Minnehaha Creek Watershed District *REQUEST FOR BOARD ACTION*

MEETING DATE: July 9, 2015

TITLE: **Lake Zumbra 2014 High Water Investigation – Acceptance of Technical Report**

RESOLUTION NUMBER: 15-063

PREPARED BY: Renae Clark

E-MAIL: rclark@minnehahacreek.org **TELEPHONE:** 952-641-4510

REVIEWED BY: ☐ Administrator ☒ Counsel ☐ Program Mgr.(Name):_____
☐ Board Committee ☐ Engineer ☐ Other

WORKSHOP ACTION:

☐ Advance to Board mtg. Consent Agenda. ☐ Advance to Board meeting for discussion prior to action.

☐ Refer to a future workshop (date):_____ ☐ Refer to taskforce or committee (date):_____
☐ Return to staff for additional work. ☒ No further action requested.

☒ Other (specify): ____**Final Action July 9, 2015**____

PURPOSE or ACTION REQUESTED:
The Board of Managers is requested to accept the Lake Zumbra High Water Level Investigation Technical Memorandum dated May 29, 2015 prepared by Wenck Associates.

PROJECT/PROGRAM LOCATION:
Lake Zumbra, Victoria MN

PROJECT TIMELINE:
Complete upon approval of proposed resolution.

PROJECT/PROGRAM COST:
Fund name and number: 600 Planning and Policy Development
Current budget: $10,000
Expenditures to date: $10,000
Requested amount of funding: None
Is a budget amendment requested? No
Is additional staff requested? No

PAST BOARD ACTIONS:
January 29, 2015, Board action to authorize contracting with Wenck Associates for an amount not to exceed $10,000 for analyzing the flooding problems at Zumbra Ridge, Victoria MN.

SUMMARY:

DRAFT for discussion purposes only and subject to Board approval and the availability of funds.
Resolutions are not final until approved by the Board and signed by the Board Secretary.

In 2014 16 lakes throughout the watershed reached historic levels. During this high water event, the District assumed a lead role collecting data and coordinating with local agencies to share data. In June 2014 the City of Victoria reported high water concerns from homeowners in the Zumbra Ridge neighborhood on Lake Zumbra. A subsequent multi-jurisdictional meeting was held on June 13, 2014 to discuss high water concerns with the Zumbra Ridge Homeowners Association. During the June 2014 multi-jurisdictional site meeting emergency response versus long term planning roles were discussed. It was offered that that given the unprecedented flooding and the designation of Six Mile Creek subwatershed as a priority geography, that the District may be positioned to voluntarily coordinate future technical work following the flood event. Following receipt of the attached letter from the President of the Zumbra Ridge Homeowners Association, dated January 12, 2015, District staff coordinated between staff from Carver County, the City of Victoria and Three Rivers Park District to discuss a coordinated response to the concerns of the Zumbra Ridge Homeowners Association. On January 29, 2015 the Board of Managers authorized retaining Wenck Associates to assemble historic data and reports on Lake Zumbra and data relating to the 2014 high water event. The City of Victoria hosted a public kick-off meeting where the District had the opportunity provide a clear project description to the residents and gather community input and questions for the report. Upon completion of the attached draft report – Lake Zumbra High Water Level Investigation Technical Memo dated May 29, 2015, the City of Victoria hosted a second informational meeting where the District delivered the details of the report and answered questions.

A summary presentation of the report will be provided by staff; the full, draft report is attached. The Board of Managers is requested accept the draft report.

ATTACHMENTS:

1. DRAFT Lake Zumbra High Water Level Investigation Technical Memorandum, May 29, 2015, Wenck Associates
2. Board Memorandum, Zumbra Ridge Homeowner Association Correspondence, January 29, 2015, James Wisker, Director of Planning and Projects
3. January 12, 2015 letter from the President of the Zumbra Ridge Homeowners Association

RESOLUTION

RESOLUTION NUMBER: 15-063

TITLE: Lake Zumbra 2014 High Water Investigation – Acceptance of Technical Report

WHEREAS, the Six Mile Creek subwatershed is identified as a District priority focus and that the District shall reflect this commitment its planning activity, work plans and proposed budgets, and in coordination efforts with subwatershed partners and stakeholders;

WHEREAS, the January 1, 2014 through June 30, 2014 timeframe was the wettest on record and resulted in sustained high water conditions throughout the Minnehaha Creek Watershed District (MCWD); and;

WHEREAS, the District's role during the high water event was to monitor lake levels, collect data, and coordinate with local communities and emergency response services to share data; and

WHEREAS, Lake Zumbra, within the Six Mile Creek subwatershed was one of sixteen waterbodies within the Minnehaha Creek Watershed District that reached historic peak water level elevations; and

WHEREAS, residents of the Zumbra Ridge Homeowners Association on Lake Zumbra reported flooding during the 2014 high water event; and

WHEREAS, Lake Zumbra is within the City of Victoria and part of a local drainage area that includes land managed by Three Rivers Park District and Carver County; and

WHEREAS, consistent with the Minnehaha Creek Watershed District's role during the 2014 flood event, the District assumed a lead role in the coordination between Carver County, City of Victoria, and Three Rivers Park District's response to the high water concerns of the Zumbra Ridge Homeowners Association; and

WHEREAS, on January 29, 2015 the Board of Managers authorized retaining Wenck Associates in an amount not to exceed $10,000 to assimilate the available technical data and data related to the 2014 high water event for analyzing the concerns of the Zumbra Ridge Homeowners Association; and

WHEREAS, the District coordinated with the City of Victoria, Three Rivers Park District, Carver County and the MN Department of Natural Resources to aggregate historical data and data from the 2014 flood event; and

WHEREAS, the draft Technical Memorandum reviews historic lake levels, hydraulics, hydrology and the 2014 flood event and finds that monitoring water level on Sunny Lake will help anticipate flooding events on Lake Zumbra; and

WHEREAS, on June 1, 2015 a public meeting was hosted by the City of Victoria for the District's presentation of the data and findings in draft Technical Memorandum; and

WHEREAS, the memorandum finds the following: (a) several properties riparian to Zumbra Lake have land, low floor, or low openings at or below the 100-year high water level; (b) the present outlet hydraulics for Lake Zumbra are more efficient than the historical condition and appear to be more efficient than the natural condition; and (c) modifications to increase the hydraulic

efficiency of the Lake Zumbra outlet may require lowering the ordinary high water level of the lake and may cause an unacceptable increase in water levels to downstream landowners; and

WHEREAS the Board understands that the City intends to develop a flood response plan that may incorporate, among other things, notification to residents, assistance with sand bags and, with the consultation of coordinating agencies, roles of such agencies to ensure timely collection and sharing of data; and

NOW, THEREFORE, BE IT RESOLVED that the Minnehaha Creek Watershed District Board of Managers hereby accepts the Lake Zumbra High Water Level Investigation Draft Technical Memorandum dated May 29, 2015 with such further non-substantive changes as necessary for the District engineer to present the memorandum in final form; and

THEREFORE BE IT RESOLVED that the District administrator, through staff and the District engineer, will provide consultation and technical assistance to the City of Victoria in its development of its flood response plan.

Resolution Number 15-063 was moved by Manager _____, seconded by Manager _____.
Motion to adopt the resolution ___ ayes, ___ nays, ___abstentions. Date: July 9, 2015
_____ Date: _____
Secretary

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Technical Memo

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To: Renae Clark, Planner – Project Manager, Minnehaha Creek Watershed District

From: Chris Meehan, Wenck Associates, Inc.
Erik Megow, Wenck Associates, Inc.

Copy: Carver County, Three Rivers Park District, City of Victoria

Date: July 6, 2015

Subject: Lake Zumbra High Water Level Investigation

In the spring and early summer of 2014, a record amount of precipitation was experienced throughout the Minnehaha Creek Watershed District (MCWD). Chaska received 13.24 inches of rain in June, more than triple the precipitation normally received for the month. Throughout the District, flooding and high water issues resulted in many of the lakes and streams. Seventeen lakes in the District experienced record breaking high water levels. One of those lakes was Lake Zumbra.

The water level of Lake Zumbra reached a peak elevation of 944.91 on July 3, 2014 which is 1.61 feet above the lake's ordinary high water level (OHW) of 943.3, established by Minnesota Department of Natural Resources. The 944.91 elevation was the highest recorded since 1958 when the record began. The high lake level caused flooding on improved properties and residences on Zumbra Drive and Zumbra Circle and several of them experienced surface flooding issues and wet basements. Several had been installing sand bags supplied by the City of Victoria to limit structure impacts.

Minnehaha Creek Watershed District (MCWD) received communications from the City of Victoria regarding complaints from residents with flooding issues. MCWD representatives met with residents, City staff and representatives from Three Rivers Park District to share information and discuss issues being experienced by homeowners. Homeowners were seeking relief from the high water condition and were looking for help to increase the outlet capacity of Lake Zumbra. While that sounds straightforward, there are many complexities involved like determining and communicating what downstream impacts would be and seeking emergency approvals from the Minnesota Department of Natural Resources and Three Rivers Park District.

MCWD is not an emergency response authority, but it's high level of water resources expertise was offered to methodically investigate the behavior of the lake outlet and help inform homeowners and local partner agencies about Lake Zumbra water levels. MCWD agreed to review the hydrology of Lake Zumbra and its outlet, and to collect lake level information on both Lake Zumbra and Sunny Lake. The purpose of the review was to understand the lake level response and to inform all parties involved of the facts.

Wenck Associates, Inc. completed a review of lake levels and precipitation, constructed an XP-SWMM hydrologic response model, ran multiple model scenarios including the actual precipitation time series received, both TP-40 and Atlas 14 storm precipitation, reviewed past water level issues on Lake Zumbra, and surveyed low lying residences sensitive to lake level rises. The balance of this memorandum discusses the results of this hydrologic review.

Lake Zumbra Lake Levels

Since 1958, Lake Zumbra has experienced water levels that have fluctuated almost 8 feet. Figure 1 shows the recorded water levels through the past 57 years showing elevations between 936.7 in 1958 and 944.9 in 2014.

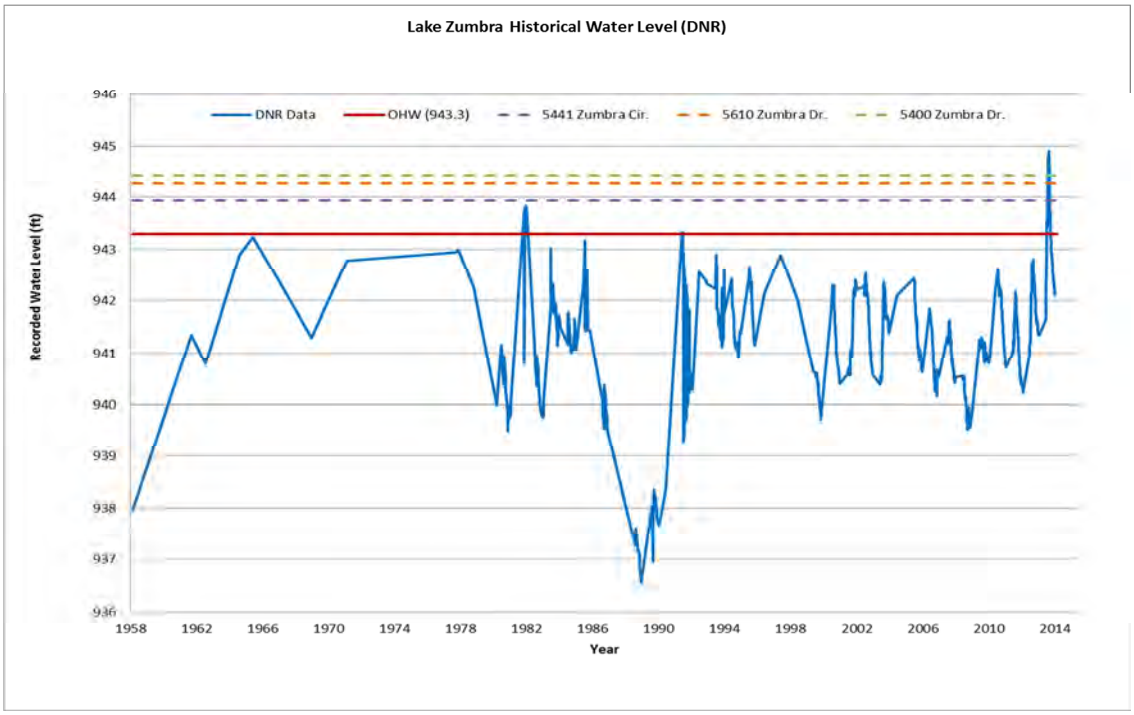

Figure 1. Lake Zumbra water level from 1958 to 2015

To understand the water level fluctuations, the hydrology and hydraulics of both Lake Zumbra and Sunny Lake were investigated. Many of the fluctuations are seasonal, however Figure 1 shows a low lake level period between 1986 and 1992. Lake Minnetonka was also low during this period reflect less than normal precipitation. The high peak during the summer of 2014 demonstrates a large range of lake levels and is the result of an extended period of wet weather.

Lake Zumbra Hydrology

Lake Zumbra is a 207 acre lake located in Carver County. It has a watershed area of 524 acres that is comprised primarily of wetlands and maple-basswood forest. Adjacent to Lake Zumbra is Sunny Lake which has always been hydraulically connected to Zumbra. A large portion of the Lake Zumbra and Sunny Lake watersheds lie in the Carver Park Reserve. Currently, only a small portion around Lake Zumbra is developed for residential use while the rest is made up of wetlands, forest, and other water features such as ponds and Stone Lake. Figure 2 shows the watersheds for Lake Zumbra, Sunny Lake, and an unnamed wetland that is located between Sunny Lake and Lake Auburn. Table 1 shows a comparison of the three waterbodies and their watersheds. It is interesting and informative to note Lake Zumbra has a watershed to lake area ratio of 2.53:1 while Sunny Lake, the tail water on the Lake Zumbra outlet, has a ratio of 45.2:1. Sunny Lake is a much smaller water body yet it receives a great deal more runoff compared to Lake Zumbra.

