Memorandum

To: Bassett Creek Watershed Management Commission
From: Barr Engineering Co.
Subject: Item 6A: Final Results of Carp Removal and Long-Term Control Options for Schaper Pond and Sweeney Lake
BCWMC February 18, 2021 Meeting Agenda
Date: February 9, 2021

Recommendations:

1. Direct Commission Engineer, Administrator and Attorney to work with City of Golden Valley to evaluate feasibility, maintenance, liability and long-term efficacy/costs of carp control options for Sweeney Lake and Schaper Pond system. Summarize carp control options and develop recommendations for consideration at a future Commission meeting.

Summary of Results:

1. Sweeney Lake: 452 carp removed, representing an estimated 43.5% reduction in population; reduction in biomass from 122 kg/ha (kilograms per hectare) to 68 kg/ha [>100 kg/ha = threshold for impacts to water quality]
2. Schaper Pond: 152 carp removed representing an estimated 76% reduction in population; reduction in biomass from 321 kg/ha to 75 kg/ha
3. Analysis of carp movements indicate significant movement between Sweeney Lake and Schaper Pond, and the possibility that carp from Sweeney Lake could easily re-populate Schaper Pond and use it as a nursery, which would compromise stormwater treatment in the pond.

1.0 Project Purpose

Several investigations in 2017 and 2018 identified problems with stormwater treatment in Schaper Pond and found carp populations exceeding the 100 kg/ha threshold associated with impacts on water quality (Bajer et al., 2009). In 2019, the Commission was awarded grant funding for the Sweeney Lake Water Quality Improvement Project, which included a goal to reduce carp biomass in Sweeney Lake and Schaper Pond during the spring and summer of 2020. In addition, this project intended to track carp movement to 1) assess the likelihood that carp from Sweeney Lake could re-populate Schaper Pond, and 2) assess the need to prevent movement of juvenile and adult carp from Schaper Pond to Sweeney Lake. The Commission Engineer hired Carp Solutions, LLC as its subconsultant on this investigation (and all previous investigations) to analyze carp impacts in the Sweeney Lake-Schaper Pond system.

2.0 Summary of Previous Studies

Nearly 90 percent of the Sweeney Lake watershed drains through Schaper Pond. Modification of the pond to improve stormwater treatment was identified as the best method by the TMDL implementation plan to reduce phosphorus levels in Sweeney Lake so that it would meet water quality standards (BCWMC and

MPCA, 2011). The Sweeney Lake Total Phosphorus TMDL (BCWMC and MPCA, 2011) requires a reduction of 99 pounds of total phosphorus from external sources.

Schaper Pond, a Minnesota Department of Natural Resources' public water wetland, is located south of Sweeney Lake and north of Highway 55 in Golden Valley. The pond receives about 90% of its flow from the Sweeney Branch of Bassett Creek from the south (under Highway 55), and 10% of its flow from a stormwater inlet (called the Railroad inlet) in the northwest lobe of the pond. The pond outlets directly to Sweeney Lake from its northeast lobe (Figure 1).

The BCWMC selected the Schaper Pond Diversion Project alternative from the Schaper Pond Improvement Project feasibility study (Barr, 2012). The City of Golden Valley constructed this BCWMC CIP project in 2015, which was designed to divert water, via a floating water baffle, within the pond to direct more of the water flows to the northwest part of the pond so that more settling could occur. Based on the 2011 monitoring data and modeling, it was believed that the diversion would reduce the amount of phosphorus reaching Sweeney Lake by an estimated 81 – 156 pounds.

After the floating barrier was secured and working properly, the Commission approved a program to monitor the effectiveness of the diversion project in 2017. Figure 1 shows the water quality grab sample locations in 2011 and 2017 (using identical equipment and methods). When comparing the water quality in the pond and upstream of the pond between 2011 and 2017, it was determined that Schaper Pond was not removing suspended solids or total phosphorus as well as it did in 2011, and during most of the monitored events, the pollutant concentrations were higher at the pond outlet than the combined inflows. (In other words, after the diversion project was completed, more total phosphorus and total suspended solids were leaving the pond than entering the pond.) In addition, a single monitoring event, with multiple samples taken from upstream to downstream, appeared to provide a better understanding about where within the pond system the treatment effectiveness was compromised.

