Memo

Project	Rock River Flood Management	**Date**	September 27, 2024
To:	Rock River Contact Group		
From:	Rob Montgomery, Nick Hayden		
Subject	Gate operation proposal and anticipated benefits		

Introduction

This memo is a follow-up to the dam operators meeting that was held on September 13, 2024, at the DNR Horicon Marsh Visitor Center. In that meeting, we requested changes in gate operations at the dams at Hustisford, Horicon, and at the Federal dike for the winter of 2024-2025, to provide storage to reduce spring flooding impacts downstream. As requested, we provide here background on what benefits the residents and Towns downstream of Hustisford hope to gain from these changes in gate operation.

Background to the flooding problem

As we have discussed in meetings this year, property in the Towns of Hustisford, Lebanon, Ashippun, and Ixonia is particularly vulnerable to flooding from the Rock River. This flooding vulnerability is due to the very shallow slope of the river in the reach between Hustisford and Pipersville (CTH P bridge over the Rock River, west of Ixonia), and impacts both agricultural and recreational use of properties. In recent years, the flooding has been both higher and of much longer in duration than in the past, due to increased precipitation and possibly agricultural land use changes in the watershed. For example, in 2018, 2019 and 2020 the river was at high flood stage, substantially out of its banks, for many months at a time. Again, this year, late spring/summer flooding inundated many areas in Lebanon and Ixonia. **Figure 1**, below, illustrates the significant flood discharges that have occurred over the last 10 years. Note the substantially higher recorded discharge compared to the long-term median (the orange line in the graphic).

Gage data, modeling analyses and observations in the Towns of Lebanon and Ixonia indicate that out of bank flooding begins at discharges above 500 cfs and extensive flooding occurs (for discharges exceeding 1250 cfs.

The area subject to flooding is large. Analysis using a hydraulic model for the river combined with GIS topographic data indicates that at 1250 cfs, more than 10,000 acres (16 square miles) of land are inundated, as shown in **Figure 2**. 1250 cfs is often exceeded in this reach of the river, meaning that the flooded area often exceeds 10,000 acres. As a consequence of flooding, many mature forest trees adjacent to the river are now dead, and access to agricultural land that was in past years tilled regularly is now a year-by-year question.

For more than 5 years, Town of Lebanon residents Steve Folkman and Tim Cargill have been discussing this flooding problem with Dodge and Jefferson counties, the Towns of Hustisford, Lebanon and Ixonia, and the operators of the Federal dike, and dams at Horicon and Hustisford. One of the problems in describing the flooding issue was that there was not an

easily accessible source of data on river water surface elevation or discharge in the areas downstream of Hustisford that were being flooded. Agreeing to address this issue, the Village of Hustisford and the Towns of Ashippun, Lebanon and Ixonia have together funded a United States Geological Survey gaging station in the Town of Lebanon, at the CTH MM bridge. This gage has been operational since April 2022. We have used data from this gage to prepare this analysis and discussion.

This year, we have conducted a series of meetings to discuss the flooding issue and have proposed that several avenues of possible flood mitigation activities be evaluated, including gate operations for water retaining structures upstream to provide flood storage, creating or restoring runoff storage areas in upland or off-channel locations in the watershed, and identifying options for corridor land use and infrastructure management.

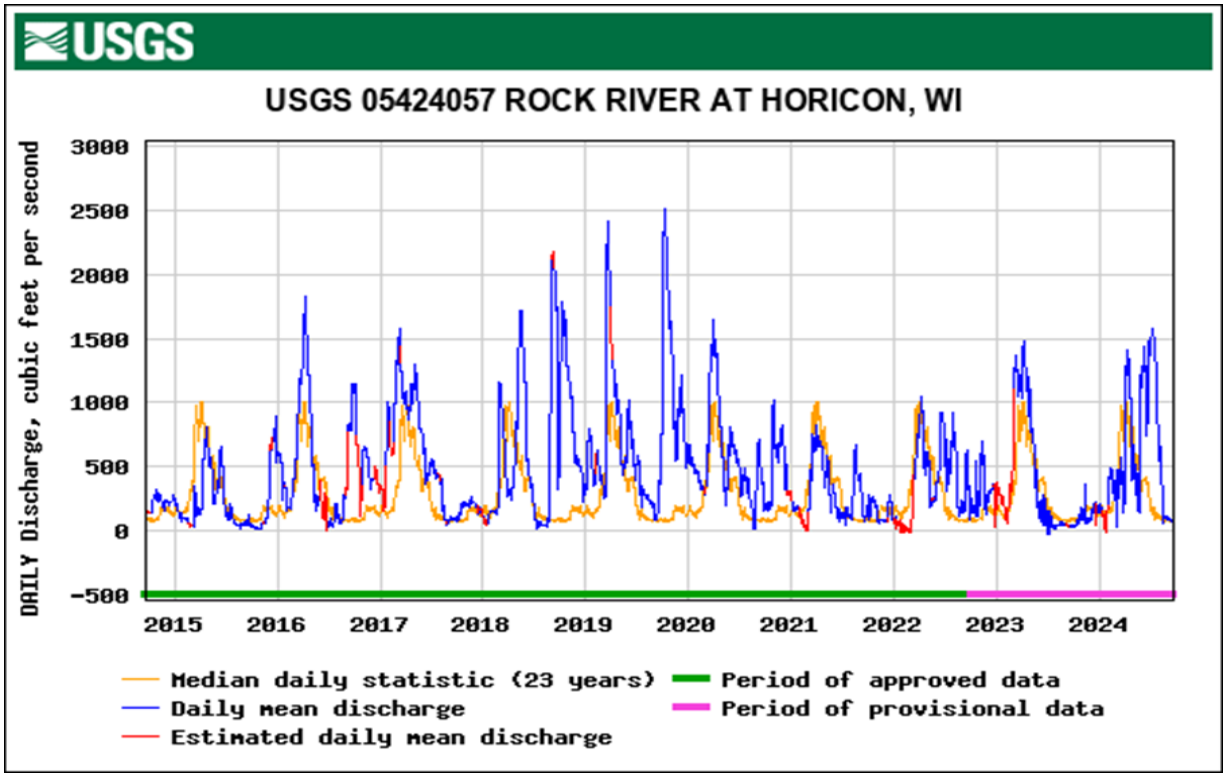


Figure 1. Rock River discharge at Horicon, illustrating significant recent flooding