Table 1. Waterbody Comparisons

Waterbody	NWL (ft)	Lake Surface Area at NWL (ac)	Watershed Area (ac)
Lake Zumbra	941.1	207	524
Sunny Lake	941.1	32	1,445
Unnamed Wetland	940.3	22	118

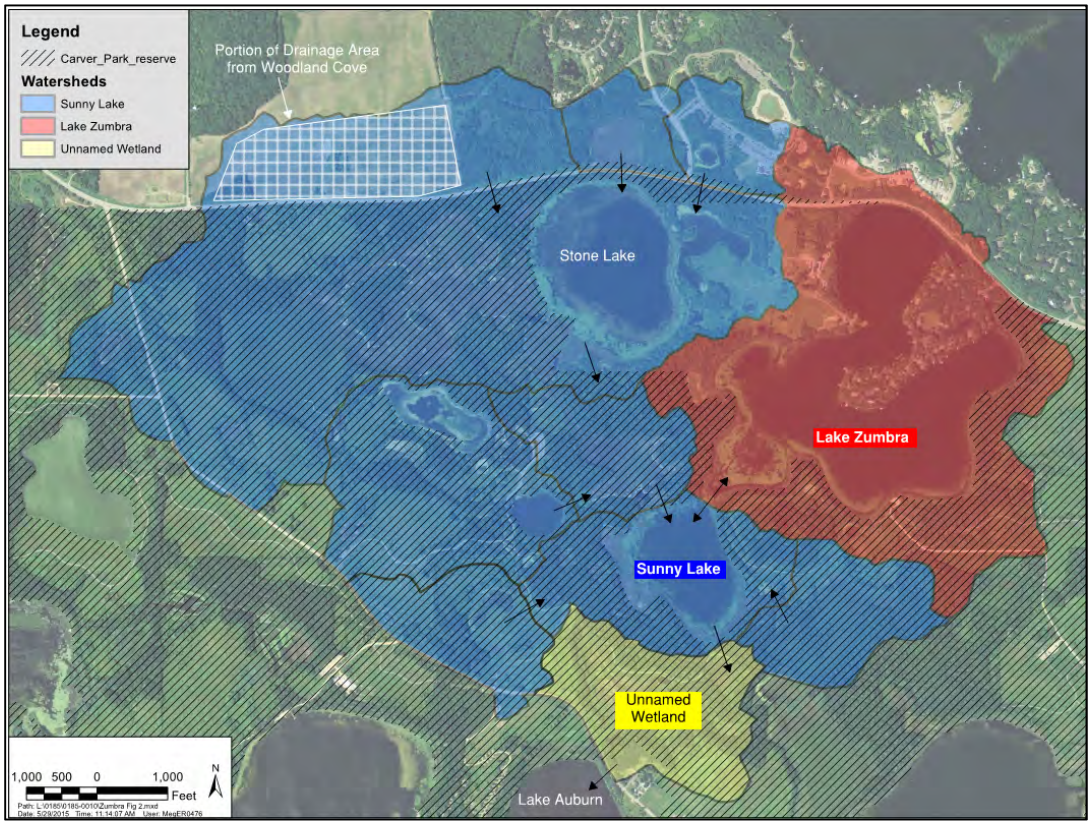

Figure 2. Lake Zumbra and Sunny Lake watersheds *See Appendix E, Figure 3 for the Lake Auburn watershed.*

Looking at historical aerial photos (Appendix A), there does not seem to be many critical changes in hard surfaces in these watersheds. Very little residential development has occurred within the watersheds that would create increases in runoff rates and volumes.

It should also be noted that future developments within these watersheds will be regulated by MCWD's Stormwater Management Rules. These rules make sure that developments include stormwater abstraction BMPs that reduce the runoff rates and volumes leaving a site, for 1-, 10-, and 100-year storm events, ensuring runoff volumes and rates do not increase to Sunny Lake and Lake Zumbra.

Woodland Cove, a development on Lake Minnetonka and contributing runoff to Sunny Lake, can be used as an example for how the stormwater rules will restrict future development. To meet the District's stormwater requirements, the development included a total of 51 sedimentation basins and 58 infiltration basins designed to reduce runoff rates and volumes

and increase water quality. Table 2 shows the pre-development and proposed runoff and water quality parameters that were reviewed and permitted in 2011.

Table 2. Woodland Cove Runoff Reductions

Runoff Parameter	*Pre-development*	*Proposed*	*Reduction*
Total Phosphorus Load (lbs/yr)	35.53	5.82	83.2%
Total Suspended Solids (lbs/yr)	9,614.8	284.4	97.0%
Runoff Volume (ac-ft)	34.80	18.41	47.1%

From the aerial photo review and additional historical documents, an increase in runoff rates and volume to Lake Zumbra, due to residential development, does not appear likely based on current stormwater regulations.

Lake Zumbra Outlet Hydraulic Capacity

Through a review of the Minnesota Department of Natural Resources and Three Rivers Park Board records, the overall hydraulic capacity between Lake Zumbra and Lake Auburn has not changed significantly in the past 45 years. The most significant change in the watersheds were the installations of trail and road crossings between Zumbra and Sunny in the early 1960s and the changing culverts at the trail and County Road 11 crossing downstream (see Table 3, Pg. 5)

Since the 1960s, Lake Zumbra has discharged to Sunny Lake and Sunny Lake has discharged to Lake Auburn through an unnamed wetland. Figure 3 shows how water flows from Lake Zumbra to Lake Auburn and where flows from sub-watersheds enter the system at Sunny Lake. Figure 3 also shows the three critical crossings/culverts that regulate flow through the system.

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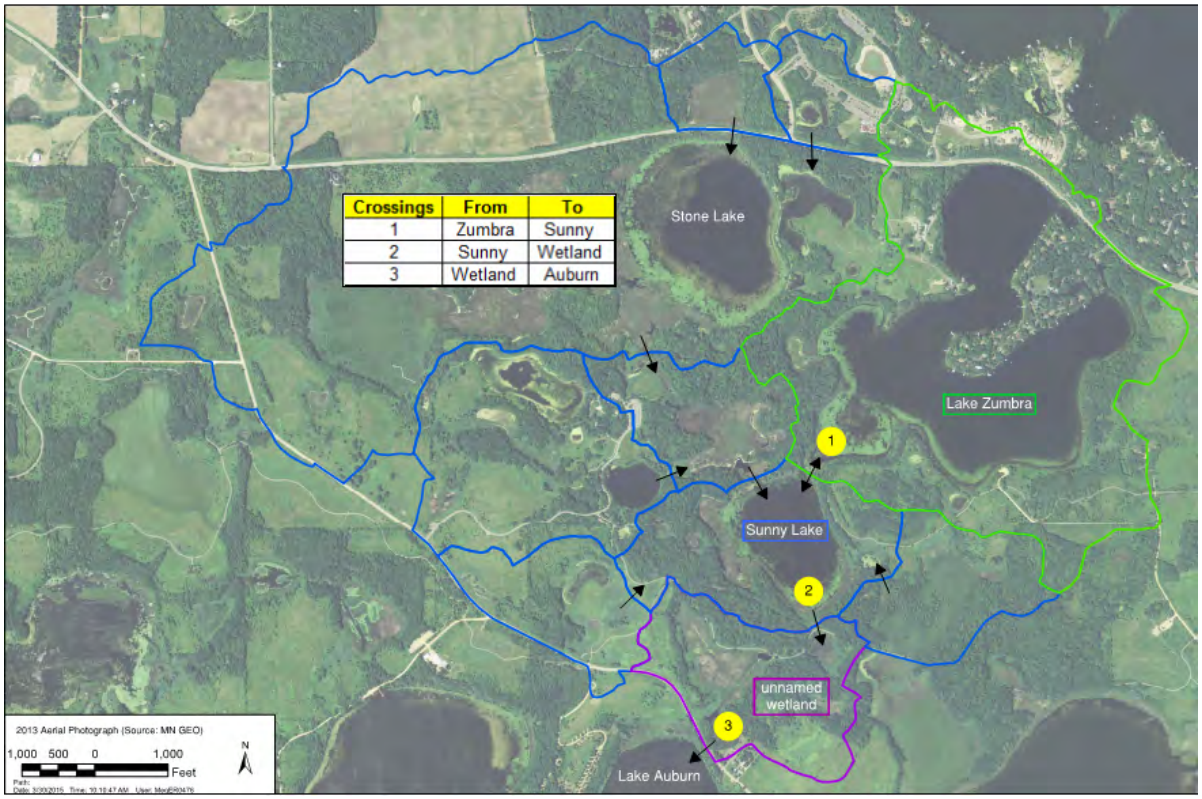


Figure 3. Flow direction of water from Zumbra to Auburn and the three critical crossings

The three crossings shown in Figure 3 regulate flow in between Lake Zumbra and Lake Auburn. A review of historical documents and aerial photos reveals that these three crossings have changed since 1966. Table 3 lists recorded elevations and culvert sizes and how they have changed over time.

Table 3. Culvert sizes at critical crossings

Crossing	From	To	Year[1] Surveyed	Type	Diameter (in.)	Capacity (cfs)	Upstream Elev. (ft)	Downstream Elev.(ft)
1	Zumbra	Sunny	1966	CMP	18	6.3	940.71	940.10
			2012[2]	CMP	24	6.5	940.70	940.80
2	Sunny	Wetland	1966	CMP	18	Unknown	943.80	Not Surveyed
			1978	CMP	24	Unknown	942.50	Not Surveyed
			2012	CMP	30	19.7	941.17	941.46
3	Wetland	Auburn	1976	CMP	24	6.8	941.10	940.00
			2012	HDPE	18	8.3	940.27	939.55

[1]These years represent the years which these crossing were surveyed and not the year they were installed.
[2]According to the Three Rivers Park District, this culvert was installed sometime between 2005 & 2006

The 2012 survey from the Three Rivers Park Department is the most recent survey collected for the crossings. No work at these crossing has been performed since 2012. Table 2 does show that there have been some changes in the size and elevation of the culverts during the last 50 years;

- *Crossing 1 – Zumbra to Sunny*
  - A review of aerial photos (Appendix A) shows that prior to the early 1960s, Lake Zumbra and Sunny Lake were connected without impediment. Sometime during the early 1960s an earthen berm was constructed and an equalization pipe was placed in the berm to connect the two lakes hydraulically. It is assumed the culvert placed in the berm was the 18" CMP Culvert listed in Table 2. At some time between 1966 and 2012, the CMP Culvert was increased to 24 inches, but the slope was decreased such that capacity of the pipe has remained the same.
- *Crossing 2 – Sunny to Unnamed Wetland*
  - A review of aerial photos shows that a trail of some sort has always been at this location. Over the past 50 years the culvert has been both increased in size from 18 inches to 30 inches and has been constructed at a lower invert elevation.
- *Crossing 3 – Unnamed Wetland to Lake Auburn*
  - The culvert under County Road 11 (Victoria Drive) was reduced from a 24" CMP culvert to an 18" HDPE sometime between 1976 and 2012, but the capacity of the pipe was increased by using HDPE, reducing the friction losses.

To evaluate the hydraulic interaction between the different waterbodies, an existing XPSWMM hydrologic and hydraulic model was updated to represent the current hydrology and hydraulics.

XPSWMM Modeling

The 2013 DNR FEMA XPSWMM model was updated with the most current impervious surface calculations and the 2012 TRPD survey of the crossings. The updated model was used to evaluate two scenarios:

1. A 100-year, 24-hour event using an Atlas-14 rainfall distribution and
2. The 2014 Flooding event from April to July using 15-minute rainfall data from Carver County.

Scenario 1:
The 100-year, Atlas 14 storm was modeled first to see how the system responded during an intense rainfall event. Table 4 shows a summary of the Atlas 14, 100-year modeling results, along with the 1-year & 10-year scenarios for comparison. The hydrographs for the lakes and crossings during the Atlas 14 100-year event can be found in Appendix B.

Table 4. Atlas 14 1-, 10-, & 100-year XPSWMM Results

Waterbody	*100-year*		*10-year*	*1-year*
	Peak Elev. (ft)	*Peak Outflow (cfs)*	*Peak Elev. (ft)*	*Peak Elev. (ft)*
Lake Zumbra	943.37	5.98	942.28	941.83
Sunny Lake	945.96	36.71	943.94	942.86
Wetland	945.15	11.71	943.37	942.13

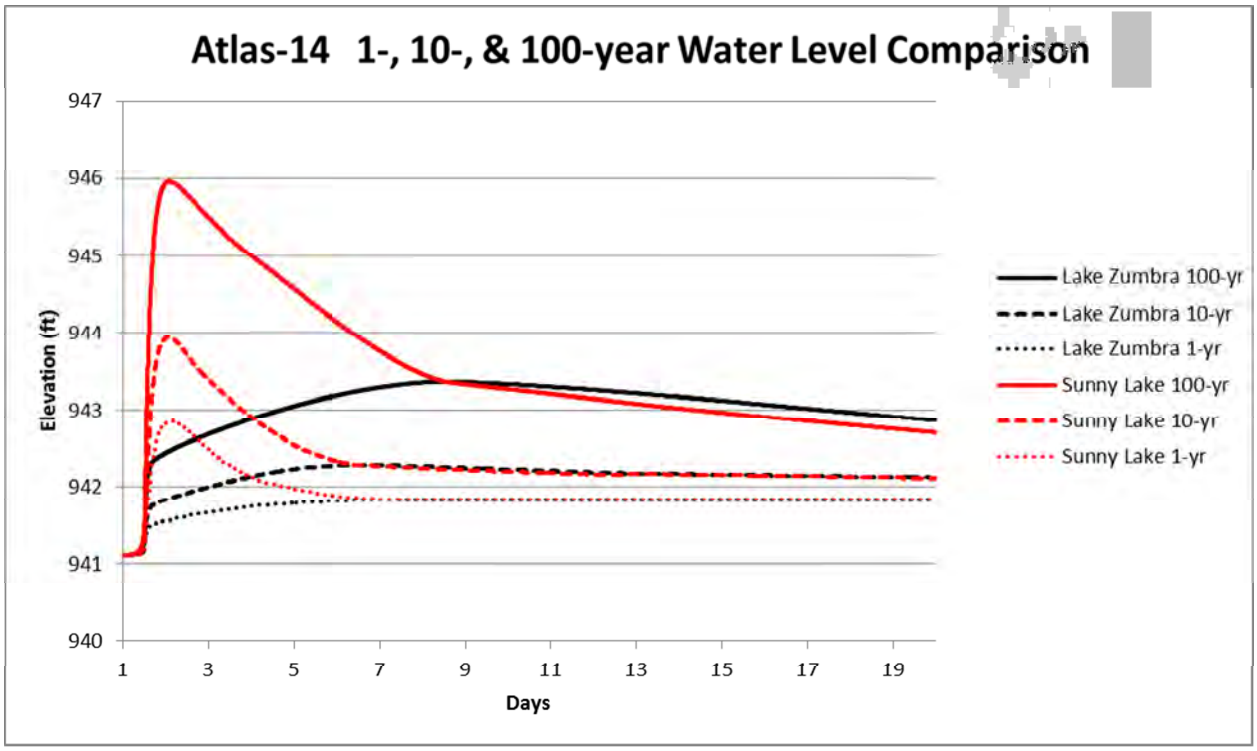


Figure 4. Lake hydrographs from XPSWMM showing the Atlas-14 1-, 10-, and 100-year storm events as modeled in XPSWMM.

