by multiple city departments and demographics.

1) Massive reduction of pavement (benefits = stormwater reduction, carbon goals, ecological, and social equity):

- narrow existing streets when road re-construction is done (reduces runoff, increases permeability)
- design narrower roadways for new developments; work with Dane County on this, too, since their roads in Madison's watersheds are excessively wide
- reduce size of parking lots (maybe incentivize this with the private sector?)
- remove sidewalks where unnecessary and unused (look at the south side of E. Springs Dr. for example)
- incentivize removal of homeowner pavement (double-wide driveways, etc.) Just like Madison incentivizes low-flow toilets, we could do the same with reducing driveway pavement size
- less new pavement reduces Madison's carbon footprint (cement production is very carbon intensive)
- reduced pavement helps keep city temperatures lower and Madison more livable and pleasant
- narrower roadways reduce traffic speed and severity of accidents, and encourage pedestrians and bicyclists

2) Addition of tree canopy (trees can play a huge role in stormwater reduction strategies): https://www.cwp.org/making-urban-trees-count/

Please see this document regarding watershed runoff and trees: https://owl.cwp.org/mdocs-posts/review-of-the-available-literature-and-data-on-the-runoff-and-pollutant-removal-capabilities-of-urban-trees/

- densely plant city terraces and boulevards with canopy tree cover
- plant existing parkways and edges of water retention areas with forest cover (instead of just grass)
- trees intercept and evapotranspire rainfall, greatly reducing storm runoff
- tree roots increase water infiltration into soil (reducing surface runoff after storms)

- trees lower water level in soil allowing for greater absorption and retention after rainfall events (they drink up to 47 gallons per tree per day consumed... multiply by tens of thousands of new trees = huge reduction of stormwater runoff)
- trees give needed shade to streets, terraces, boulevards, and sidewalks... makes Madison more walkable and livable (increased social equity = bus ridership up with walkable streetscapes, pedestrians increase when shade trees line our terraces), and trees reduce summer heat
- street trees prevent "traffic blindness" from low sun angles and prevent accidents due to glare, and road rage due to road heat
- trees increase water quality downstream

I hope you'll consider working with different city and county departments as well as private businesses and homeowners to reduce excessive pavement, and implement massive citywide tree planting strategies to reduce water runoff and flooding.

Response to Comment #1

Thank you for providing comments on the reports. You are correct in that the solutions described in the reports are more of traditional stormwater management solutions – ponds, pipes, etc. As you've started to list below, there are numerous potential ways to impact stormwater runoff. We (the City) had to pick something for the studies. We chose the more traditional route because many of the traditional stormwater management types were created for flood control, the current tools available are more geared towards those types of solutions (because the solutions have been around longer), and most folks can picture what they look like.

The purpose of the watershed studies it to find out what it would take to reduce flooding – in other words – what are the magnitudes of the solutions we need to meet our targets. With the study results we now know things like, how much volume we need to store (or infiltrate) or how much flow capacity we need to add, etc. This is key information we did not have previously.

In parallel, the City has other programs that are evaluating other types of stormwater management. Engineering conducted a distributed green infrastructure analysis to understand how typically sized green infrastructure would impact flooding. The City is working with the USGS on a Pilot Study area to understand how much green infrastructure it takes to see a measurable reduction of volume in a certain area. The City has tree canopy goals and tree canopy was just added to a common stormwater model Engineering utilizes. Our Traffic Engineering Department is working on a Green Streets project to understand what types of stormwater management are best suited for certain types of streets (commuter, arterial, residential, etc). Our vegetation specialists are slowly converting our stormwater utility properties to native species and desirable species of plants and trees. There are times when high value trees are in a very difficult location to work around and in these situations a decision may be made to remove those trees. Our stormwater ordinance was recently revised to require green infrastructure for redevelopment (previously it was only required for new development) and we have increased the incentives to both residential and commercial property owners for installing green infrastructure on their properties.

The solutions shown in the watershed studies are concepts to give engineering an idea of the size. When the solutions go to design, all the available stormwater management types will reviewed to

determine which types work best for a particular area. And, we will continue our other citywide initiatives as well.

As a side note, we realize we need to create some information describing all the other great things the City is doing/looking into. We have some of that available, but not all. We'll be working with our Public Information Officer to get the rest of the information available to the public. And, based on the comments we've received, we realize we need to create a paragraph or two in the reports describing these parallel efforts.

Thank you so much for taking the time to provide this valuable feedback. We really appreciate it.