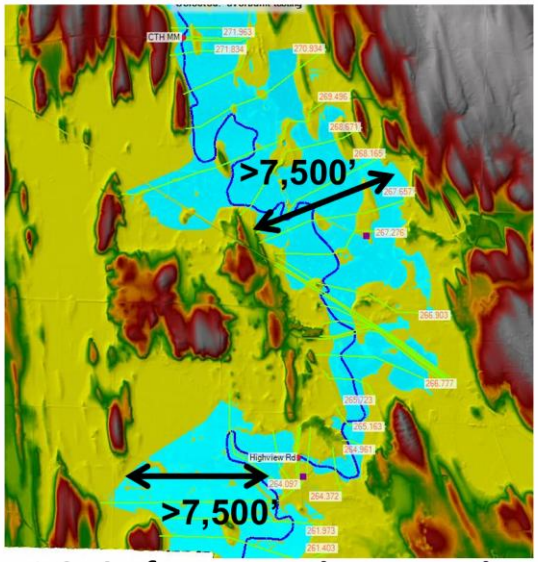


Figure 2. A portion of the extent of flooding at 1250 cfs in the Rock River, showing most of the Town of Lebanon and portions of the Towns of Ixonia and Ashippun

Requested change to gate operations

We have requested that, for the 2024-2025 season, water levels at the dam at Hustisford be lowered in December to approximately 1.0 ft. below the spillway crest, and that the lowered water level be allowed to extend upstream through the state portion of Horicon marsh and the federal portion of Horicon marsh by opening gates at the Horicon dam and at the Federal dike. The purpose of this drawdown is to provide storage for spring floodwaters that enter the system to refill the storage in Spring. Providing the storage will reduce the springtime discharges from Hustisford dam into the area subject to flooding downstream. We have also requested that the Village of Hustisford consider lowering the summer water levels somewhat, again to provide additional storage to absorb floodwater from upstream. The details of this request were presented at our meeting on September 13, and are attached to this memo, for your reference.

These proposed gate operation changes are in conformance with the operating orders for the dams at Hustisford and Horicon, and the additional operational information contained in the Inspection, Operation and Maintenance plans for those dams.

Analysis of flood reduction produced by requested gate operation changes

In previous meetings, we have described the benefits of providing flood storage as moderate, but not sufficient to control the largest of the floods that we have recently experienced. This is because the potential storage volume is limited, and flood conditions in the river are extremely variable from year to year, so that it is not possible to project specific level of flood reduction that will be achieved each year. However, we can describe anticipated benefits for particular historic flow situations. We present below three graphical analyses illustrating the flood

reduction benefit of providing the storage that we have requested by changed gate operations. These analyses are for:

- The requested storage and gate operations for long term median daily flows, determined by the USGS at the gage at Horicon.
- Flooding that occurred in 2022-2023 based on flow data collected at the new USGS Town of Lebanon gage.
- Flooding the occurred in 2023-2024 based on flow data collected at the new USGS Town of Lebanon gage.

The analyses are illustrated and explained in the figures below. They are predicated on a 1.0 ft water level drop at the dam in Hustisford, operating on Lake Sinissippi (3,000 acres), the main pool of the state portion of Horicon marsh (8,000 acres), and the main pool of the federal portion of Horicon marsh (11,000 acres) totaling 22,000 acre-feet of storage. The storage volume would be released downstream in December and restored in April. Note that these analyses must be considered approximations of the complex real-world situations in the river system.

