Effect of Weir on Honeoye Lake Level
Jack Starke
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Background

Lately the weir has been blamed as a potential cause of several problems on Honeoye Lake. At a 2010 Richmond meeting on lake water quality, an attendee blamed the weir for the increase in algae. This suggestion has found support from a group of individuals. Recently, as result of the flooding Honeoye experienced on July 28 there has been a suggestion by some, that again the weir may be the cause.

Previously I wrote a short report (Starke 2014) expressing my opinion that the weir is not a factor in algae blooms. In this report some observations related to water flow and flooding and any possible influence of the weir are addressed.

History of the Weir

Based on the two aerial photographs from 1954 and 1963 in Figure 1, it is evident that the original earthen weir and lagoon was constructed sometime in this time interval.. The weir and lagoon were constructed by Jack Evans, the owner of the property, who had a business renting trailers located along the path from the Main Street to the existing Sandy Bottom Park and also had a small marina in the lagoon. This property was private property until 1973, when it was transferred to the town of Richmond. Figure 2 includes three pictures of the weir over a 60+ year period. In the 1950s there are only a few small trees on the northern bank of the earthen weir and there are several boats along the western shore of the lagoon. Nearly fifty years later, in 1998, the picture shows that the weir is no longer level with high spots near trees and low spots in-between. Whether these large trees are the same as the small ones from 50 years earlier is unknown, but quite possible. In 1998-99 the trees were removed and a new wider weir was constructed using concrete Jersey barriers that resulted in a weir of more uniform height across its width. The top of this new weir was constructed at 803.5 feet above sea level, which is the historical average lake level. In 2007 the junction between the Jersey barriers were grouted to minimize erosion and leakage of the weir. **From these three pictures it is evident that a weir has been in approximately the same location for over 60 years and the reconstruction of the weir in 1998 did not significantly change its character.**

While pictures give a subjective impression of the weir, it is more instructive to examine the resulting lake level over the 60+ year time interval (Figure 3). Lake level monitoring varied in its frequency during this period; with volunteers from 1955-1960, USGS 1968-1994, and Telog monitoring equipment 2005-present. Maximum levels are primarily caused by the severity of storm events, and the lake generally returns to normal within a short period of time. Hence, maximums are not a good measure of the weir's effectiveness at maintaining a constant lake level. Since there are no recorded lake levels prior to 1955 when the original earthen weir was installed, it is not possible to access its effect. The average level shows that after the changes to the weir in 1998 there are more uniform levels from year to year, and the lake level is closer to the target level. The minimum lake level generally occurs during the summer months and is about 5 inches higher with the new weir, since the weir is more uniform in height across its width and does not have low points that allow draining below the target lake level. This results in keeping the lake level closer to its long term average of 803.5. **Hence both the new and old weirs have done an excellent job, with the new weir somewhat more effective at controlling a more uniform lake level.**

2014 Summer Storms & Flooding

Figure 4 shows the lake level and precipitation for 2014, which clearly shows two major increases in the lake level due to severe storms this summer. On May 16 2.5 inches fell and on July 28 6.3 inches. Since 1992 the next highest daily precipitation was 3.7 inches in 1994 and 2.6 inches in 2005, making these very significant storms. Both of these storm events resulted in highest recorded lake levels (805.3 & 805.9) except for 1972 during Hurricane Agnes (806.5) and 1993 (805.4). The lake level in 1972 during Agnes is also included in Figure 4 as a comparison to this year and clearly shows it to be a significantly more severe event both in terms of maximum lake level and duration above the target lake level. There was also significant shorefront damage in 1972.

The two storms this summer were quite different in the rate of rise and fall of lake level as shown in Figures 5 & 6, which are both plotted using the same scale over a 15 day period. In the May storm the lake level rose at a rate of 0.18 ft/hr during its initial stage whereas for the July storm it was 0.96 ft/hr, which is larger by over a factor of five. The reason that the maximum lake level reported in Figure 4 is less than in Figure 6 is that in Figure 4 the lake level is the daily average. This rapid rise in the July storm is further discussed in a later section on the effect of Mill Creek.

The present Telog lake level monitor, which was installed in 2004, samples lake level every minute but only records the minimum, average, and maximum every half hour. This makes it possible to determine maximum and minimum lake levels to the minute. The USGS lake level monitor in place from 1972-1993 only recorded daily lake levels. Manual lake level monitoring prior to 1971 was done by volunteers with a variable sampling schedule.

