SOUTH WASHINGTON WATERSHED DISTRICT

Powers Lake

DNR ID #82-0092	Municipality: Woodbury
Surface Area: 56 Acres	Watershed Area: 1,384 Acres
Mean Depth: 16 feet	Maximum Depth: 41 feet
SWWD Maximum Allowable Phosphorus Load: 0.06	
SWWD Trophic State Index (TSI) Goal: 50-55	

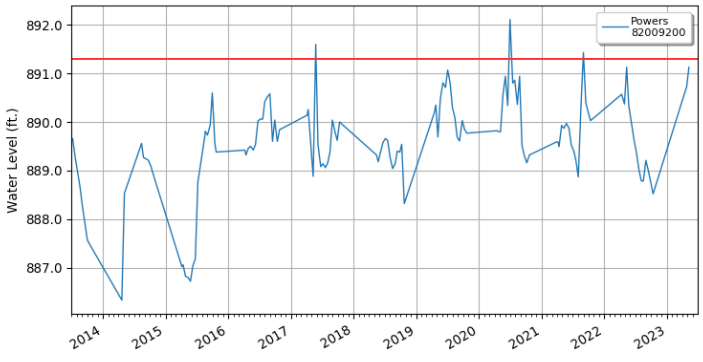
Map 1: Powers Lake

Powers Lake is a 56 acre lake in SWWD's Northern watershed. The lake has been the subject of several planning efforts, most recently through an updated lake management plan completed in 2019 by SWWD and City of Woodbury. This historically high quality lake lies in a naturally land-locked basin with several inlets that receive runoff from developed areas (Map 1). A lift station was installed in 1995 and serves as an emergency outflow.

The natural watershed draining to Powers Lake has been significantly expanded at the same time that historical hydrological connections with Wilmes Lake have been severed. In 1999, the contributing watershed was 430 acres. Due to urbanization and expansion of the storm sewer network, the Powers Lake drainage is currently approximately 1380 acres. The additional watershed area consists mostly of the Dancing Waters development which drains to Powers Lake via Fish Lake.

Powers Lake has a maximum depth of 41 feet and a littoral zone covering about 48 percent of its surface. The City has established a shore line preservation zone for the lake to ensure the lake has sufficient natural buffer around the perimeter. DNR fishery surveys were conducted in 1977, 1984, 1992, 2007, 2012, and 2022. The most recent survey is available at http://www.dnr.state.mn.us/lakefind/showreport.html?downum=82009200. The fishery is actively managed through the DNR's Fishing in the Neighborhood (FiN) program.

Figure 1: Powers Lake Surface Elevation



A vegetation survey of Powers Lake

was completed in 2021. 35% of the lake is vegetated with 5% of the lake having vegetation to the surface. While those percentages are low for District lakes, it is due to the depth of the lake which limits vegetation. The lake contains Eurasian watermilfoil, curly-leaf pond weed, and purple loosestrife all invasive, non-native plant species. However, abundance for all three remains low. The City of Woodbury occasionally harvests vegetation near shore which can periodically have dense vegetative cover.

Surface elevation of Powers Lake is shown in Figure 1. High fluctuations in surface elevation are often a concern for residents. However, Powers Lake does behave as expected for a closed basin system. Following wet periods and extreme events (early 2011, 2016, currently) the lake is at its highest levels (Ordinary High Water = 891.3 ft). Between wet periods/extreme events surface elevations recede (to around 885 ft). What isn't clear, though, is the importance of groundwater in maintaining elevations between wet years/extreme events, or how development and increased use of groundwater has impacted groundwater inflows.