Flood reduction under long-term median flow conditions

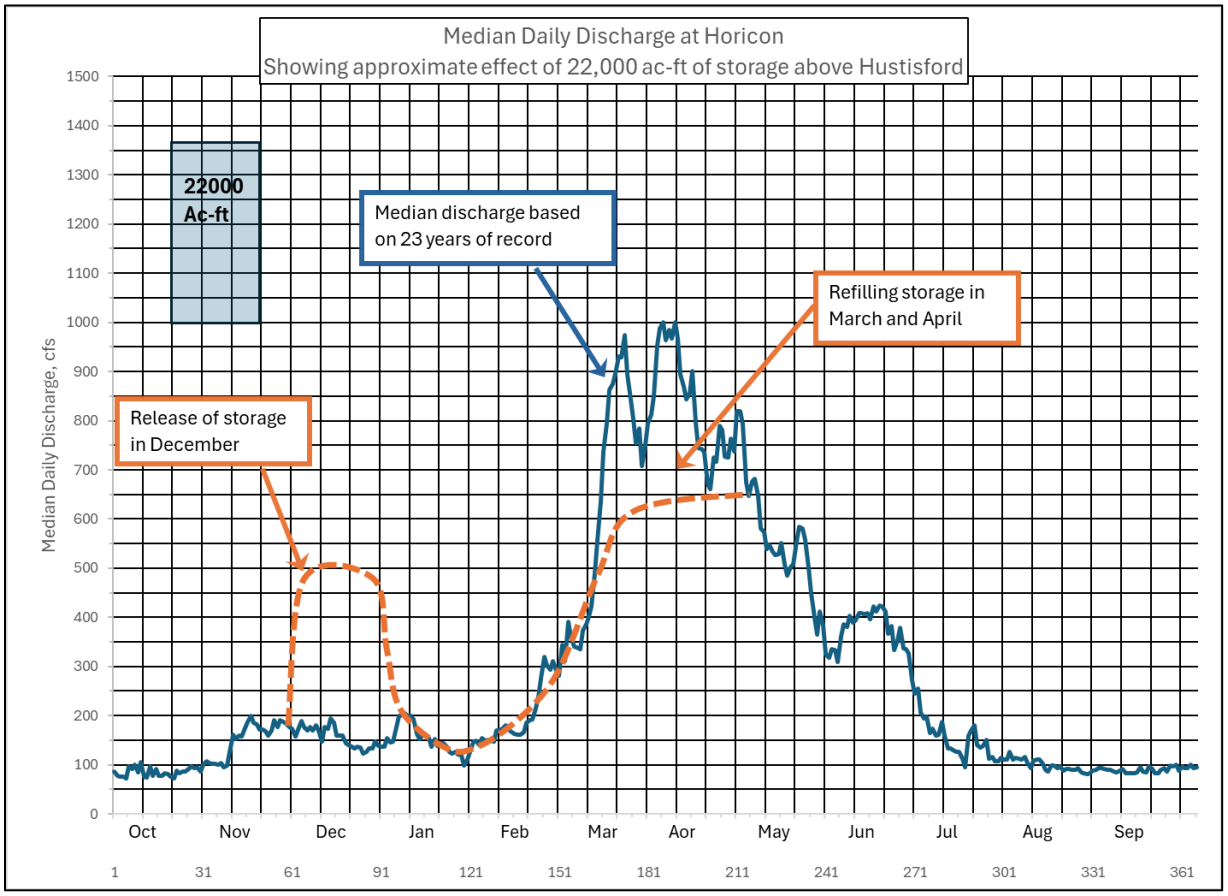


Figure 3 Flood reduction benefits under long-term median flow conditions

This analysis is based on the median daily flow of the 23-year long record of the USGS gage on the Rock River at Horicon. The graphical flood routing analysis in **Figure 3** illustrates the

release of 22,000 acre-feet from the combination of Lake Sinissippi and Horicon marsh in December, and the reduction in discharge produced by refilling the storage in March, April, and May. Note that the area of the blue box in the upper left represents approximately 22,000 acre-feet, being approximately 370 cfs for 30 days. Refilling of this storage in the spring would produce a substantial reduction in Rock River discharge for several months, for the long-term median flood condition. Note that the relative reduction in discharge in the Town of Lebanon would likely be less, due to tributary inflow to the Rock River between Horicon and Lebanon.

Flood reduction benefits for conditions observed in 2022-2023

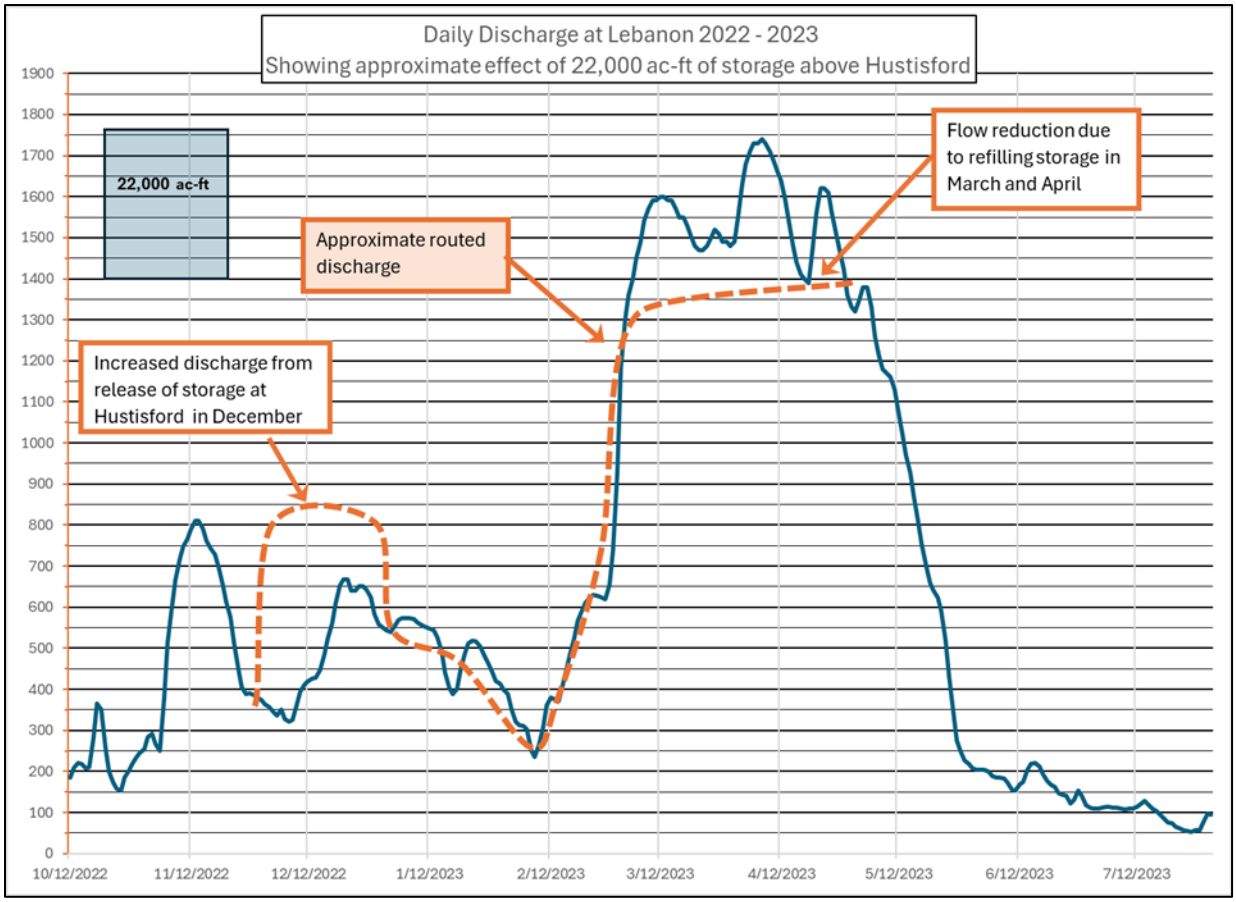


Figure 4 Flood reduction benefits for 2022-2023 observed flow conditions in Lebanon

A significant flood during March, April, and May 2024 caused flooding that lasted for several months in Lebanon and Ixonia. Peak discharges recorded at the USGS Town of Lebanon gage exceeded 1600 cfs several times. The discharge plot in **Figure 4** shows the result of discharge of 22,000 acre-feet of storage upstream of Hustisford during the month of December. This discharge, compared to the conditions that were on record, would have created modest flooding. However, the benefit of creating a storage is shown on the plot, where Rock River discharge would have been significantly reduced in March and April.

