

## Fox River Task Force Operations Committee Anticipatory Drawdown

Many residents believe that if the gates at Stratton Dam are opened before the rain starts falling then no flooding would occur. As discussed below, the benefits of opening the gates before it rains are minimal. The gates at Stratton and Algonquin Dams are opened based on predicted peak flows on the tributaries to the Chain of Lakes from recorded precipitation and the current stage at Fox Lake gage. Since it can take up to 6 days for the runoff to enter the Chain of Lakes, the gates are adjusted before the peak flows enter the Chain of Lakes. Opening the gates before the Chain of Lakes starts to rise does not release significant volumes of water and will not significantly lower the Chain of Lakes, but it will increase Fox River stages downstream of Stratton Dam

Most flood events occur after several days of rain. Following the approved operation plan, the gates at Stratton and Algonquin Dams are opened incrementally based on predicted inflows to the Chain of Lakes from recorded rainfall amounts. Predicted inflows have to be above 5000 cfs before all the gates at Stratton and Algonquin Dams will be fully opened. The gates are fully opened only when downstream flooding is certain to happen so downstream flooding is not induced by gate operations. Releasing more than 3000 cfs will cause flood damages to properties on the Fox River downstream of Stratton Dam. The amount of predicted rainfall is analyzed to determine its impact on the estimated inflows to the Chain of Lakes. Minor changes to gate settings may be made based on predicted rainfall if no flooding is induced by these changes.

### Operation Guide Development

During the development of the operation guide and hydrologic prediction model, various alternatives were modeled to investigate possible reduction in peak water surface elevations during historic flood events (Illinois State Water Survey Contract Report 533). One of the alternatives investigated was the elimination of winter pool while operating the gates, both sluice and hinged crest, per the current operation plan. The analysis showed that benefit of the winter drawdown (the ultimate anticipatory drawdown) would have been the lowering of the peak water surfaces 0.1' from the Chain of Lakes to the Fox River in East Dundee for the 1960 flood event. In other words, if the Chain of Lakes had been raised from winter pool stage of 2.5 to a stage of 4.0 before the flooding begun, the flooding would have been increased by 0.1 foot at the peak stage from the Chain of Lakes to East Dundee. The 1960 flood event had a similar peak to the August 2007 event, 6600 cfs at Algonquin Dam. It takes weeks to lower the Chain of Lakes to winter pool without inducing downstream flood damages and cannot be accomplished in a few days. This analysis shows that the benefits of this drawdown are minor for large flood events.

The Illinois State Water Survey analysis looked at results of using predictive rainfall, 2 days and 1 days before the rainfall occurs, in the operation of the gates using the hydrologic prediction model. The analysis was completed on the October 1986 flood event which had a peak flow at Algonquin Dam of 6170 cfs. The analysis also investigated a delay in opening the gates. The analysis, results shown below, was based on using the hydrologic prediction model with the sluice gates and hinged crest gates. (ISWS CR 533 page 70) The "Near Real Time" operation is how gates are currently operated using recorded precipitation to determine estimated inflows.

Effect of Response Time on Peak Stages (feet) using Alternative 8: 1986 Flood

Open Gates Using:	Fox Lake	Johnsburg	Stratton	Algonquin Dam	East Dundee
2 Day Prognosis	740.31	739.72	738.12	732.88	713.90
1 Day Prognosis	740.34	739.74	738.14	732.90	713.92
Near Real Time	740.36	739.77	738.16	732.91	713.94
1 Day Late	740.39	739.80	738.19	732.93	713.97
2 Day Late	740.42	739.83	738.23	732.96	714.00

Based on this analysis by the Illinois State Water Survey there is only a 0.11 foot of stage difference between opening the gates 2 days early and 2 days late.

Post Flood Analysis

The Office of Water Resources (OWR) performs Post flood analysis after major events to review gate operations. The analysis is completed using the hydraulic model of the Fox River with observed inflows from Nippersink Creek near Spring Grove and the Fox River near New Munster. The flows for the other tributaries are estimated from the hydrologic prediction model. The analysis is run for the entire storm period. The analysis looks at the gates as operated, the dam without the hinged crest gates, and if the gates had been opened all the way as soon as it started raining (even though the criteria for opening the gates was not met). This analysis provides for the verification that the OWR computer models mimic what happened, the determination of the benefits of the hinged crest gates, and the determination of the benefits of early operation of the gates, if any.