The HWL during the Atlas-14, 100-year storm is expected to be 943.37 which is just above Lake Zumbra's OHW of 943.3. More importantly, the HWL of Sunny Lake reaches 945.96. This water level is important, because it shows that Sunny Lake's water level rises faster and higher than Lake Zumbra's and actually creates a backflow of water into Lake Zumbra. As was determined in the 1983 report from E.A. Hickok and Associates (Appendix D), Lake Sunny and the Unnamed wetland rise quickly and begin discharging to Lake Auburn and Lake Zumbra simultaneously. During the Atlas-14, 100-year storm Lake Sunny discharges a total of 229 ac-ft of water through the equalization culvert. This amount of water dispersed over the surface area of Lake Zumbra (207 ac) results in a rise of about 1.1 feet. Indicating that by making the equalization pipe between the two lakes larger would not reduce the HWLs of Lake Zumbra.

Scenario 2:
The summer of 2014 saw record precipitation in the first half of the year. Between January 1 and June 30, Carver County recorded 25.98 inches of precipitation. This precipitation led to many lakes within the watershed district recording record high water elevations, including Lake Zumbra where a water level of 944.91 was recorded.

To determine how the system would handle multiple intense storms, the 2014 Flooding event was modeled. Modeling the 2014 storm event also provides a benchmark to see how high water levels could be compared to recorded water levels. Using rainfall data from Carver County between late April and early July, the model shows that this fast rise of Sunny Lake and the Unnamed wetland drove the HWL of Lake Zumbra higher and higher. Table 5 shows a summary of the 2014 Flooding Event model using Carver County rainfall

data. The hydrographs for the lakes and crossings during the 2014 Flooding event can be found in Appendix C.

Table 5. 2014 Flooding XPSWMM Results

Waterbody	*Peak Elevation (ft.)*	*Peak Outflow (cfs)*
Lake Zumbra	944.29	6.47
Sunny Lake	945.47	27.73
Wetland	945.02	10.91

The XPSWMM 2014 Flooding model showed that Lake Zumbra would rise to an elevation of 944.29 which is a foot higher than its OHW (943.3). Additionally, Sunny Lake and the downstream wetland would rise above 945.0 restricting the outflow of Lake Zumbra for extended periods of time. Included in Figure 5 are elevation data from the DNR and MCWD during the summer months.

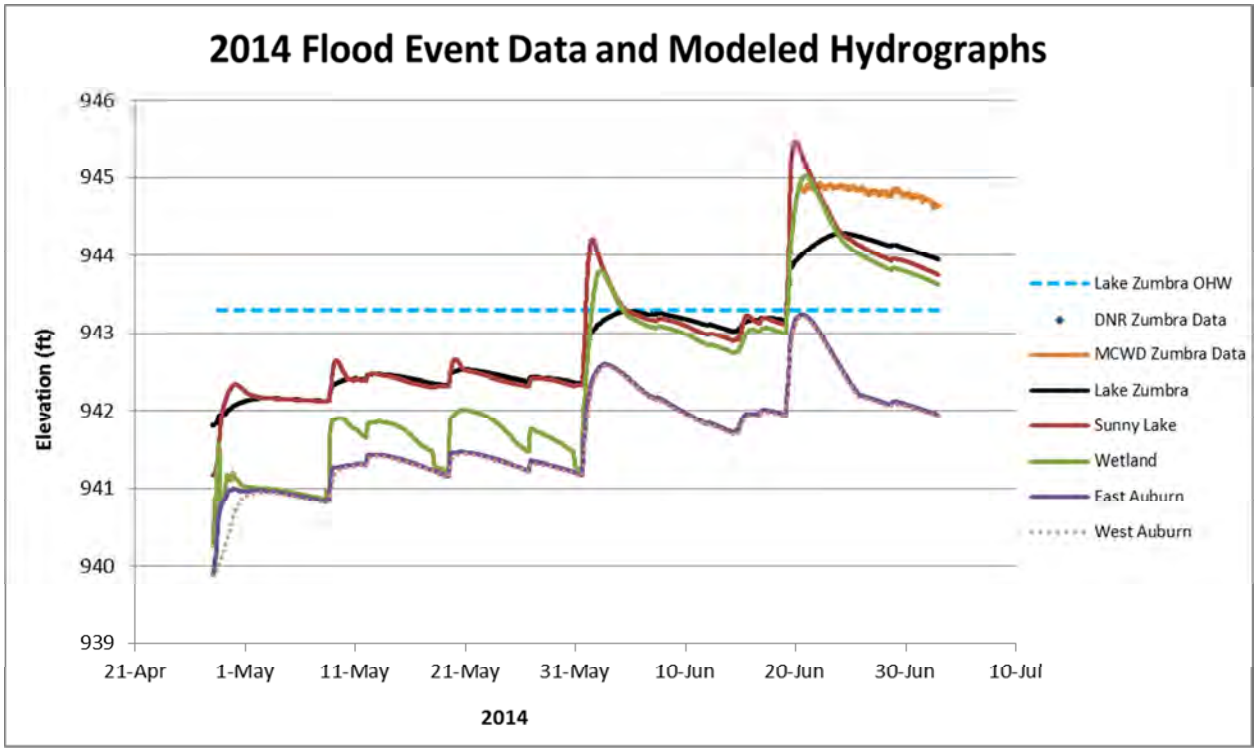


Figure 5. Lake hydrographs from XPSWMM showing the 2014 Flooding event using Carver County precipitation data.

Figure 5 shows how high Lake Auburn, Sunny Lake, and the Unnamed wetland bounced over a foot during the intense rain events at the end of May and on June 19th. These three waterbodies bouncing so high permitted flow out of the system backing up into Lake Zumbra. The model shows that Sunny Lake discharged 251 ac-ft to Lake Zumbra between April 28 and July 3. This amount of water dispersed over the surface area of Lake Zumbra (207 ac) results in a rise of about 1.2 feet. Even with the high elevations that were modeled, the recorded elevations from the DNR data set show that the levels were even higher, possibly alluding to other phenomena that proliferated the water levels even higher.

The Three Rivers Park Board noticed that there might have been some clogging due at the outlet of Sunny Lake due to cattail mats and beaver activity. These observations were made in June and early July, with TRPB staff hiring someone to remove the beaver blockage in mid-to-late July.

2014 Flooding Overview and Summary

During the 2014 Flooding event, 16 property owners on Lake Zumbra experience impacts due to high water levels. Five of the 16 properties had structural impacts in the homes due to the Lake Zumbra water rising above their lowest opening. It is estimated that the flooding caused $371,000 in costs which equates to about $23,000 per property (Appendix E). Additionally, the City of Victoria provided $20,000 of sandbagging efforts bringing the total cost to just under $400,000. Figure 6 shows the 16 parcels along Lake Zumbra that experienced damage due to the flooding.

Figure 5. Flood damaged parcels and the 944.0 contour elevation (LiDAR). *See Appendix E, Figure 2 for a more detailed breakdown of the parcel damage.*

A breakdown of the property damage assessment shows that a majority of the damage (64%) was due to landscaping and 32% was due to structural/housing damage. A breakdown of the property damage is shown in Table 6. A detailed breakdown of the damage per parcel is listed in Appendix E.

Table 6. Property Damage Assessment Breakdown

Type of Damage	*Costs*[1]	*% of Total*
Landscape	$237,600	64%
Equipment	$14,900	4%
Structural[2]	$118,500	32%
Total	***$371,000***	***100%***

1. Costs were provided by the Zumbra HOA (Appendix E)
2. Structural elements refer to flooring, falls, furniture, and the exterior of homes

According to a 2015 Survey, low opening elevations along Lake Zumbra are as low as 943.93. Table 7 lists the low opening elevations for parcels which requested to be surveyed. A map of these elevations are shown in Appendix F.

Table 7. 2015 Surveyed Low Opening Elevations

Parcel Address	*Low Opening Elevation (ft)*	*Low Opening Type*
5400 Zumbra Dr.	944.44	Garage
5429 Zumbra Cir.	946.32	Garage
5441 Zumbra Cir.	943.93	Floor
5451 Zumbra Dr.[1]	945.59	Garage
5471 Zumbra Cir.	946.41	Window
5610 Zumbra Dr.	944.26	Floor
5430 Zumbra Dr.[2]	939.23	Floor

1. The basement floor is located at a lower elevation than the lowest opening.
2. Flooding of this residence is caused by flooding in the park and not Lake Zumbra.

Going Forward

A historical review of lake management, crossing elevations, and development within the Zumbra-Sunny watershed does not indicate any changes that would have proliferated the 2014 flooding beyond the record precipitation. The high water levels have been a problem since 1970s and solutions were explored in the 1980s.

Modeling results show that an Atlas-14, 1-year and 10-year storm would not produce flooding elevations above the low openings that were surveyed. MCWD's high water elevation rule states that there should be at least two vertical feet of separation between low openings of structures and the 100-year high water elevations of waterbodies. For events where 2 feet of freeboard is not present, the City of Victoria and homeowners should look into flood protection/proofing measures, such as sandbagging or berming. Table 8 shows which houses would be affected for which storm events and the expected costs of sandbagging for these events.

Table 8. Property Damage Assessment Breakdown

Atlas-14 Event	*Lake Zumbra Elevation (ft)*	*2ft of freeboard (ft)*	*Houses Needing protection*[1]	*Cost of Sandbagging*[2]
1-year	941.83	943.83	**None**	$0
10-year	942.28	944.28	**2** - 5610 Zumbra Drive & 5441 Zumbra Cir.	$4,000
100-year	943.37	945.37	**3** - 5610 Zumbra Drive, 5441 Zumbra Cir., 5400 Zumbra Dr.	$6,000

1. Houses in which 2ft of freeboard are not available
2. The City of Victoria estimates the costs of sandbagging (labor and materials) to be $2,000/home

Modeling results show that Lake Zumbra does not reach its peak elevation for about 7 days after large rain events, which would provide the homeowners and the City of Victoria time to implement flood proofing measures. Additional measures to look at monitoring lake levels on Sunny Lake would help identify potential flooding events when water would flow into Lake Zumbra.

In addition to sandbagging, the City of Victoria and the Three Rivers Park District will add measures to their operating and maintenance plan to make sure the outlet to Lake Zumbra is clear of debris. This will include more regular maintenance inspections by park staff along with implementing a solution to limit the potential of future blockage due to beaver activity. Also, the Park District will be installing a staff gauge in Sunny Lake to provide lead time for the City and homeowners to implement a flood prevention program in the event of heavy rainfall events.

Beyond the flood measures listed above, a backflow flap-gate on the Sunny/Zumbra Lake equalizer pipe was investigated to reduce flow to Lake Zumbra from Sunny Lake. The flap-gate solution was not supported for the following reasons:

- Reducing the flow of water into Zumbra Lake could change the OHW in violation of State regulations;
- The flap-gate would prevent a significant volume of flood flow water from entering Lake Zumbra. That water would then back-up, causing elevated water levels in the Stone Lake basin and drowning many acres of trees. A recent legal ruling confirmed that trees in parks are very valuable and Park District policy requires monetary compensation for tree loss. In a recent award, the Park District received over $2,000,000 for the loss of trees on 20 acres of parkland;
- Increased water levels in the Stone Lake basin would also flood trails around the Lowry Nature Center as well as portions of the hike/bike trail adjacent to Sunny Lake. This would reduce the recreational use of the park for thousands of park guests;
- Installation of a gate would require development of a detailed operation/management plan, and require some entity to be responsible for future high and low water levels. Since the pipe is on Park District property, the District would be the logical responsible entity, and the District is not interested in assuming the potential liability that manipulating water levels entails.