Flood reduction benefits for conditions observed in 2023-2024

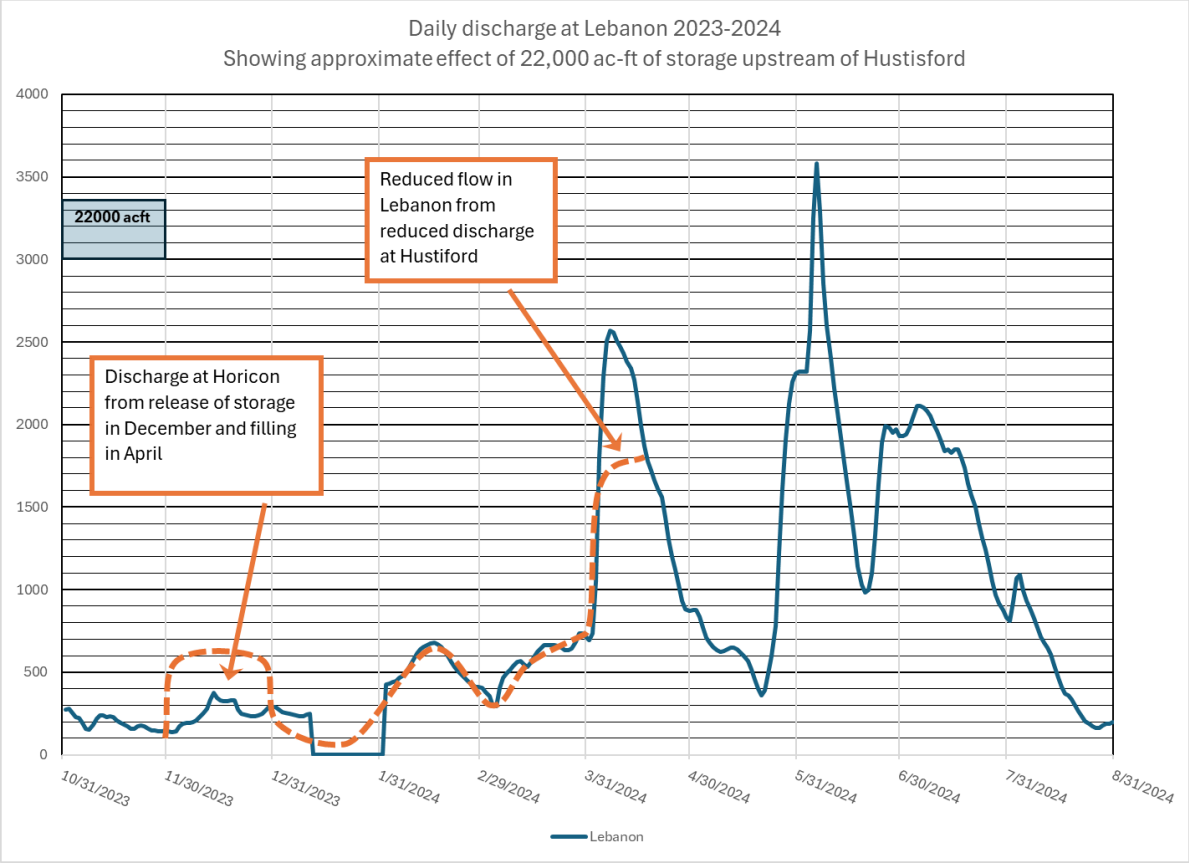


Figure 5 Flood reduction benefits for 2023-2024 observed flow conditions in Lebanon

2024 was another year of long-duration flooding, similar to the flooding conditions of 2019-2021, although with lower peak discharge. **Figure 5** illustrates the anticipated impacts of discharge to create storage in December and use of that storage to reduce flood flows in April. The storage release in December would have created some out of bank flooding downstream. However, the analysis indicates that the storage created would have been effective in reducing peak discharges in Lebanon and Ixonia in the spring. However, the storage would have been exhausted by the time the subsequent June and July flooding occurred, and those floods would not have been reduced. Creating additional storage by modest stage reductions at the Hustisford dam during the summer would not have significantly impacted these later floods.

Observations and Conclusions

Based on the analysis presented, we can draw several observations and conclusions:

1. If conditions on the Rock River are near-normal, such as the median flow conditions or even the flood of April 2024, the requested drawdowns in Lake Sinissippi and Horicon marsh would yield a noticeable reduction in flood peak discharge and associated flood elevations.
2. If additional storage is created in Horicon marsh by draining some of the management impoundments that are isolated from the main pool, further flood reductions downstream could be possible, depending on timing.
3. The Towns of Lebanon and Ixonia recognize that the proposed December drawdown is relatively rapid and could produce moderate flooding downstream, depending upon pre-release discharge rates and precipitation/melt events. However, the potential for flood reduction benefits later in the spring are valuable enough to justify the proposed gate operation program.
4. Constraints on the timing of the drawdown include hunting access and potential problems due to ice in the control gates controlling the main pools of the state and federal marsh. Confirming the details of the mechanical systems at Horicon dam and the federal dike would be helpful in evaluating this further.
5. Due to seepage problems at Horicon dam, it is likely that gates will remain open and there will be little head differential across the dam until repairs are complete in several years.
6. Implementation of this gate operation proposal will require frequent communication between the gate operators and careful monitoring of USGS gauges, soil moisture and other watershed data available, and the NWS flood forecast system. One of the key decisions will be when to begin filling the storage during the spring flood using gate closures. We propose to cooperate and collaborate in making these decisions.

We look forward to discussing this analysis with you further at our next meeting.