The August 2007 flood event was caused by rainfall recorded from August 19 thru August 24. The peak discharge at Algonquin Dam for this event was 6750 cfs on August 26, 2007. The Wisconsin to Stratton portion of the watershed received the majority of their rainfall recorded on August 19 and 20 (6" in Burlington, Wisconsin and 3.3" at Stratton Dam) with an additional 1" of rain recorded on August 23. The watershed south of Stratton Dam received additional heavy rainfall on August 23 (9.5" total rainfall in Elgin). The sluice gates at Stratton Dam were opened on August 19, opened further twice on August 20, and pulled out of the water (fully opened) on August 21. The hinged crest gates were fully opened at Stratton and Algonquin Dams on August 21. The hydraulic model output matched measured peak water surface elevations within 0.15' except the Algonquin Dam tailwater gage. The benefits of the hinged crest gate as measured from operation scenario without the hinged crest gates were 0.2' in the Chain of Lakes, 0.2' at Johnsburg, 0.5' at Stratton Dam Pool, 0.1' at Stratton Dam tailwater, 0.3' at Lake County Marina, and 0.9' at Algonquin Dam pool. If the hinged crest gates had been fully opened on August 19, when the first rainfall amounts were recorded, the peak water surface elevations would have been reduced by 0.04' from the Chain of Lakes to the Fox River in East Dundee.

The June 2008 flood event started with rain recorded on June 5. The peak discharge at Algonquin Dam for this event was 6320 cfs on June 18, 2008. The majority of the rain was recorded on June 8 and 9 with the Wisconsin portion of the watershed receiving twice (9.1" in Milwaukee, Wisconsin) as much rain as the Illinois portion (4.7" at Stratton Dam). The sluice gates were opened on June 6 and 7 and pulled out of the water on June 8. The hinged crest gate was partially opened on June 8 and fully opened on June 9. The Fox River at New Munster, Wisconsin crested on June 15 and the Chain of Lakes crested on June 18. The same analysis that was completed for the August 2007 flood was completed for this flood event. The computer modeling matched observed peak stages within 0.10' except for the staff gage upstream of Northwest Highway and Algonquin Dam tailwater gage. The benefits of the hinged crest gate were determined by comparison with an alternative scenario that kept the hinged crest gates even with the spillway. This analysis showed reductions in stage, from the use of the hinged crest gate, of 0.15' in the Chain of Lakes, 0.19' at

Johnsburg, 0.4' in the Stratton Dam pool, 0.2' at the Stratton Dam tailwater, 0.5' at Northwest Highway, and 1.0' in the Algonquin Pool. The benefits downstream of Algonquin Dam were minimal. If the hinged crest gates had been opened completely on June 6 all locations on the Chain of Lakes and Fox River thru Elgin would have been lower 0.03'.

A post flood analysis was not completed for the September 2008 event since the flooding occurred downstream of Stratton and Algonquin Dams. The rainfall downstream of Stratton Dam was much higher than the rainfall recorded upstream of Stratton Dam. On September 13 and 14, 2008, Elgin recorded 6.1" of rain; McHenry recorded 4.7" of rain; and Milwaukee, Wisconsin recorded 1.2" of rain. During this event the gates were not opened fully. The storage in the Chain of Lakes was utilized to reduce flooding downstream. If the gates had been fully opened before the rain started based on Quantitative Precipitation Forecast, stages on the Fox River downstream of Stratton Dam would have been much higher at the beginning of the event. Therefore the peak water surface elevations in the Fox River would have been higher because the Fox River would have been full when the tributaries were contributing the highest flows. Flooding on the Fox River downstream of Stratton Dam would have increased due to anticipatory drawdown.

#### Summary

Consistent with the Illinois State Water Survey analysis for the operation guide development, the peak water surface elevations would have been minimally reduced (less than ½") for the August 2007 and June 2008 flood events if the gates had been opened completely two days earlier than operated. Flooding residents on the Fox River based on predicted rainfall is not worth the ½" reduction in water surface elevations when using forecasted rainfall amounts when the rainfall forecasts are not accurate. The large volume of water during these large flood events along with the high peak flows causes the high water surface elevations. The flows on the Fox River are limited by the channel configuration and not gate operations during extreme high flow events.