The 2017 monitoring indicated that there were unexpected factors contributing to the results, which had not previously been assessed (e.g., carp) or might require updated information (such as the pond's bathymetry). Consequently, the Commission Engineer performed additional monitoring during the summer of 2018 to identify the gaps in the available data and distinguish the source(s) or factors that were limiting the treatment capacity of the pond. The 2018 monitoring included performing additional water quality monitoring and surveys of the carp and pond's bathymetry. Results of the 2018 monitoring and surveys indicated the following:

- The bathymetric survey indicated that some sedimentation occurred in discrete areas of the pond, but that it is unlikely that those changes greatly altered the settling or treatment capacity in the northwest corner of the pond.

Figure 1

MONITORING & BAFFLE LOCATIONS
Schaper Pond Effectiveness Monitoring
Bassett Creek Watershed Management Comission

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- The water quality monitoring confirmed that pollutant concentrations were higher as the flow moves through the pond. One out of the four monitoring events showed that sediment phosphorus release could have contributed to higher phosphorus levels at the outlet, compared to the upstream sites. Otherwise, it does not appear that anoxic sediment phosphorus release was a significant source of the phosphorus that reaches the outlet when higher flows (above summer baseflow levels) are conveyed through the pond.

- The first carp survey (performed by Carp Solutions) estimated the carp population in the pond that day to be 227 individuals, with an average mass between 4 and 5 pounds. The carp biomass for the pond at that time was calculated to be about 368 kilograms/hectare. Carp biomass over 100 kg/ha can contribute to poor water quality (Bajer et al., 2009); when carp biomass is above this threshold, carp management measures are recommended. The carp biomass in Schaper Pond was nearly four times this recommended threshold for carp management. The second survey resulted in the capture of 37 carp in one hour of electrofishing. Most of the carp were captured in the deeper-water portion of the northwest lobe. Six of the 37 carp were young of year (YOY), meaning it was very likely that successful recruitment (i.e., fish surviving to enter the fishery or a mature life stage) occurred that year, and likely within Schaper Pond (i.e., these fish likely hatched, and continue to survive, in the pond).

Since initial carp surveys confirmed that large numbers of carp inhabit the northwest lobe of Schaper Pond, additional carp monitoring was conducted during the fall of 2018 and spring of 2019 to gather the kind of data needed to make future carp management decisions, including information about carp recruitment and mobility throughout the Sweeney Branch system.

PIT (passive integrated transponder) tags were attached to nearly all of the carp that were caught during the October 2018 carp survey and antenna stations were installed at the Hwy 55 inlet and the Schaper Pond outlet to Sweeney Lake. PIT tags are attached to carp and used in conjunction with stationary antenna (to trip a signal) and recorders, to track the movement of each fish. PIT tags provide a means to obtain representative data on the whole carp population (including YOY carp), including the upstream and downstream movement of the carp from the pond over time.

Carp Solutions conducted three boat electrofishing surveys in October 2018: two in Sweeney Lake and one in Schaper Pond. A total of 206 carp were captured (70 in Schaper Pond and 136 in Sweeney Lake). Of the 70 carp tagged in Schaper Pond, 50 were YOY and 20 were adults. Based on the average electrofishing catch of carp per hour, the carp biomass in the Schaper Pond and Sweeney Lake systems was estimated to be 420 and 1,030 kg/ha, respectively, well over the carp management threshold of 100 kg/ha.