Attachments

Proposal for gate operations presented at our September 13 meeting

THIS IS THE PROPOSAL DISCUSSED IN THE DAM OPERATORS MEETING ON SEPTEMBER 13

Proposed Winter 2024-2025 water level management, Rock River upstream of Hustisford

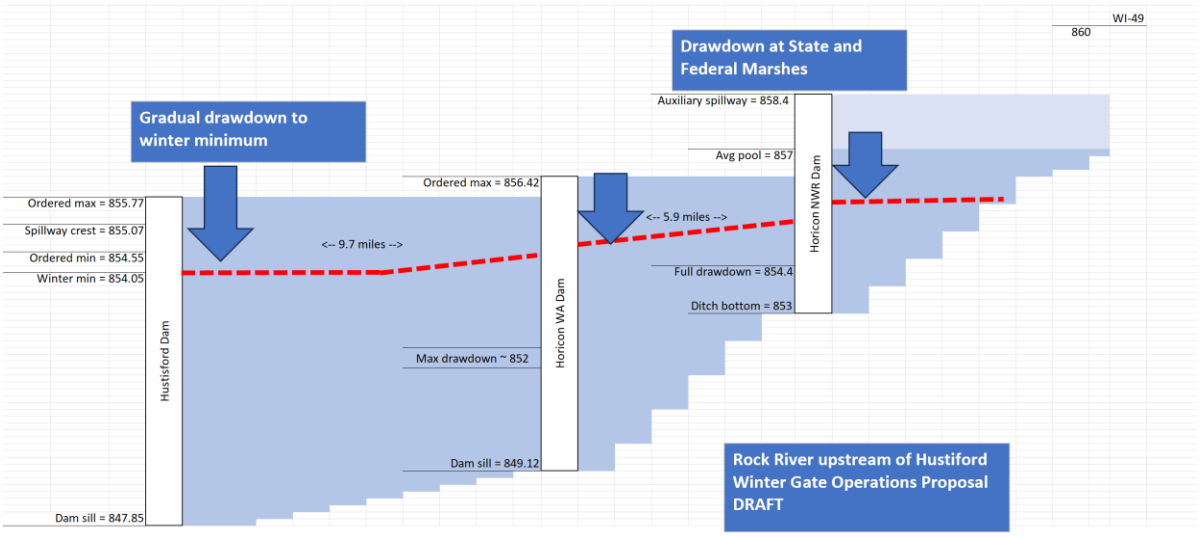


Figure 1: Schematic layout of Proposed Winter drawdown

Objective:

Create available water storage volume in Lake Sinnissippi and the state and federal portions of Horicon marsh in late winter, to mitigate spring flooding downstream, while providing more options for water level management in Horicon marsh. All gate operations to be consistent with current operating orders.

Summary:

1. Drawdown begins at Hustisford in December to draw water level down to ordered minimum 854.55 by February 15.
2. Drawdown continues after February 15 to achieve water level lake winter minimum of 854.05.
3. Hustisford Dam gate release rate changes to be gradual, to avoid discharge greater than 500 CFS at the USGS Lebanon gauge (as possible, see note 7).
4. Drawdown in the state portion of Horicon marsh controlled by Horicon dam beginning in December, to minimize head differential across Horicon Dam, and lower water levels in the state marsh.

5. Federal dike gates to be opened allowing drawdown in Horicon NWR marsh.
6. Hustisford Dam to close gates to refill Lake Sinissippi in April, maintaining a minimum flow of approximately 100 cfs at Lebanon
7. All involved recognize that heavy flooding or drought conditions may make achieving these target water elevations impossible at times.
8. Communication between the three dam operators and a representative from Lebanon or Ixonia will occur at least weekly from December through April.

Proposed Summer 2025 water level management, Rock River upstream of Hustisford Dam