Effect of Weir on Water Flow

The basic concepts of flowing water are pretty simple but their effects can be profound as experienced during the recent flooding. Water flows downhill due to gravity. The amount of water that can flow through a pipe/channel is determined by the velocity of the water and the size of the pipe/channel.

When the lake level is less than 803.5 the weir blocks outflow from the lake and contributes no water to flow downstream. When the lake level is greater than 803.5 water can flow over the weir and flow into the outlet stream. However, the outflow is dependent on the size of the downstream channel and the velocity of the water which is dependent on the gradient of the stream. **<u>When the lake level is greater than 803.5 the weir has no effect on outflow.</u>**

For example if there were a deep chasm just north of the weir with an infinite capacity to accept water, then when the water flows over the weir it would instantly flow into the chasm and the lake level would not exceed 803.5. However, this is not the case in Honeoye, as there is only about a three foot drop in elevation between the weir and the bridge on 20A and the size of the channel limits the volume of water that can be moved downstream.

Effect of Mill Creek on Water Flow

If sufficient water is flowing down Mill Creek such that its height is higher than the lake level this water will flow back toward the lake and in essence make the normal lake outlet an inlet. This has been observed many times by numerous people during previous storm events. In the storm on July28, 2014 this was very evident. Although I wasn't there to observe it, Bill Hershey did see the effect at the bridge on 20A, and when he went to Sandy Bottom there was a large plume of sediment laden water visible in the lake that was coming from Mill Creek.

A few days later I was walking along the old 3M property just south of Mill Creek where at one point the bank on the south side of the creek was at least 8 feet above the creek bed and there was evidence that it had recently flowed over the bank. This also meant that at this point in the creek that is normally about 15' wide was over 100' in width during the peak of the storm. Due to the amount of precipitation over a short period of time the creek level rose dramatically to accommodate the large volume of water. When this water flowed further west into lower flatter terrain (Figure 7) it spread out and flooded the area around the Mill Creek Café, Gazebo, and Christman insurance agency. Flooding in the western portion around Honeoye Central School was probably from the water coming down the hill on 20A. Hence, the flooding of Honeoye was primarily due to the 6.3 inches of precipitation over a few hours and the topography around Mill Creek and the region west of town. **The weir and lake level did not contribute to the flooding.**

Conclusions

The new weir completed in 1999, although not radically different from the older earthen weir, does maintain the lake at more constant level.

The weir does not impede the flow downstream when the lake level is higher than 803.5. It is only the downstream physical characteristics of the stream that determines its flow rate.

The major flooding in Honeoye from the July storm was due to over six inches of precipitation in just a few hours that exceeded the ability of the streams leaving Honeoye to the north to adequately drain the large volume of water. The contribution of Mill Creek and water from the east coming down 20A is a major contributor to the flooding of Honeoye. The weir was not a factor in the flooding

Acknowledgements

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References

Starke, Jack, Is the Honeoye Lake Weir a Factor in Nuisance Algae Blooms?, June 11, 2014