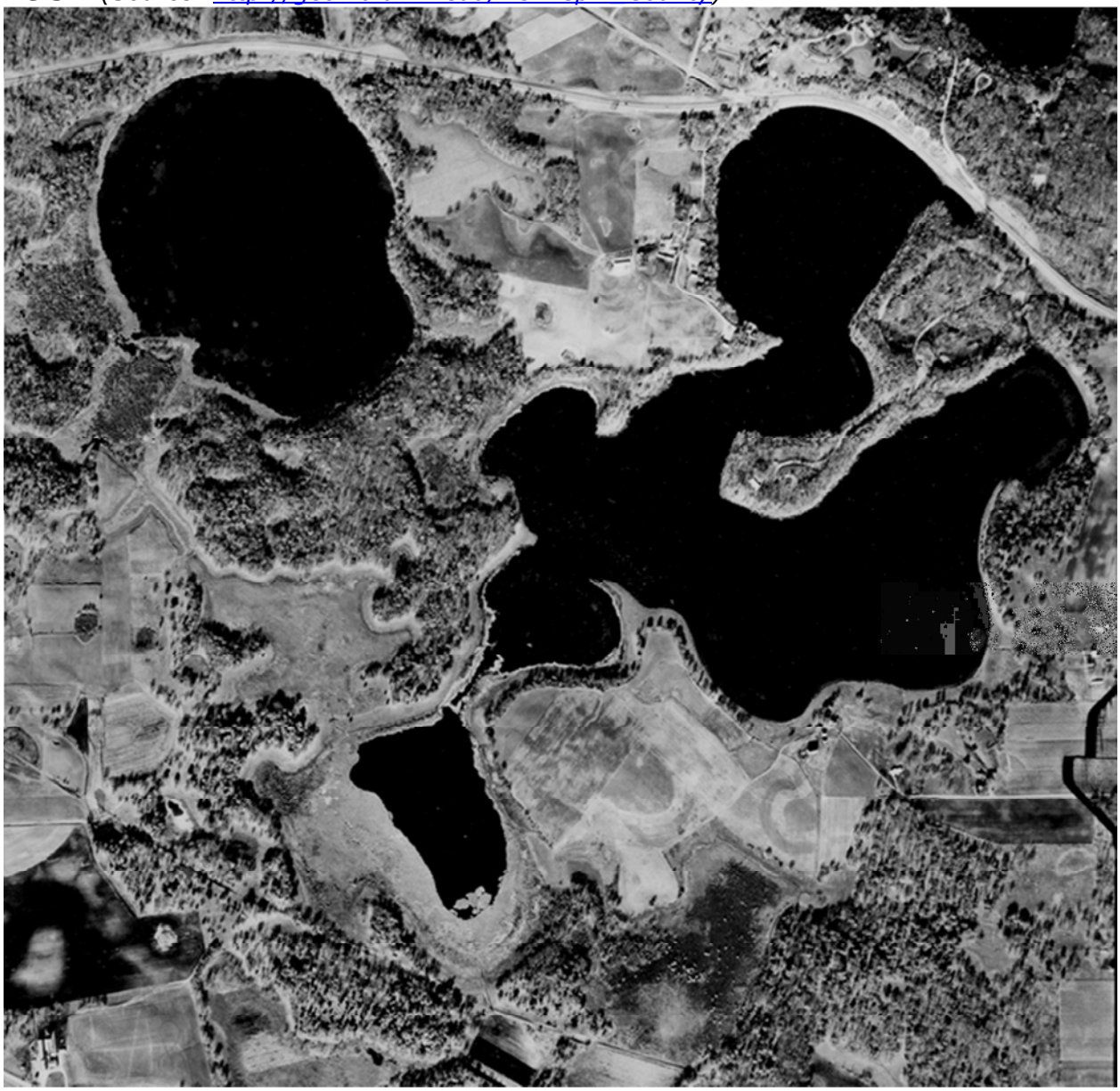
Appendix A

Historical Aerial Photos

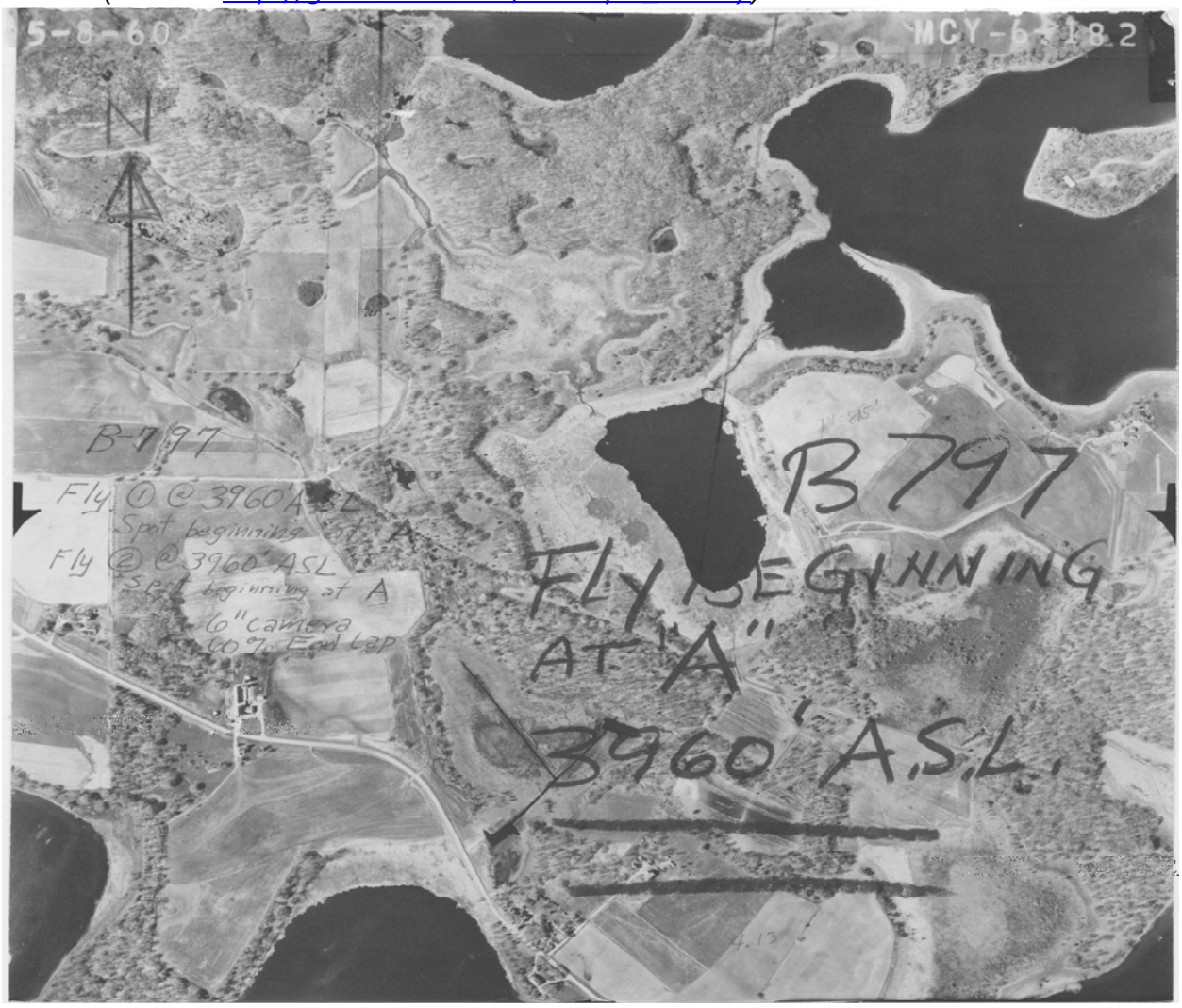
1937 *(Source: http://geo.lib.umn.edu/Hennepin_County)*

1940 *(Source: http://geo.lib.umn.edu/Hennepin_County)*

1957 *(Source: http://geo.lib.umn.edu/Hennepin_County)*



1960 *(Source: http://geo.lib.umn.edu/Hennepin_County)*

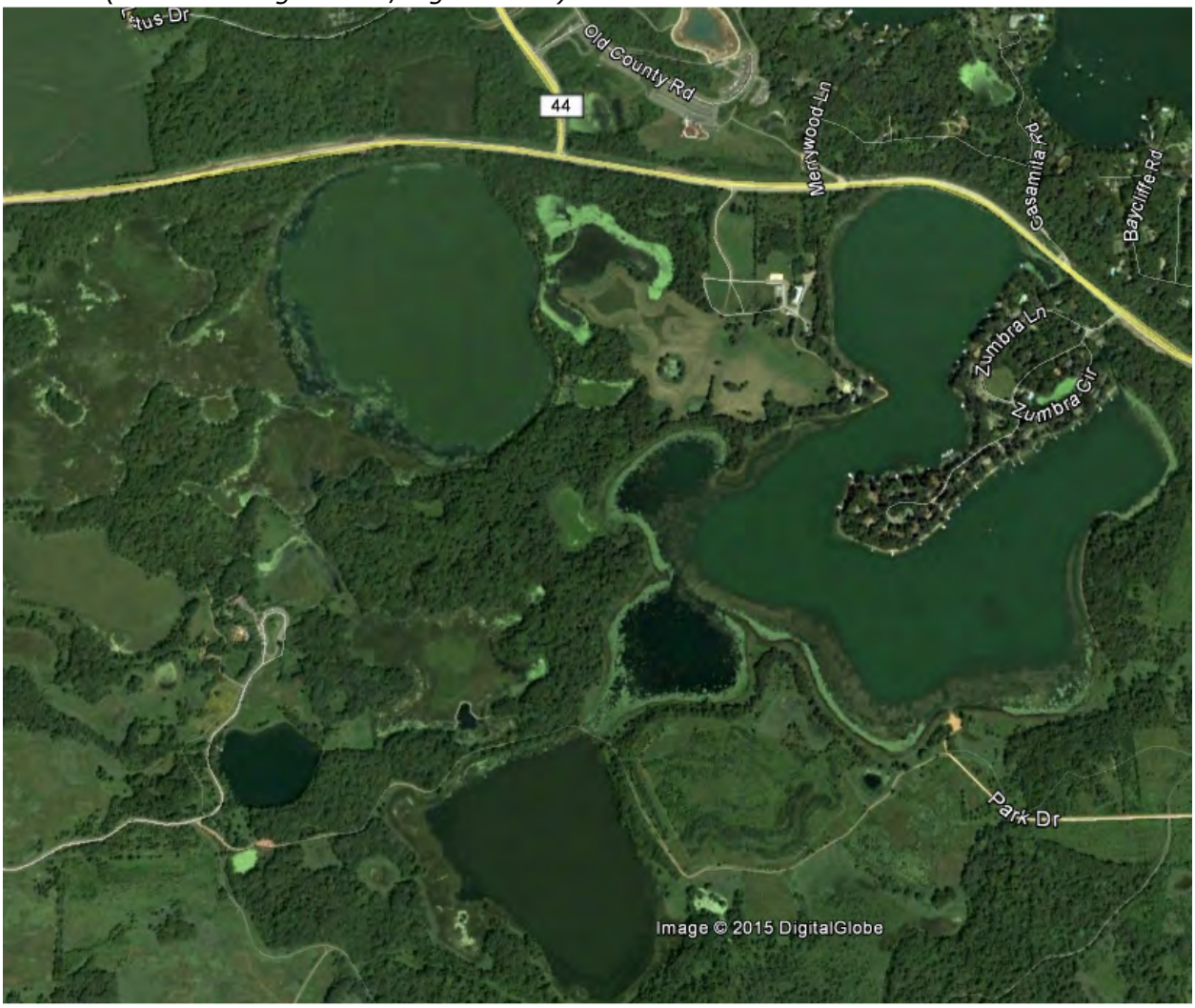


1963 *(Source: http://geo.lib.umn.edu/Hennepin_County)*

1971 *(Source: http://geo.lib.umn.edu/Hennepin_County)*

1991 *(Source: Google Earth/U.S. Geological Survey)*

2002 *(Source: Google Earth/DigitalGlobe)*



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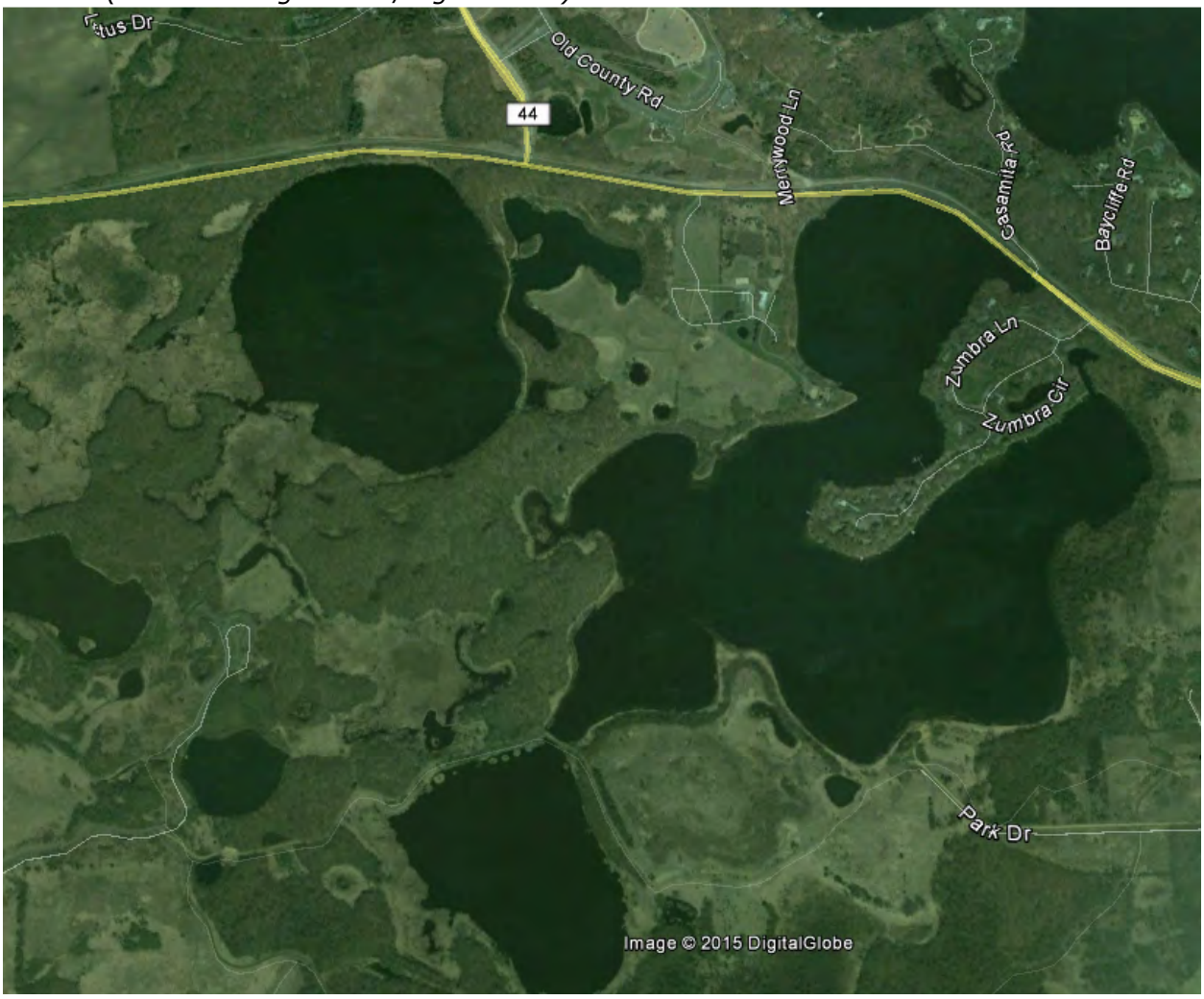