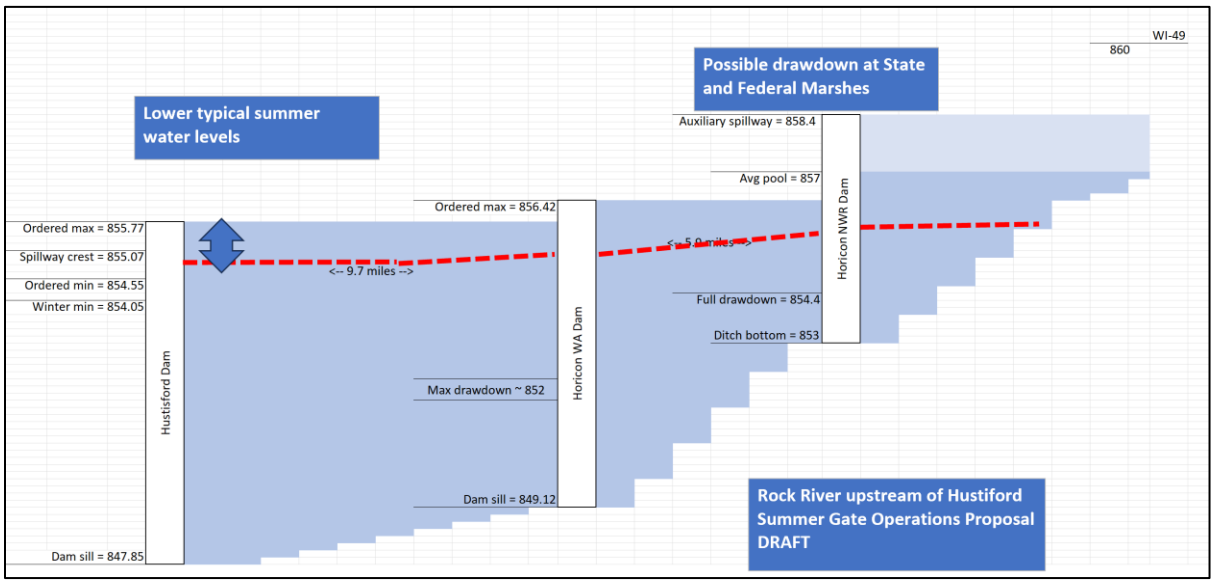


Figure 1: Schematic layout of Proposed Summer drawdown

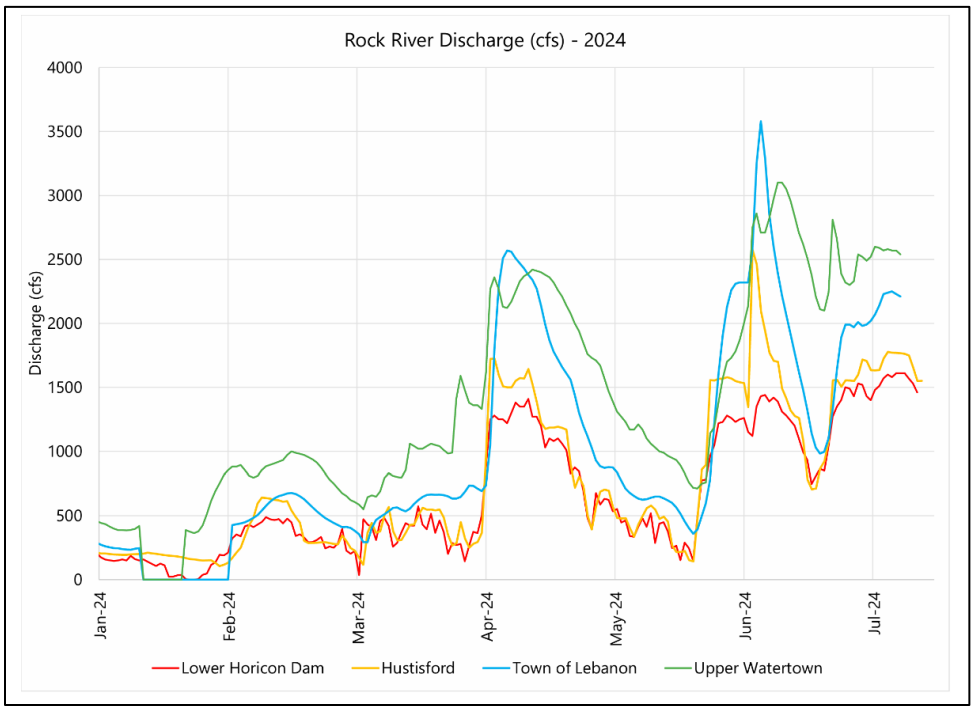
Objective:

Manage water levels in Lake Sinnissippi at a lower level during summer than in recent years, to create storage to moderate small floods and create potential for increased water level management the state and federal portions of Horicon marsh.

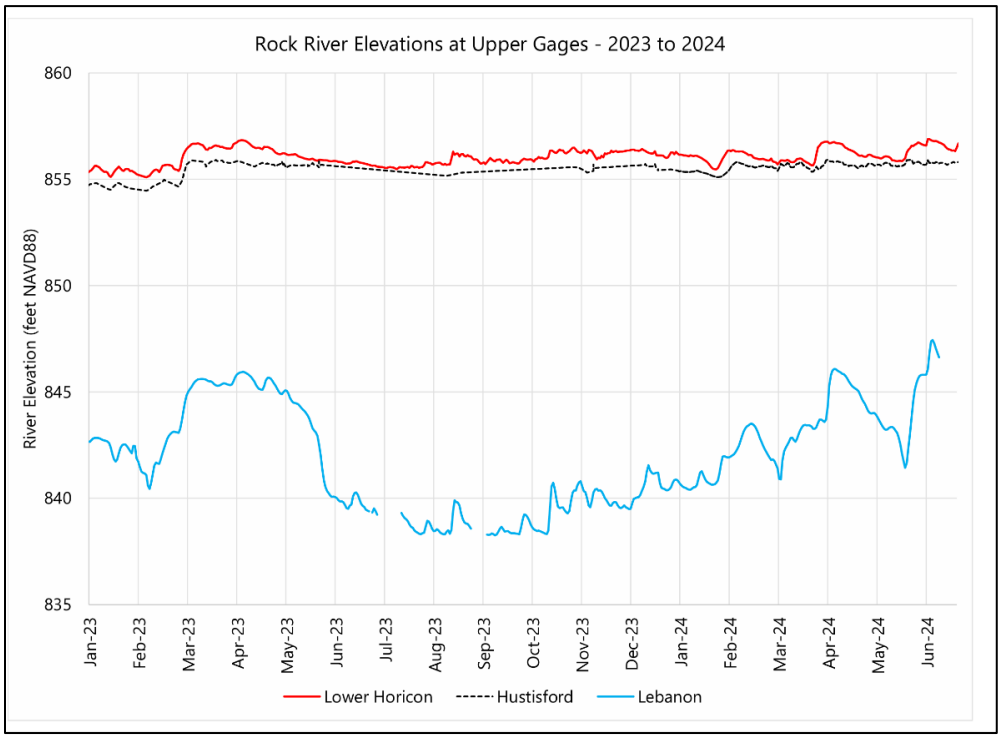
Summary:

1. Manage water levels to be no higher than 855.2 (or lower as agreed) in non-flood conditions.
2. Allow Lake Sinissippi water levels to rise and fall controlled by the fixed crest spillway without gate operation, up to elevation 855.6.
3. Hustisford Dam gate release rate changes to be gradual, avoiding discharge greater than 500 CFS at Lebanon gage (as possible, see note 4) and above approximately 100 cfs.
4. All involved recognize that heavy flooding or drought may make achieving these target water elevations impossible at times.
5. Communication between the three dam operators and a representative from Lebanon or Ixonia will occur at least biweekly from April through November.