PIT antennas showed that very little movement occurred in the fall of 2018. Nevertheless, there were two tagged YOY carp, both of which were tagged in Schaper Pond, which moved downstream to Sweeney Lake on November 25, 2018. No detections were recorded over the winter, but more movement occurred

in April 2019. Between April 8 and June 27, 2019, there were 31 unique carp that crossed at least one of the two antennas. All of these carp were tagged as adults and there were no detections of YOY carp at either antenna. The migration of juvenile carp is often delayed until the 2nd or 3rd year of life (Lechelt et al., 2017). Of the 31 carp detected, 7 were originally tagged in Schaper Pond (35% of tagged adults) and the other 24 were from Sweeney Lake. The antenna at the southern end of Schaper Pond (pump house) detected a total of 21 unique tags (7 from Schaper Pond and 14 from Sweeney Lake).

The results of the previous investigations confirmed that high numbers of carp were compromising stormwater treatment in Schaper Pond, and populations exceeding 100 kg/ha meant that reductions in carp biomass in Sweeney Lake and Schaper Pond should be pursued. As a result, carp removal and monitoring efforts were recommended for 2020, to assess the likelihood that carp from Sweeney Lake could re-populate Schaper Pond and the need to prevent movement of juvenile and adult carp from Schaper Pond to Sweeney Lake.

3.0 Results of 2020 carp removal efforts

We expect that carp removal will restore the water quality treatment capacity of the Schaper Pond diversion project, which should result in a 100-pound reduction of total phosphorus delivered to Sweeney Lake (Barr, 2012). Since electrofishing surveys suggest that carp biomass in both Schaper Pond and Sweeney Lake was 5 to 10 times above the 100 kg/ha threshold associated with impacts on water quality (Bajer et al., 2009), the 319 grant funded project for the Sweeney Lake Water Quality Improvement Project included carp biomass reduction work in Sweeney Lake and Schaper Pond during the spring and summer of 2020. Carp removal work was followed by the first phase of the Sweeney Lake alum treatment in the fall of 2020.

There were two main objectives of carp management work in 2020. Objective 1 focused on carp removal with box-nets and use of the mark-recapture method to estimate carp abundance and removal efficiency in Sweeney Lake and Schaper Pond. To complete this objective, two rounds of boat electrofishing surveys were conducted in Sweeney Lake and one survey on Schaper Pond to mark carp before removal. Box nets were installed in both water bodies in late June. Carp captured in the nets were removed in July and August. Objective 2 focused on documenting carp movement between Sweeney Lake and Schaper Pond to determine if spring removals via an electric guidance system would be feasible.

3.1 Sweeney Lake carp removal

Following preliminary electrofishing, Carp Solutions conducted two rounds of carp removal with baited box nets. They installed five box nets of varying sizes in the lake to conduct carp removal. Figure 2 shows the location of the nets. In addition, Carp Solutions installed an antenna around the bait in net 3; the antenna continuously scanned for the presence of PIT tagged carp at the bait and reported that data to a remotely monitored computer. Carp Solutions used the resulting information to determine the best time

to lift the nets (i.e. time when most carp were present at the bait), which was usually between 4 am and 6 am. All carp captured in box nets were euthanized and examined for fin clips from the spring surveys to estimate carp population in the lake and determine the percent of the population removed.