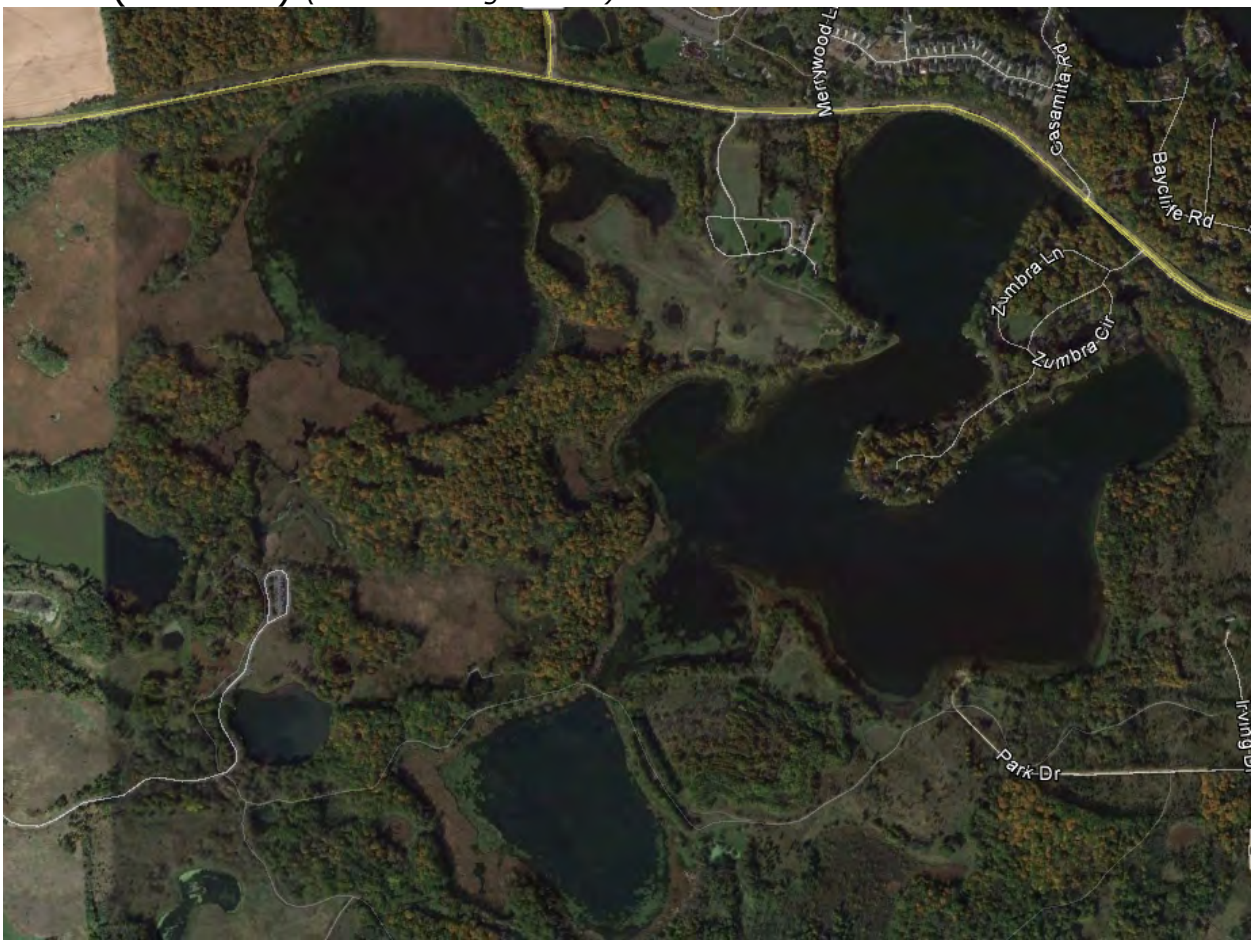
2004 *(Source: Google Earth/U.S. Geological Survey)*