Attachment A: Recent flow and water elevation data

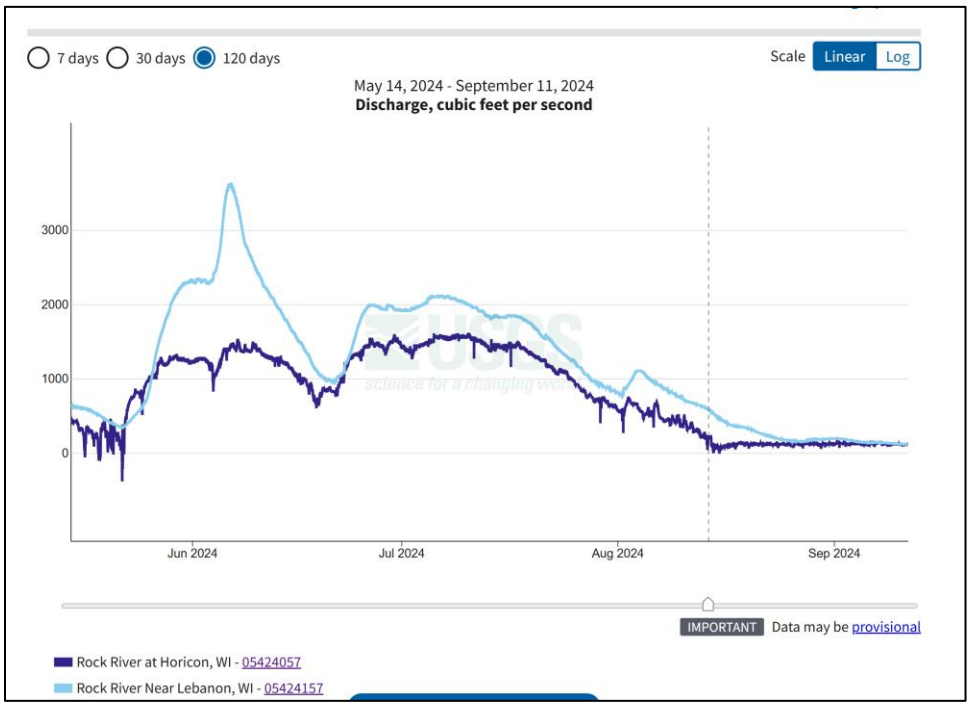


Discharge at Horicon, Hustiford, Lebanon and Watertown, Jan – July 2024

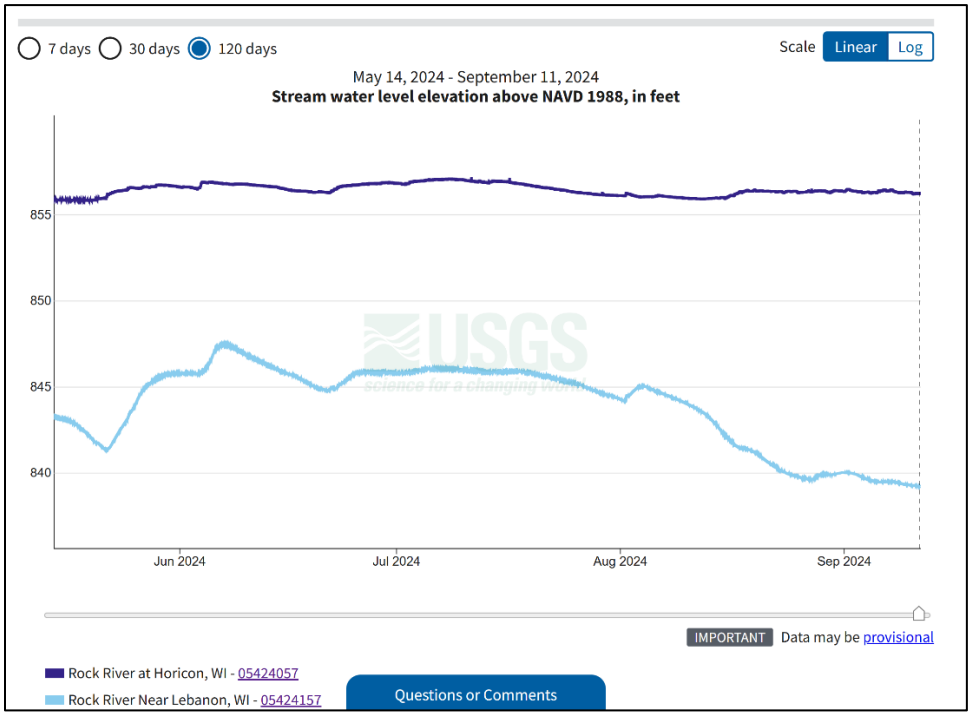


Water Surface Elevations at Horicon, Hustisford and Lebanon, January 2023 – June 2024