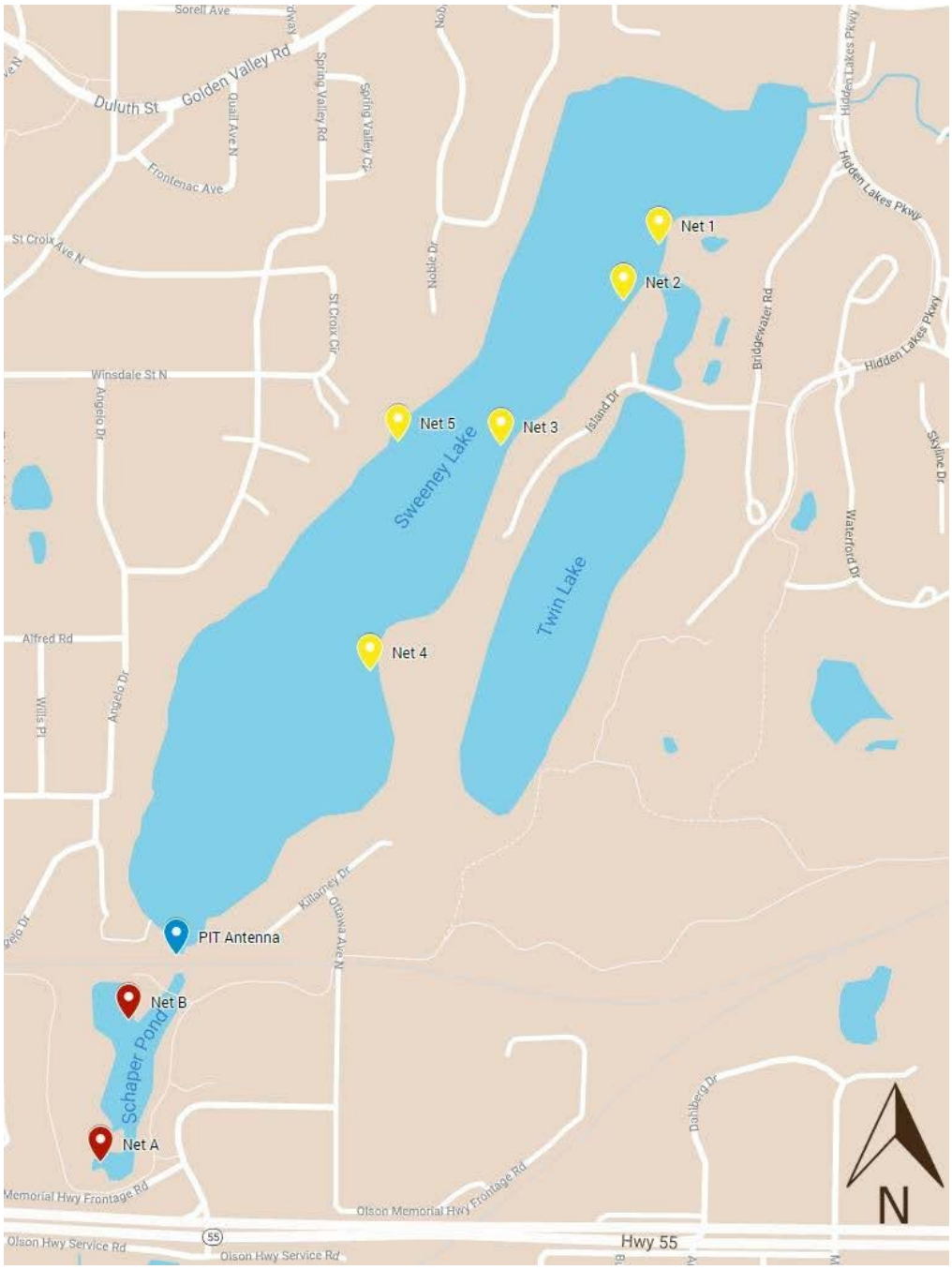

Figure 2: The location and ID numbers of nets in Schaper Pond (red) and Sweeney Lake (yellow) along with the PIT Antenna in between Schaper and Sweeney (blue).

The first round of box netting occurred on three separate days between June 18, 2020 and July 1, 2020. In the first round, 334 carp were removed (mean length 629 mm, mean weight 3.2 kg). Among those fish were 20 of the 69 carp that were marked and released in the spring of 2020. The second round of removal occurred on July 21, 2020 and resulted in the capture and removal of 118 carp (mean length 631 mm, mean weight 3.3 kg), among which were 10 carp marked in the spring. Captured carp were also scanned for PIT tags implanted during the 2018 survey work in Sweeney Lake.