2006 *(Source: Google Earth/USDA Farm Service Agency)*

2011 *(Source: Google Earth/USDA Farm Service Agency)*

2013 *(Source: Google Earth)*

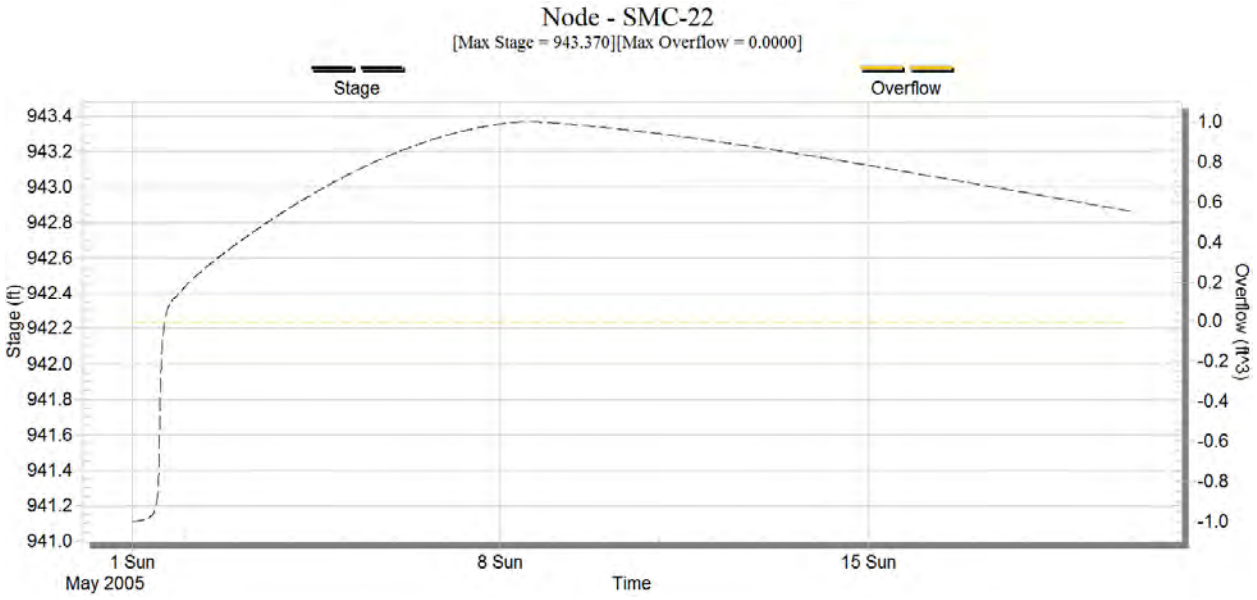
2014 (October) *(Source: Google Earth)*



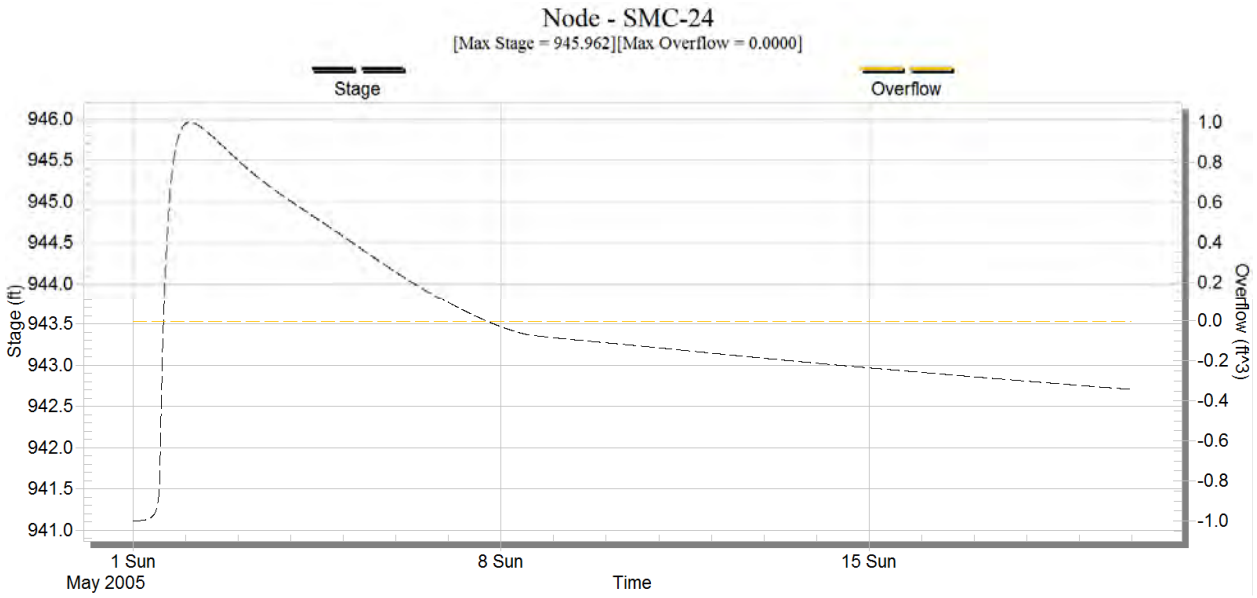
Appendix B

Atlas-14, 100-year Hydrographs from XPSWMM

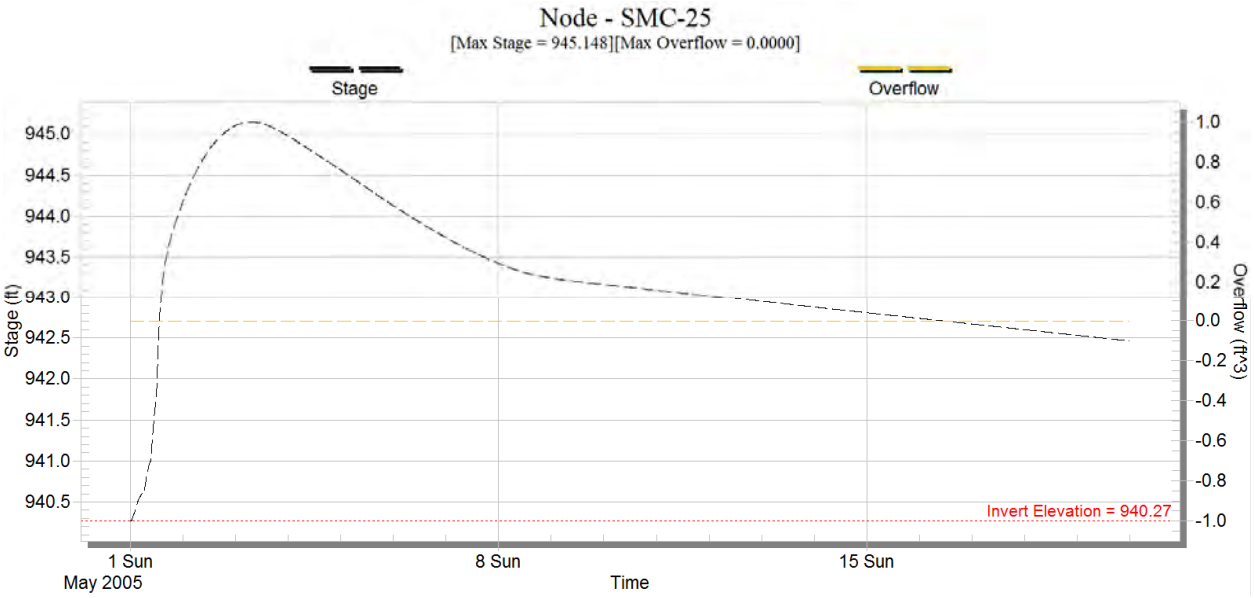
Lake Zumbra



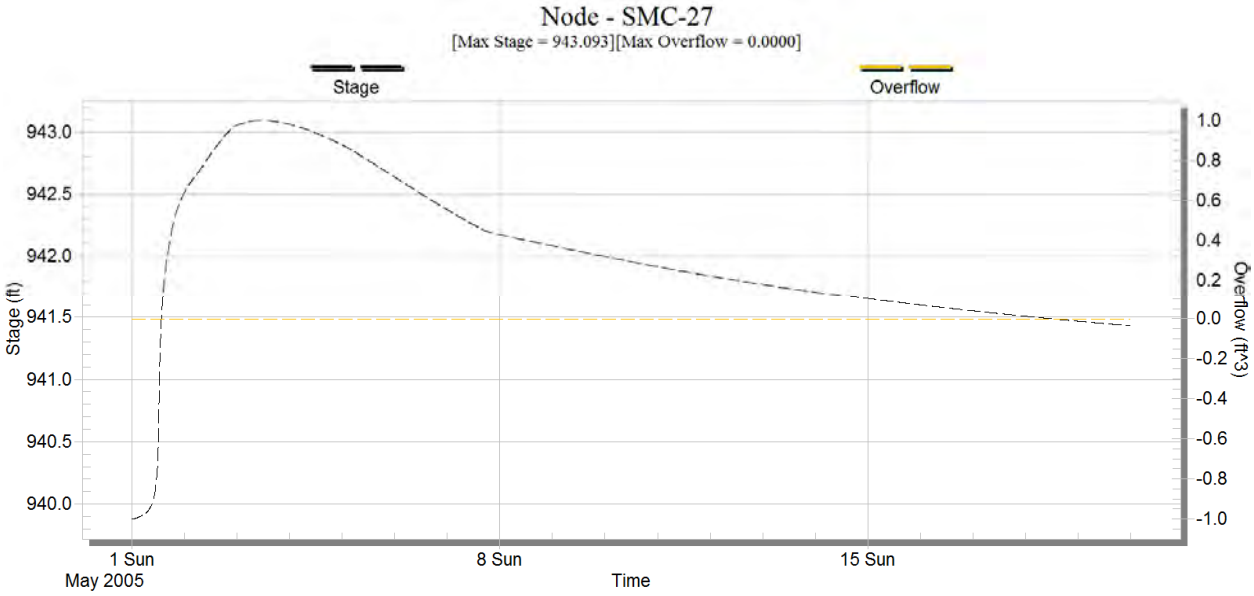
Sunny Lake



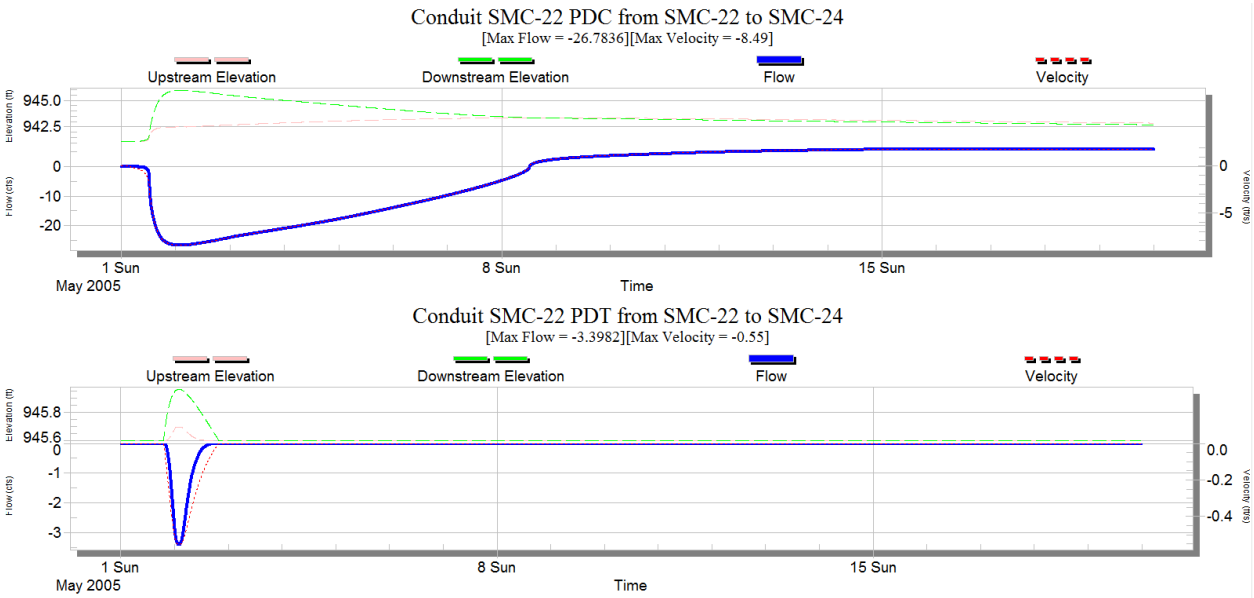
Unnamed Wetland



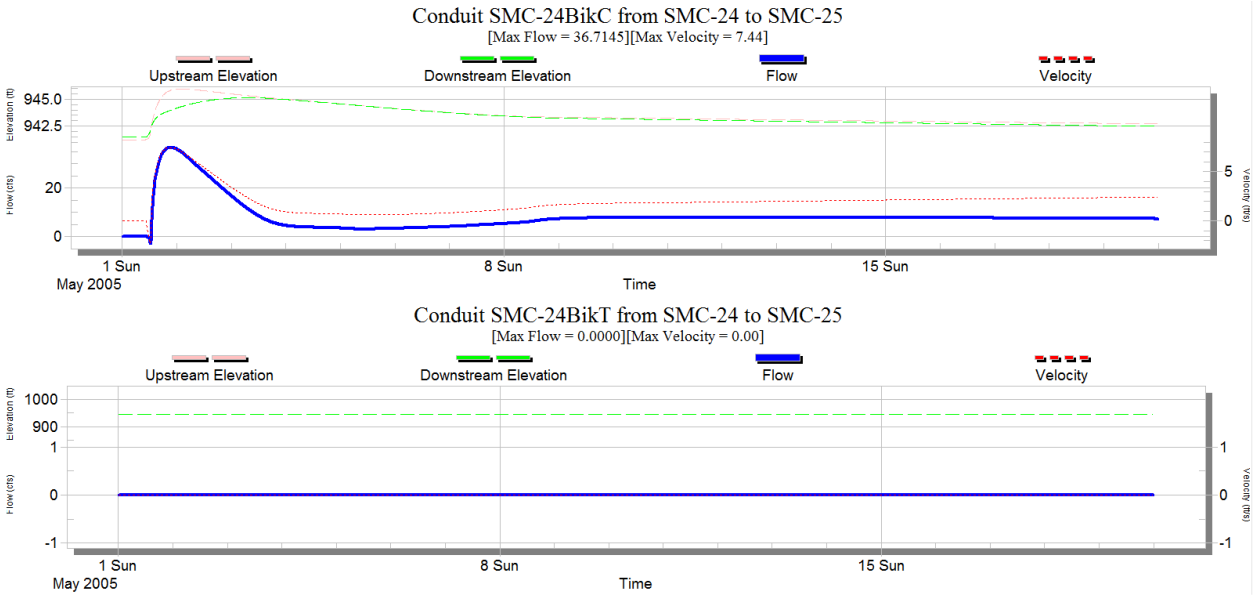
Lake Auburn



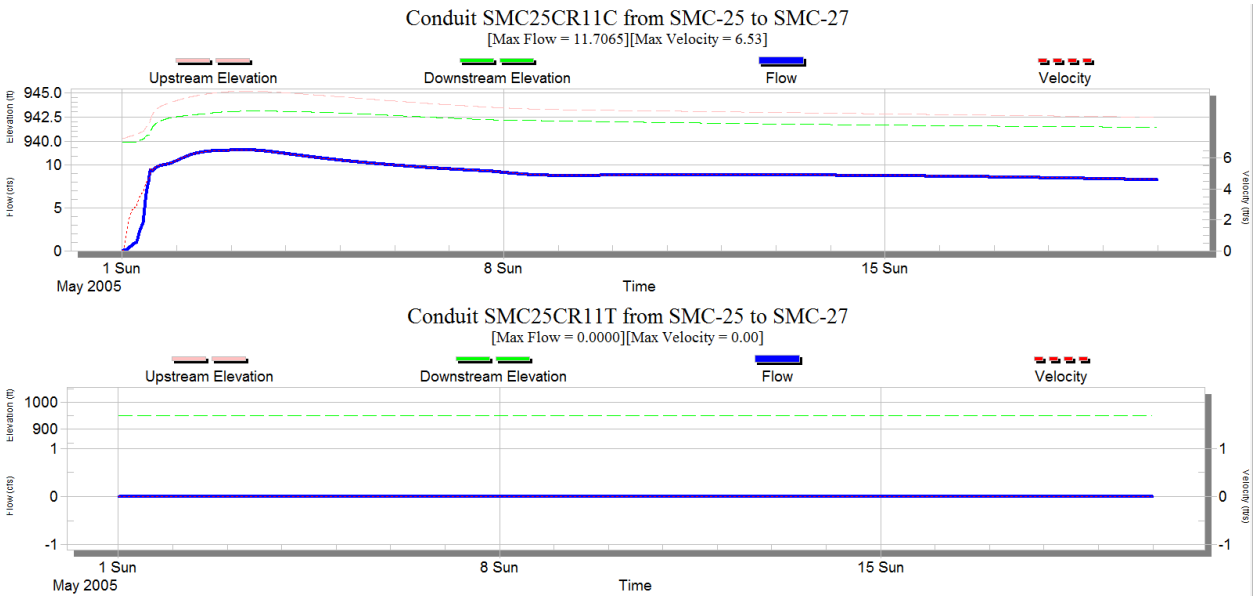
Zumbra-to-Sunny (Crossing 1)



Sunny-to-Unnamed Wetland (Crossing 2)



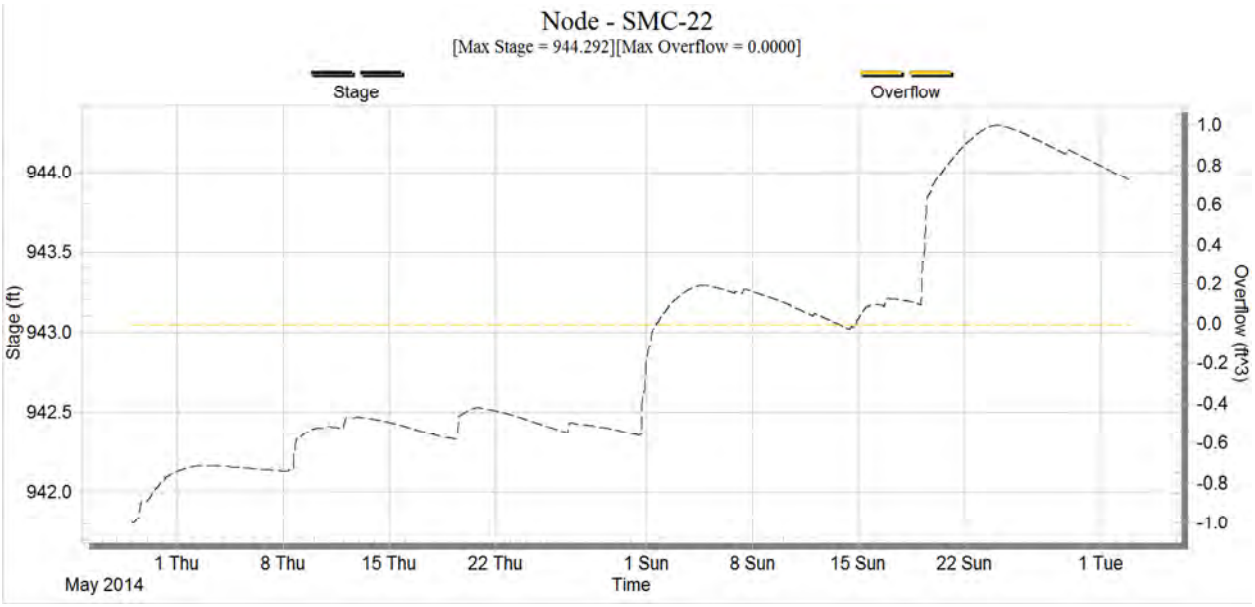
Unnamed Wetland-to-Auburn (Crossing 3)