Attachment B: Last 120-day comparison of Horicon vs. Lebanon from USGS Website

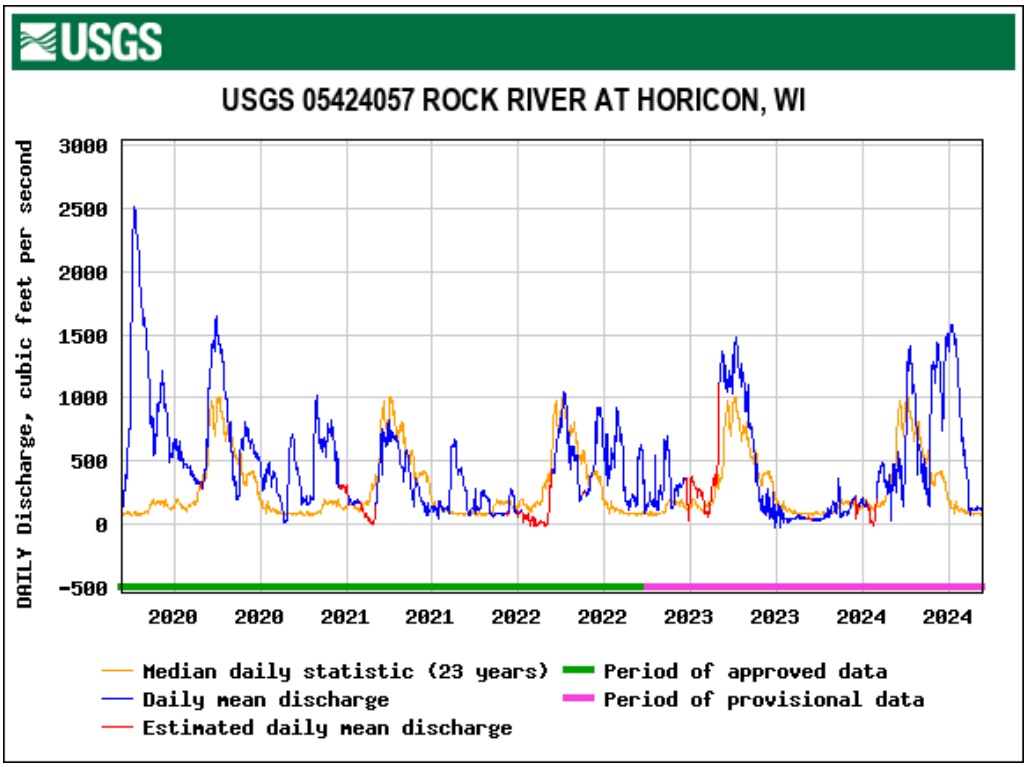


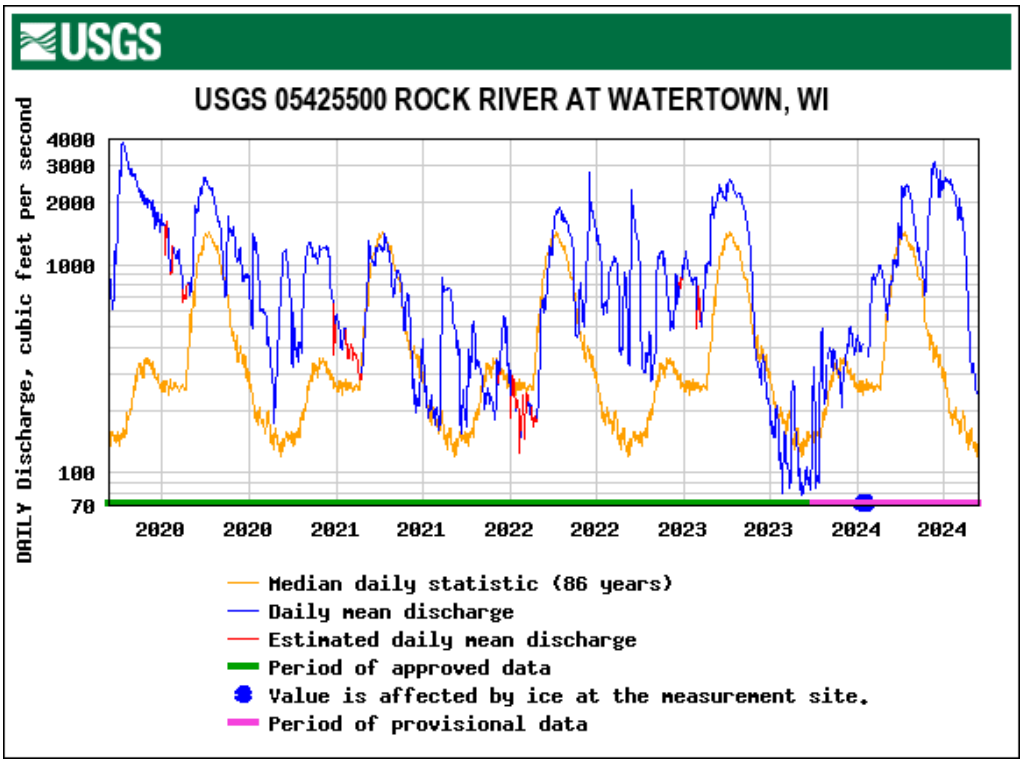
Discharge. Higher and more variable flows at Lebanon compared to Horicon



Water surface elevation. Water surface at Lebanon typically 10 to 15 ft lower compared to Horicon. There is <u>much</u> more stage fluctuation at Lebanon

Attachment C: 5-year discharge records at Horicon and Watertown





Attachment D: Average monthly discharge for period of record at USGS Horicon gage

USGS 05424057 ROCK RIVER AT HORICON, WI												
00060, Discharge, cubic feet per second,												
Year	Monthly mean in ft3/s (Calculation Period: 1997-12-01 -> 2022-09-30)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1997												67
1998	86.1	225.9	517.5	1,194	310.1	110.1	89.3	48.6	35.4	106.2	175.4	121.2
1999	91.8	436.8	246.3	646.1	538.4	345.6	572.8	448.3	165.9	96.3	106.6	153.1
2000	72.5	149.6	354.2	286.1	367.7	469.9	138	70.5	149.8	62.3	161.1	82
2001											228.7	205.2
2002	138.2	440.9	794	627.6	342.9	224.7	40.7	14	17	52.6	91	63.1
2003	42.2	26.4	81.6	144.8	417	181	51.1	21.6	6.24	10.6	92.8	283.2
2004	158.3	44	1,071	502.6	929	2,621	1,066	118.6	112.1	56.2	72.3	114.9
2005	298.4	552.3	516.7	697	206.3	44.3	29.6	12.3	6.32	15.5	46.2	59.1
2006	163.3	141.6	471.7	567.1	560.7	248	67.9	19.4	12.8	36.5	214.4	184.9
2007	176.6	54	724.6	1,278	410.2	123.7	31.6	282.8	97.2	70.4	72.4	76.7
2008	553.5	392.2	1,129	1,760	456	2,258	976.8	189.1	85.2	93.9	127.5	120.4
2009	139	279	1,356	976.7	1,191	523.1	118.2	103.4	85.5	120.6	174.2	179.7
2010	248.5	191.7	660.9	571	510.4	479.7	797.6	742	225	131.5	230.6	144.7
2011	182.4	259.2	851.2	1,357	871.7	257.5	126.3	120.4	65.7	75.4	349.8	373.9
2012	153.4	259.1	819.9	709.3	574.4	60.6	8.93	9	4.46	5.1	18.1	86
2013	110.3	286.7	618.3	1,863	1,339	589.6	293.8	81.4	29	65.9	194.6	212.6
2014	102.8	61.1	350.6	1,362	1,092	882.6	1,157	124.2	166.4	212.4	233	236.7
2015	152.3	81.5	152.6	505.4	395.4	428.8	127.8	50.7	71.1	28.2	80.1	641.6
2016	478.6	243.2	889.8	1,372	367.7	167.3	97.8	160.5	829	591	544.9	400.9
2017	475.2	818.6	1,242	1,005	982	510.2	469	175.8	99.8	168	220.2	176.5
2018	103.7	205.7	716.2	426.4	1,384	496	67.4	227.7	1,673	1,440	853.8	430.3
2019	548.3	490.9	1,233	1,146	642.6	697.2	395.2	236.8	316	1,969	968.8	825.3
2020	536.2	365.6	1,017	1,134	470.6	619.2	395	192.3	461.6	380.4	692.2	416.3
2021	188.9	59.3	512.3	617.7	382.3	165.3	131.6	425.1	208.7	189.4	84.6	145.7
2022	62.7	14.3	437.5	734.9	310.3	647.1	566.6	363.6	339.2			
Average	219	253	698	895	627	548	326	177	219	260	251	232