Figure 1
Aerial Photographs of Northern End of Honeoye Lake in 1954 and 1963

1954 Photo looking north- note no lagoon

1963 Photo looking north- lagoon same as in 2014

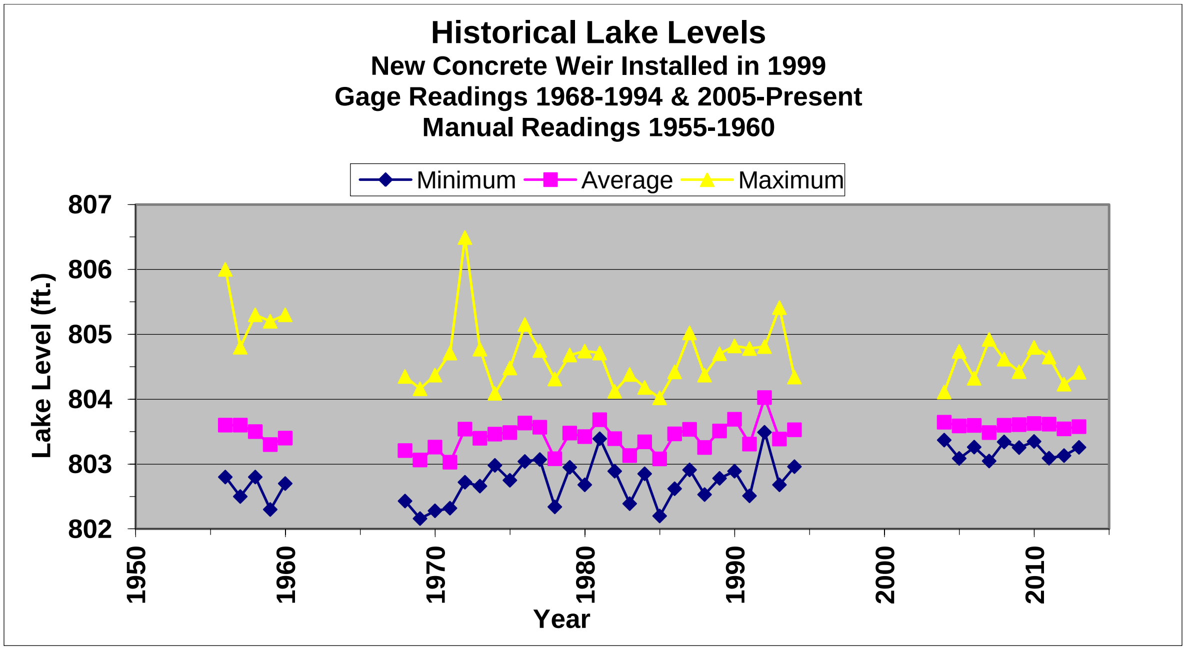
Figure 2
Pictorial History of Weir over 60+ years