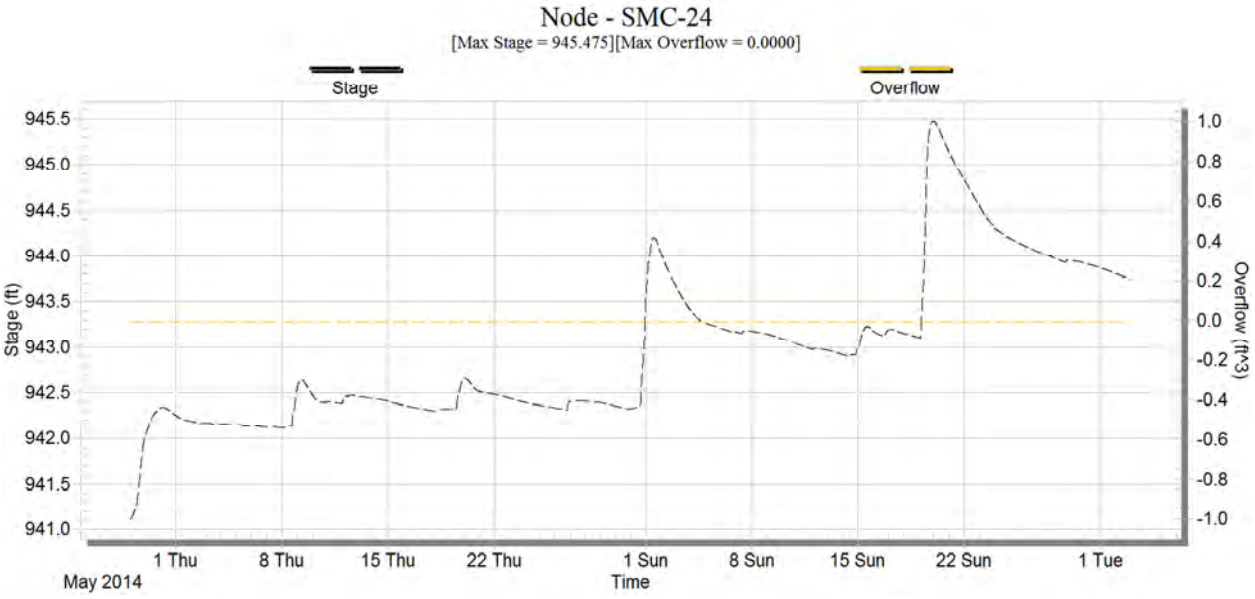
Appendix C

2014 Flooding (Carver data) Hydrographs from XPSWMM

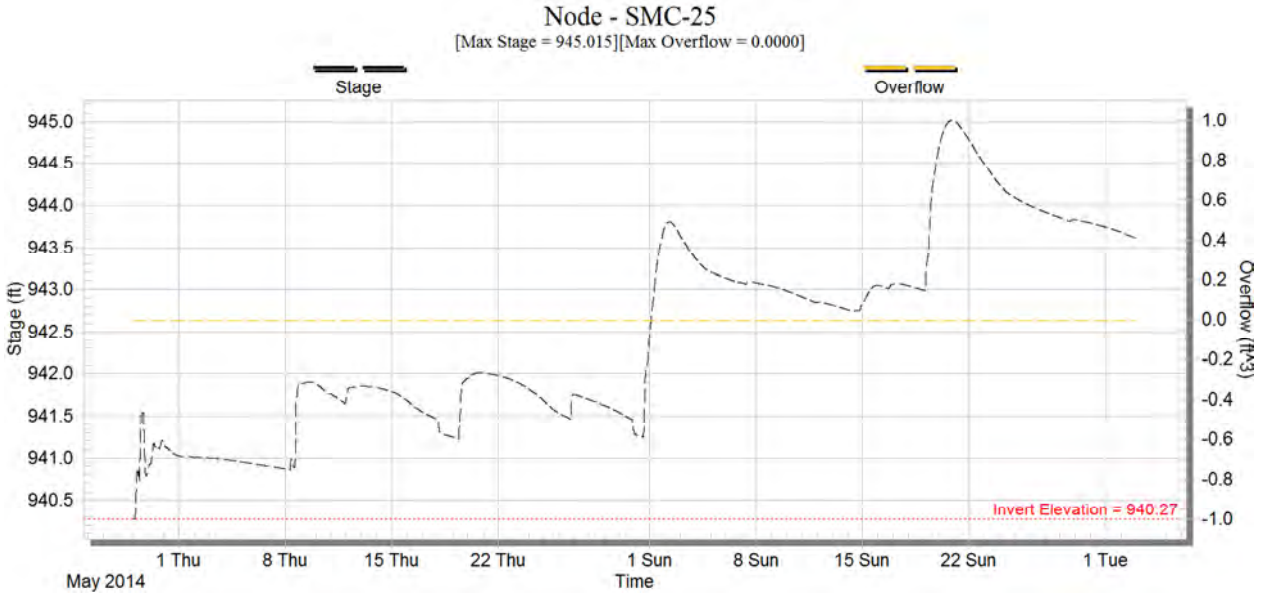
Lake Zumbra



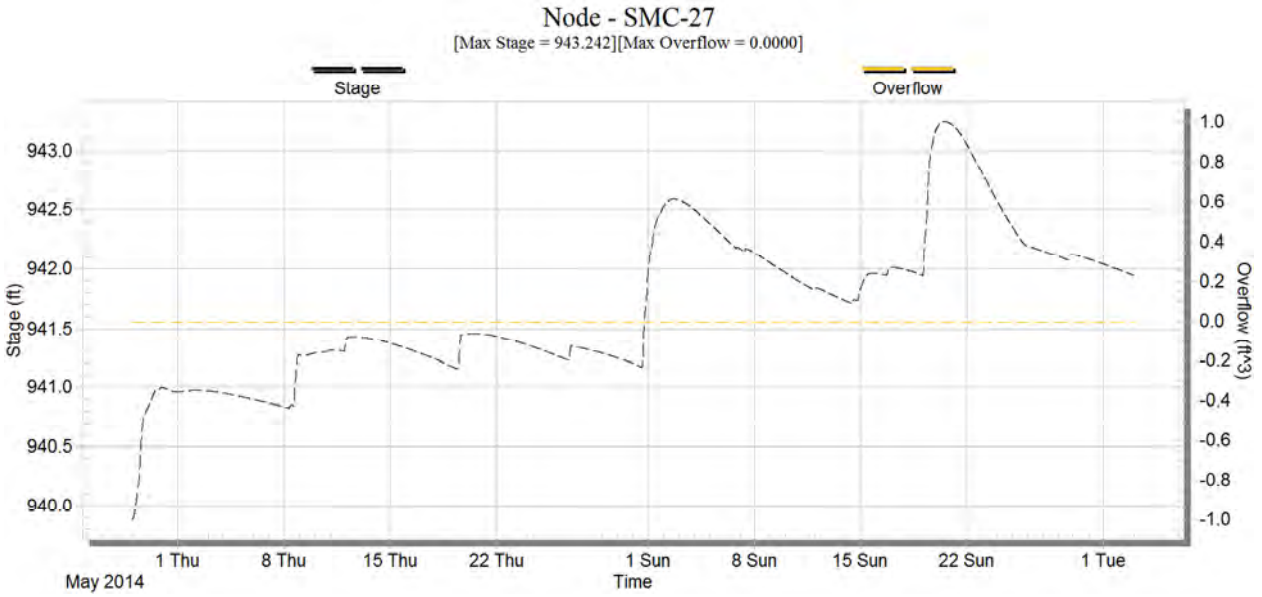
Sunny Lake



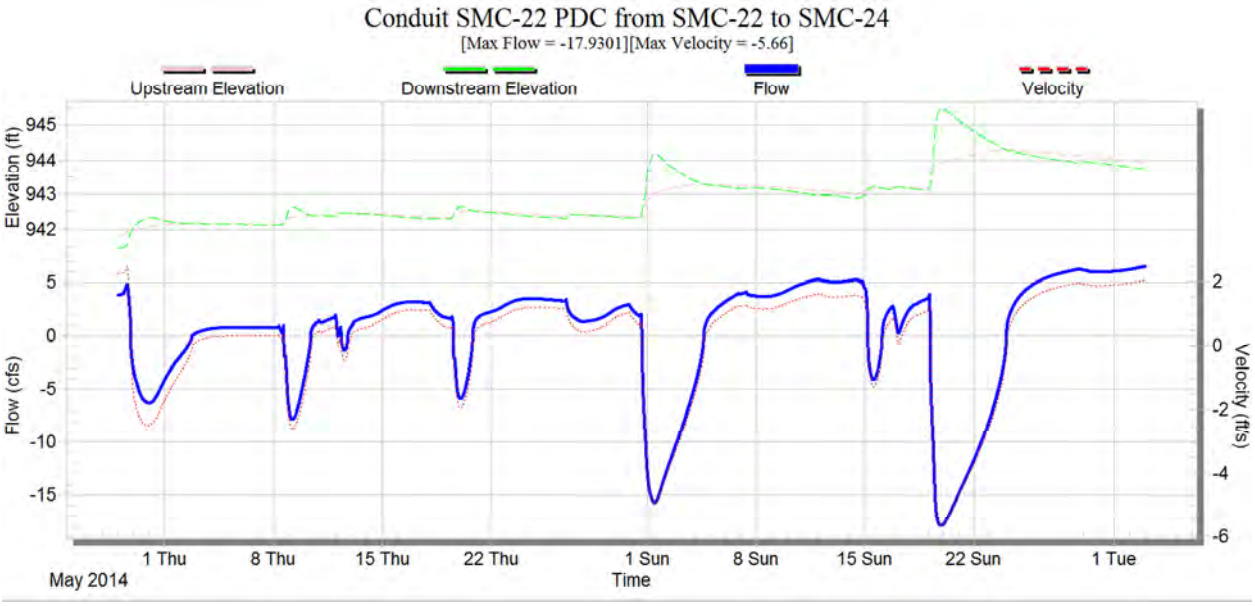
Unnamed Wetland



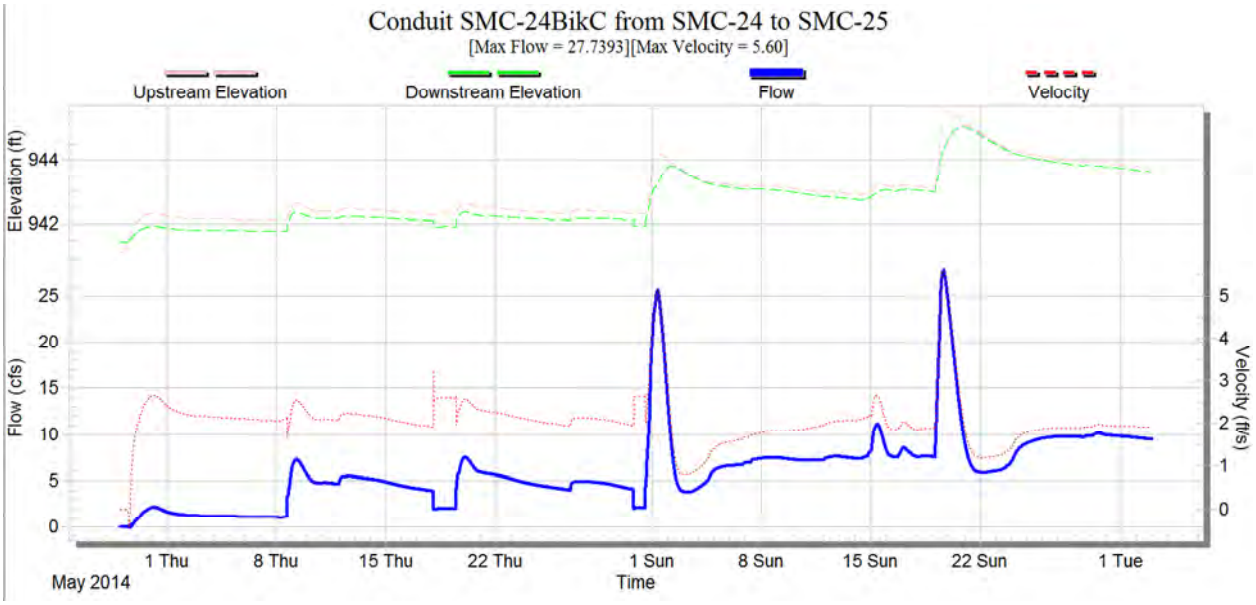
Lake Auburn



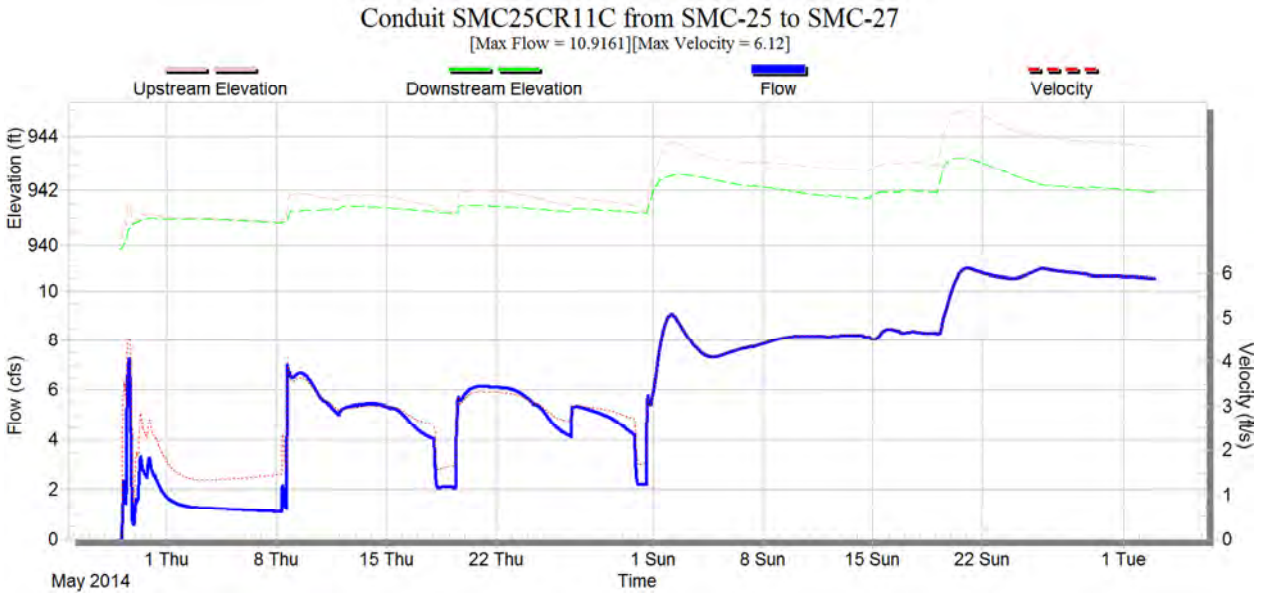
Zumbra-to-Sunny (Crossing 1)



Sunny-to-Unnamed Wetland (Crossing 2)



Unnamed Wetland-to-Auburn (Crossing 3)



Appendix D

1983 E.A. Hickok Report

MEMORANDUM

TO: Minnehaha Creek Watershed District
Board of Managers

FROM: Mike Panzer
E. A. Hickok and Associates

DATE: August 1, 1983

SUBJECT: Lake Zumbra/Sunny Lake Outlet Investigation

As directed by the Managers, I have investigated and reviewed the existing outlet system for Lake Zumbra and Sunny Lake in the Hennepin County Park Preserve District (HCPRD), Carver Park Reserve. This investigation was undertaken at the request of HCPRD and authorized by the Board of Managers on July 21, 1983.

The outlet system was analyzed based upon information provided by HCPRD, information contained in the report entitled "Carver Park Reserve Water Management Plan", E. A. Hickok and Associates, February 1975 and miscellaneous information in the Districts files.

1. Overview

Lake Zumbra borders the Carver Park Reserve and outlets through Sunny Lake and into Lake Auburn via a system of culverts, open channel and ponds. Lake Zumbra is connected to Sunny Lake by culvert which acts as a water level equalizer.

Residents who live on Zumbra Lake have frequently complained of high water and have requested HCPRD to increase the capacity of the existing connection between Lake Zumbra and Sunny Lake to relieve high water conditions. It is believed by some residents that the connection restricts flow from Lake Zumbra to Sunny Lake thereby aggravating high water problems on Lake Zumbra.

HCPRD modified the Sunny Lake Outlet after the park property was acquired. The existing Sunny Lake Outlet is lower than the previous outlet and is lower than the outlet elevation stipulated by the DNR permit issued to HCPRD to perform the work. The outlet invert would have to be raised substantially to conform with DNR requirements.

The existing Sunny Lake Outlet is higher than the outlet elevation recommended in the 1975 report. This report takes into account the interrelationships of all lakes within Carver Park Reserve and recommends control elevations. The Managers have reviewed and approved the 1975 report.

The HCPRD wishes to implement recommendations in the 1975 report, cooperate with residents on Lake Zumbra, and meet the requirements of the District and DNR. However, the improvement requested by the residents, in

the opinion of HCPRD, may not be sufficient to adequately address the problem. In addition, the DNR may not allow the work unless the existing outlet invert elevation for Sunny Lake is also raised to comply with DNR permit No. 79-6120 conditions. Finally, HCPRD is hesitant to proceed with any further work until it is known whether DNR requirements, Minnehaha Creek Watershed District requirements and concerns of the residents can all be met.

2. Analyses

Culvert sizes and invert elevations within the Carver Park Reserve were confirmed with HCPRD staff.

Hydrologic model data from the 1975 report were used to estimate runoff hydrographs, and their relationship with time, for Lake Zumbra and Sunny Lake. The runoff hydrographs were routed through the system by a reservoir routing procedure to estimate high water levels, outflow hydrographs and their relationship with time.

3. Conclusions

A. Runoff hydrographs resulting from intense rainfall cause Sunny Lake to rise higher and more quickly than Lake Zumbra. For this reason, Sunny Lake can simultaneously discharge to both Lake Auburn and Lake Zumbra. Under these reverse flow conditions, the modifications requested by residents would cause an increase in the volume of runoff to Lake Zumbra and a slight increase in the high water elevation. This is contrary to the effects anticipated by the residents on Lake Zumbra who have requested modifications.

B. The existing outlet culvert for Sunny Lake has adequate capacity to prevent damaging high water conditions on Lake Zumbra for a 100 year - 24 hour storm. However, channel capacity of the Sunny Lake outlet downstream is inadequate and causing a tailwater condition to develop that restricts flow.

C. The outlet elevation of Sunny Lake is presently higher than that recommended in the 1975 report and is substantially lower than the elevation stipulated by the DNR. It is apparent that raising the outlet elevation to conform with DNR requirements would also require a control structure and improvements to increase the capacity of the waterway between Sunny Lake and Lake Auburn. This would be necessary to prevent increased high water levels on Sunny Lake and Lake Zumbra.