Overall, 452 carp were captured and removed, including 30 individuals marked in June 2020. Carp Solutions used the recapture numbers to estimate that the pre-removal carp population was 1,022 and 43.5% of the carp population was removed. The carp biomass was reduced from 122 kg/ha (pre-removal) to 68 kg/ha (based on 2020 estimates).

3.2 Schaper Pond carp removal

Overall, 152 carp were captured and removed from Schaper Pond, including 9 of the 12 marked individuals. Additionally, 6 carp with left side pelvic fin clips, originally marked in Sweeney Lake in Spring 2020, were caught in Schaper Pond during electrofishing on September 30, 2020. These 6 carp were not included in the population estimate. Carp Solutions estimated that the pond was inhabited by 198 carp prior to removal; the 152 carp removed corresponds to a 76% removal rate. Of the carp removed, the mean length was 522 mm and mean weight was 1.93 kg. Pre-removal biomass in this small pond (1.2 ha) was 321 kg/ha; carp removal efforts reduced the biomass to 75 kg/ha.

3.3 Documenting carp movement between Sweeney Lake and Schaper Pond

To accomplish Objective 2, Carp Solutions installed a PIT system on May 8, 2020 at the southernmost end of Sweeney Lake inside of the culvert to track carp movement between Sweeney Lake and Schaper Pond. The location of the PIT system can be seen in the map on Figure 2. This PIT system was used to monitor the movement of carp that were tagged in 2018. Carp Solutions PIT tagged 69 carp in Schaper Pond on October 1, 2018 (50 of those were young-of-year and the rest were adults) and 100 carp in Sweeney Lake on October 2, 2018 (those were all adults). A total of 34 unique PIT tags were detected at the antenna in 2020, with 31 of the PIT tags corresponding with carp tagged in Sweeney Lake in 2018. Nineteen of the 34 carp detected at the antenna (55.9%) were captured in box nets throughout the summer. This removal likely contributed to a decline in carp activity at the antenna later in the summer, as individuals regularly visiting the antenna were captured and removed from the lake. Since 19 of the 34 PIT tags captured in box nets (51.4%) were detected at the PIT antenna between Schaper Pond and Sweeney Lake, this indicates that there is significant movement of carp in the system.

None of the 50 carp that Carp Solutions tagged as young-of-year in Schaper Pond in 2018 were detected by the PIT antennas in 2020. This suggests that the 2018-year class spawned in Schaper Pond has not yet recruited (i.e., become a source of juveniles) to the carp population in Sweeney.

4.0 Long-Term Control Options and Recommendations

Overall, the current data suggest that carp biomass in both Sweeney Lake and Schaper Pond is currently below 100 kg/ha, with no signs of carp recruitment detected in either water body in 2020. However, based on the PIT antenna data and that 6 carp tagged in Sweeney Lake in the spring of 2020 were later captured in Schaper Pond in the summer and fall of 2020 suggests that carp from Sweeney Lake could easily re-populate Schaper Pond and use it as a nursery, which would compromise stormwater treatment in the pond.

Physical and non-physical migration barriers, along with future carp removals and carp population/migration surveys (as needed), should be considered for long-term control of carp in the Sweeney Lake and Schaper Pond system to minimize the potential for future impacts to water quality. Such a barrier should also be designed to prevent movement of juvenile and adult carp from Schaper Pond to Sweeney Lake. The following carp control options should be considered (possibly in combination) and further evaluated:

- Carp removal through winter seining
- Carp removal through box netting and/or electrofishing
- Construction of a low-voltage electric barrier between Sweeney Lake and Schaper Pond
- Construction of a physical barrier(s) between Sweeney Lake and Schaper Pond
- Introduction of toxins with bait

The Commission would need to enter into an agreement with the City of Golden Valley for the construction and maintenance of an electric or physical barrier. Therefore, we recommend that the Commission work with the City of Golden Valley to evaluate the feasibility, maintenance, liability and long-term efficacy and costs of carp control options for the Sweeney Lake and Schaper Pond system. The results can be summarized, and carp control recommendations can be considered at a future Commission meeting.

References

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