Weir in 1950s

Wear in 1998

Weir in 2014- after new weir installed in 1999

Figure 3



Fgure 4

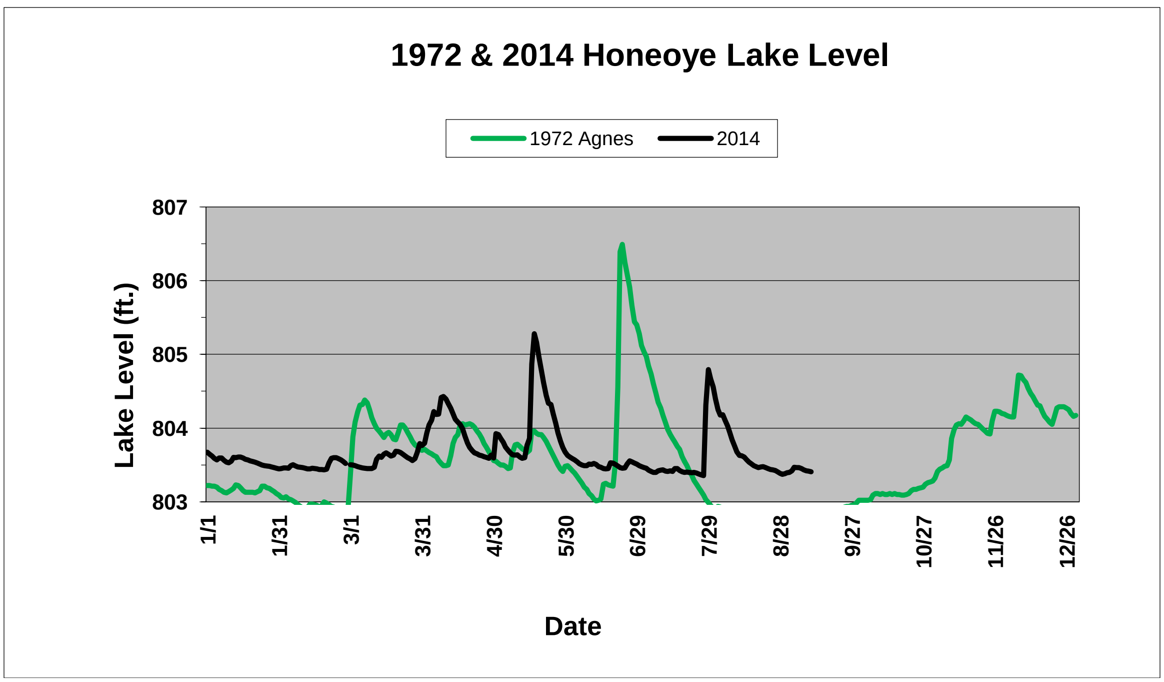


Figure 5

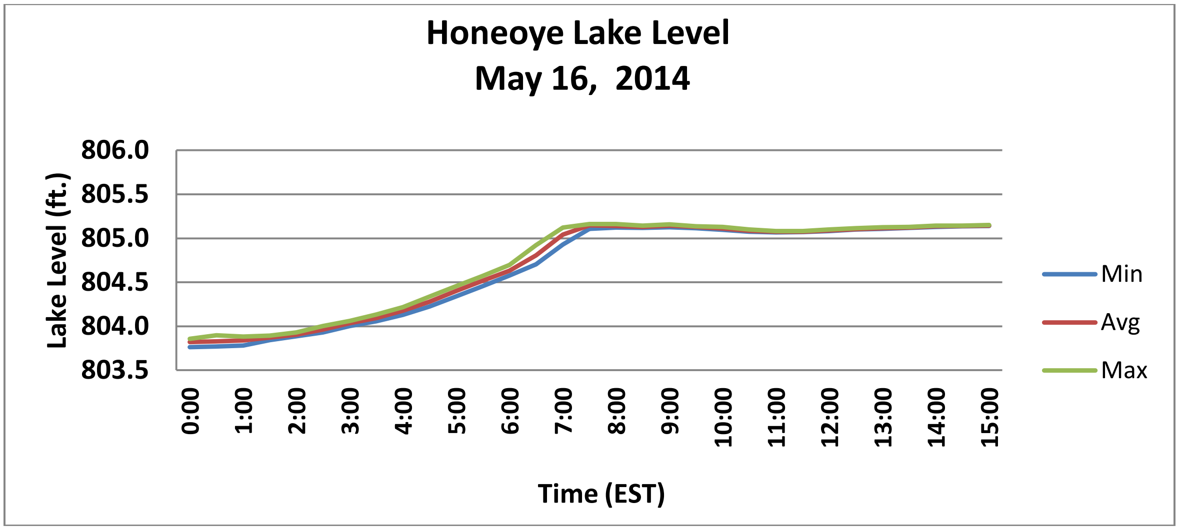


Figure 6

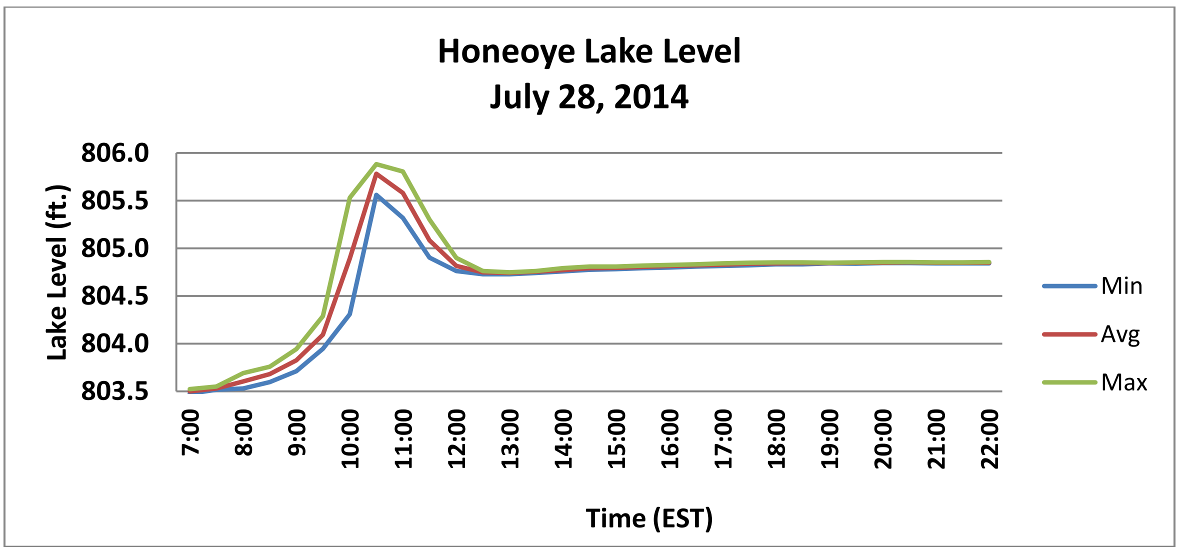


Figure 7

Topographic Map of Mill Creek and Honeoye Lake Outlet