4. Recommendations

A. Sunny Lake Outlet

The outlet channel between Sunny Lake and Lake Auburn controls water levels on Sunny Lake and Lake Zumbra. HCPRD should investigate the feasibility of improvements to increase channel capacity for the purpose of relieving high water problems upstream.

Under no circumstances should the existing Sunny Lake outlet control elevation be raised to conform with requirements set forth by the DNR unless additional improvements are implemented downstream to assure that high water levels on Sunny Lake and Lake Zumbra are not increased.

B. Lake Zumbra/Sunny Lake Culvert Connection

The capacity of the culvert connection between Lake Zumbra and Sunny Lake should not be increased unless the capacity of the Sunny Lake outlet system is also increased.

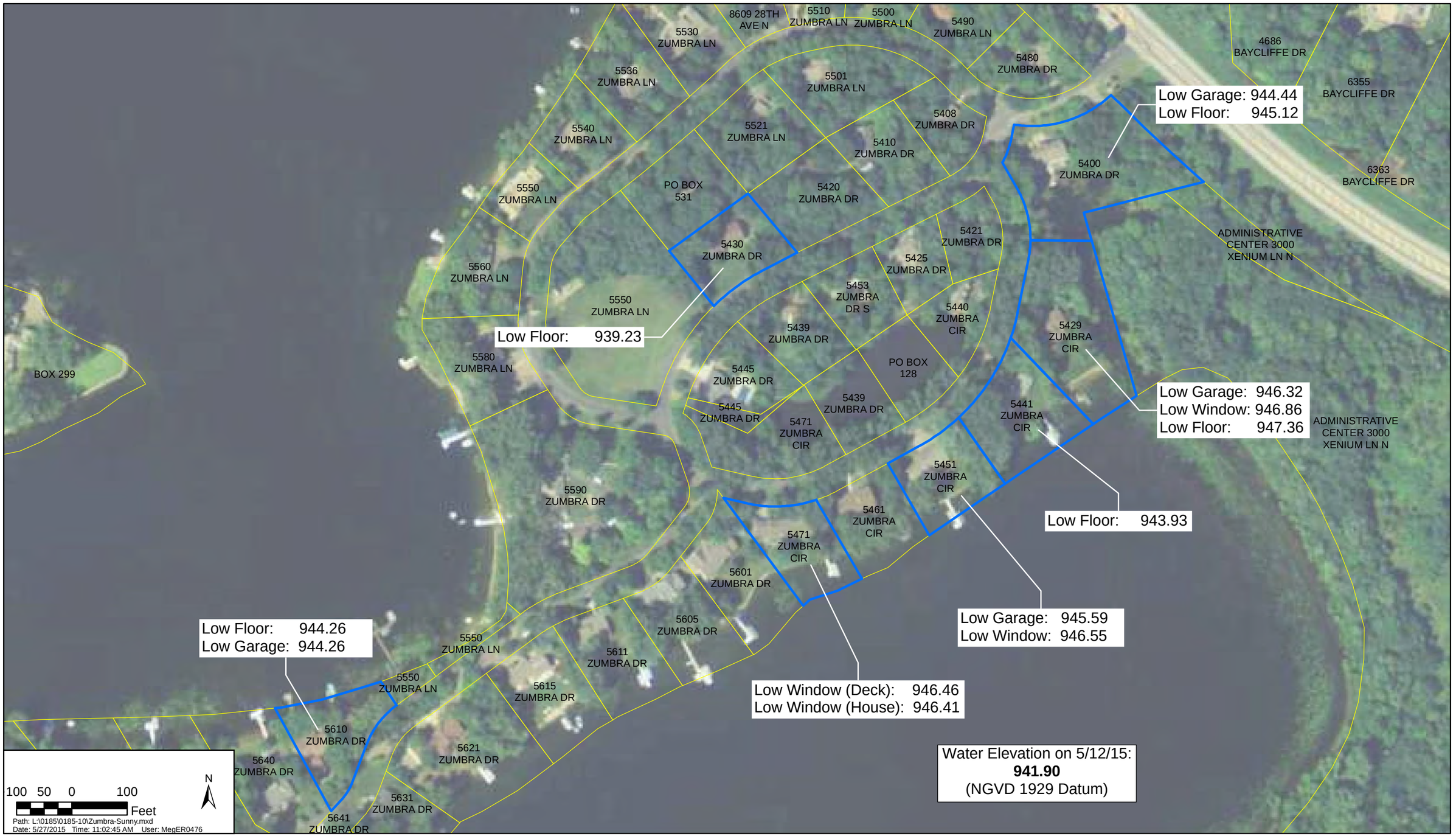
C. Lake Auburn - Auburn East/West Connection

The capacity of the open water connection between Lake Auburn East and Lake Auburn West should be verified by field surveys in conjunction with Item A above.

It is recommended that the Board of Managers accept the conclusions and staff recommendations herein and direct that they be forwarded to HCPRD.

Appendix E

Figures



MINNEHAHA CREEK WATERSHED DISTRICT

Lake Zumbra Survey

WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

MAY 2015

Figure 1

MINNEHAHA CREEK WATERSHED DISTRICT

Lake Zumbra 2014 Flooding Damage

WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

MAY 2015

Figure 2

Legend

- Lakes
- Streams
- Lake Auburn Drainage

Stone
Zumbra
Sunny
W. Auburn
E. Auburn
Steiger
Kelzer
Church
Carl Kray
Wasserman
Pierson
Marsh
Hwy 7
Hwy 5
Hwy 14

1 0.5 0 1 Miles

N

Path: L:\0185\0185-0010\Auburn Drainage.mxd
Date: 5/29/2015 Time: 10:26:29 AM User: MegER0476

MINNEHAHA CREEK WATERSHED DISTRICT

Lake Auburn Drainage Area

WENCK ASSOCIATES
Responsive partner. Exceptional outcomes.

MAY 2015

Figure 3

Appendix F

Property Damage Assessments

Zumbra Ridge Homeowners Association

Property Damage Assessments
June 2014 Lake Zumbra High Water

Bigalke, 5645 Zumbra Drive:	Equipment:	$1400
	Landscape:	4600
Hackett, 5430 Zumbra Drive:	Flooring/Walls:	15000
	Landscape:	24000
Haroldson, 5691 Zumbra Drive:	Landscape:	7500
Irene, 5730 Zumbra Drive:	Landscape:	10000
Jorgenson, 5441 Zumbra Circle:	Flooring/Walls:	35000
	Landscape:	15000
Kemppainen, 5611 Zumbra Drive:	Landscape:	10000
Kroiss, 5605 Zumbra Drive:	Landscape:	5000
Langva, 5590 Zumbra Lane:	Landscape:	17500
Larson, 5451 Zumbra Circle:	Flooring/Walls:	12000
	Furniture:	2500
	House Exterior:	10000
	Equipment:	7000
	Landscape:	5000
Lee, 5610 Zumbra Drive:	Floors/Walls:	24000
	Landscape:	44000
Leonard, 5601 Zumbra Drive:	Landscape:	16500
	Equipment:	4000
Nauman, 5720 Zumbra Drive:	Equipment:	2500
	Landscape:	7500
Nelson, Charlson Meadows:	Landscape:	28000
Running, 5510 Zumbra Lane:	Landscape:	15000
Steadman, 5429 Zumbra Circle:	Flooring/Walls:	20000
	Landscape:	10000
Swenson, 5530 Zumbra Lane:	Landscape:	18000

Zumbra Ridge Homeowners Association

January 12, 2015

From: Jerry Martin
President

To: Bill Olson, MCWD Board of Managers
Randy Maluchnik, Carver County Commissioner
Tom Workman, Carver County Commissioner
Tom O'Connell, Mayor, City of Victoria
John Barten, Director of Natural Resources, Three Rivers Park District

Subject: Lake Zumbra Outflow

As is well documented, Zumbra Ridge property owners experienced severe flooding in the Spring of 2014 due to high water levels in Lake Zumbra. Damage to homes and property exceeded $400,000 and residents are still working to finish repairs.

Lake Zumbra experiences inflow from surrounding land much of which is higher in elevation. Historically, the Lake drained into a large watershed to the south. This natural watershed has been altered with the construction of elevated roadways and hiking/biking trails. The natural watershed drainage is now restricted to culverts installed under the roadways and trails.

Lake Zumbra outflow is restricted to a single 24" culvert draining into Sunny Lake and Sunny Lake outflow is restricted to a single 24" culvert that drains into a watershed.

Prior to construction of the trails in Carver Park Reserve, Lakes Zumbra and Sunny were connected as part of the natural watershed. Construction of the trials brought major changes. The trails are elevated above the natural terrain thus blocking and redirecting natural drainage into and through the watershed. Culverts were installed under the elevated roads/trails to allow water to drain but these are limited in capacity and subject to blockage. When inflow to any one or more of the culverts is higher than the culvert can accommodate or the culvert becomes blocked or clogged, little to no water can flow through causing water to backup within the watershed.

This is what occurred in the Spring of 2014. Due to heavy rainfall throughout the watershed, the culverts were unable to handle the water flowage due to inadequate capacity and blockage. Adding to the problem, the outflow culvert for Lake Zumbra, that has limited capacity, was blocked and unable to allow water to drain out of Lake Zumbra. In addition, the outflow culvert from Sunny Lake was unable to handle the water flow causing Sunny Lake water levels to rise and create back pressure on the Lake Zumbra

outflow culvert. This resulted in historically high lake water levels in both Zumbra and Sunny. On Lake Zumbra, the water exceeded it's banks resulting in flooding and considerable damage to Zumbra Ridge homes and property.

To further exacerbate the problem, once water levels in surrounding lakes and watershed began receding Lake Zumbra remained at a very high level due to the clogged outflow culvert. This significantly extended the psychological and physical misery for affected homeowners. Added to his, was a prolonged no wake restriction depriving all Zumbra Ridge property owners the opportunity of enjoying the lake for which they pay a premium to live on.

The Zumbra Ridge Homeowners Association considers the outflow restrictions to Lake Zumbra to be a significant threat to our property and way of life. Therefore we are requesting you, as representatives of responsible agencies, to work together to find a permanent solution so we don't have a repeat of the 2014 flooding. If a watershed drainage study was completed prior to construction of the hiking/biking trails then this study needs to be revisited to determine why it was inadequate. If a study was not completed, we question why as major changes were made to the watershed that had significant impact on the drainage. If there is no study, we request that one be initiated immediately so as to come up with a permanent solution. This could be elevated hiking/biking trails, additional culverts, an adjustable weir or other improvements. It is our understanding that a weir system has been discussed previously but not acted upon.

At a meeting of responsible agencies, MCWD, city of Victoria, Carver County and Three Rivers Park District with the Zumbra Ridge Homeowners Association representatives in June 2014 to discuss the situation, MCWD voiced support of budgeting for a watershed study to come up with a solution to the problems. Our Association feels MCWD should take the lead on this issue as they are ultimately responsible for the watershed. Carver County and the City of Victoria should be closely involved as local government agencies. In that the drainage restrictions and culverts are on Three Rivers Park District property they will need to be involved also.

Zumbra Ridge Homeowners experienced major damage to real property and impact to lives due to the 2014 high water levels in the Lake and surrounding flooding. Without permanent changes to the Lake Zumbra outflow this could very likely happen again. We urgently request immediate action on finding a permanent solution.

Sincerely,

Jerry Martin
President
Zumbra Ridge Homeowners Association

MINNEHAHA CREEK WATERSHED DISTRICT

QUALITY OF WATER QUALITY OF LIFE

MEMORANDUM

To: MCWD Board of Managers

From: James Wisker, Director of Planning & Projects

CC: Jeff Spartz, Administrator

Date: January 29, 2015

Re: Zumbra Ridge Homeowners Association Correspondence

Purpose:

To inform the Board of Managers of the correspondence received from the Zumbra Ridge Homeowners Association (Attachment 1) regarding their high water concerns from June 2014, and staff's proposed response plan.

Background:

Attached to this memorandum is a letter from the President of the Zumbra Ridge Homeowners Association, dated January 12, 2015. This letter was delivered to MCWD Board Manager Bill Olson, Carver County Commissioners, the Mayor of Victoria and the Three Rivers Park District's Director of Natural Resources. MCWD Staff received this letter on January 16, 2015.

The letter details concerns regarding high water levels and the risk to residential structures. The letter also states that during a June 2014 meeting onsite, the MCWD "voiced support of budgeting for a watershed study to come up with a solution to the problems."

The MCWD (Permitting staff, District Engineer and Manager Bill Olson) attended a meeting on Friday June 13, 2014 to discuss high water concerns with the Zumbra Ridge Homeowners Association, on Zumbra Lake. Permitting Staff and the District Engineer attended on behalf of the District. The meeting was also attended by the City of Victoria, Three Rivers Park District and Carver County.

In preparation for the meeting Three Rivers Park District, a landowner around the southern perimeter of the lake, distributed information received from historic DNR files regarding the Zumbra Lake water level issue. This file included notes that the lake historically had no outlet and that in 1971 residents excavated a channel to drain the lake, which was subsequently filled back in. Information was also provided which indicated that the established Ordinary High

Water (OHW) level for the lake is 943.3 and that some homes on this lake have basement elevations at or below the OHW. More specifically, correspondence was provided from the DNR to the City of Victoria expressing concern over proposed home elevations in this area as they related to the OHW, structural flooding and natural resource impact.

During the June 2014 multi-jurisdictional site meeting emergency response versus long term planning roles were discussed. It was offered that that given the unprecedented flooding and the designation of Six Mile Creek subwatershed as a priority geography, that the District may be positioned to coordinate future technical and planning work following the flood event.

Following receipt of the letter District staff scheduled a conference call for Monday January 26, 2015 between staff from Carver County, the City of Victoria and Three Rivers Park District to discuss a coordinated response to the concerns of the Zumbra Ridge Homeowners Association.

Additional information following this call may be provided to the MCWD Board of Managers at the January 29, 2015 MCWD Board Meeting.

If there are questions in advance of the meeting, please contact James Wisker at 952-641-4509 or Jwisker@MinnehahaCreek.org