Since Powers Lake lies in a closed basin, quality of inflows is especially important due to the increased nutrient/contaminant residence time. In its Watershed Management Plan, SWWD identified Powers Lake as a significant regional resource. With the goal of maintaining an in-lake trophic state index (TSI) of 50-55, the District has adopted a maximum allowable phosphorus load of 88 lbs/yr or 0.06 lbs/ac/yr throughout the Powers Lake watershed. Powers Lake routinely met SWWD and State standards prior to 2001 which would typically be reflected in a low expected frequency of (<10%) of nuisance algal blooms[1]. However, beginning with an increase in development in 2001 and continuing through 2010, there was a significant ($p < 0.01$) increase in in-lake TP concentrations (Figure 2) corresponding with large scale grading of the Dancing Waters development and expansion of the Powers Lake watershed. Likewise, secchi transparency (Figure 4) showed a significant and sustained decline ($p < 0.01$) during and following development. Chlorophyll a (Figure 3), however, has not shown consistent trends. Increased eutrophication from 2001 through 2010 is reflected in both declining lake grade (Table 4) as assigned by the Metropolitan Council and an expected increase in frequency (~25%) of nuisance conditions[1]. Fortunately, water quality has markedly improved since 2010, potentially indicating that effects from historical development activity are diminishing. The lake now generally meets both State and SWWD goals.
Of recent concern however, is increasing chloride concentrations (Figure 5). Chloride levels do meet applicable standards but the rate of increase is cause for concern, particularly in a closed basin where chloride will never leave the system. SWWD is working with the City of Woodbury and Washington County to improve winter de-icing operations which is the major source of chloride in metro watersheds.

[1] S.A. Heiskary & W.W. Walker. 1988. Developing Phosphorus Criteria for Minnesota Lakes. North American Lake Management Society, 4(1): 1-9.

Figure 2: In-lake Total Phosphorus Concentration at Powers Lake

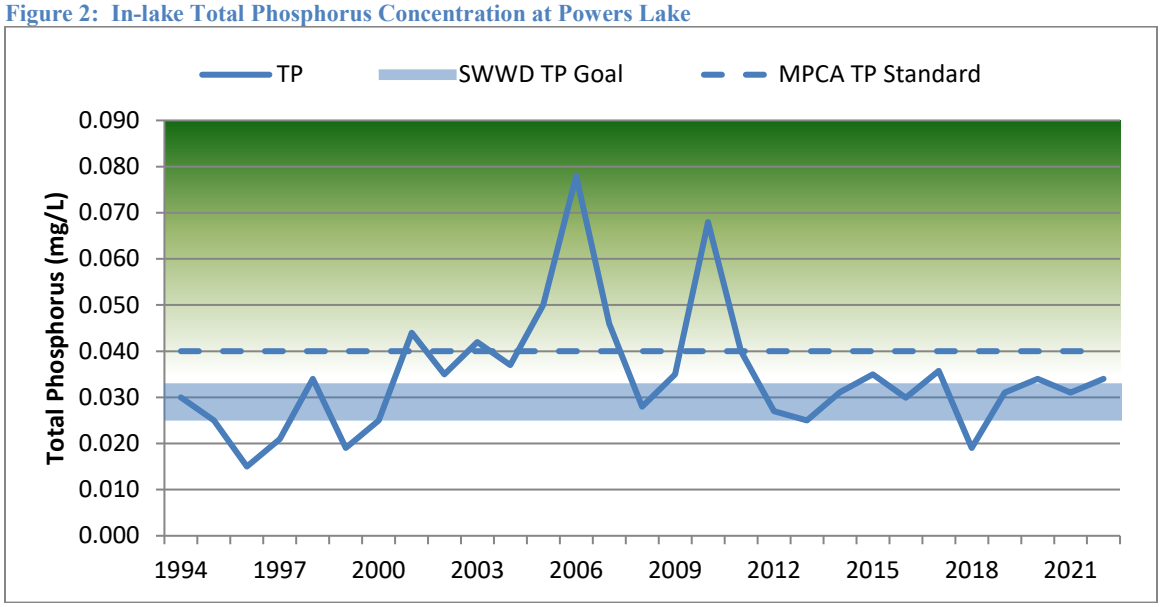


Figure 3: In-lake Chlorophyll a Concentrations at Powers Lake

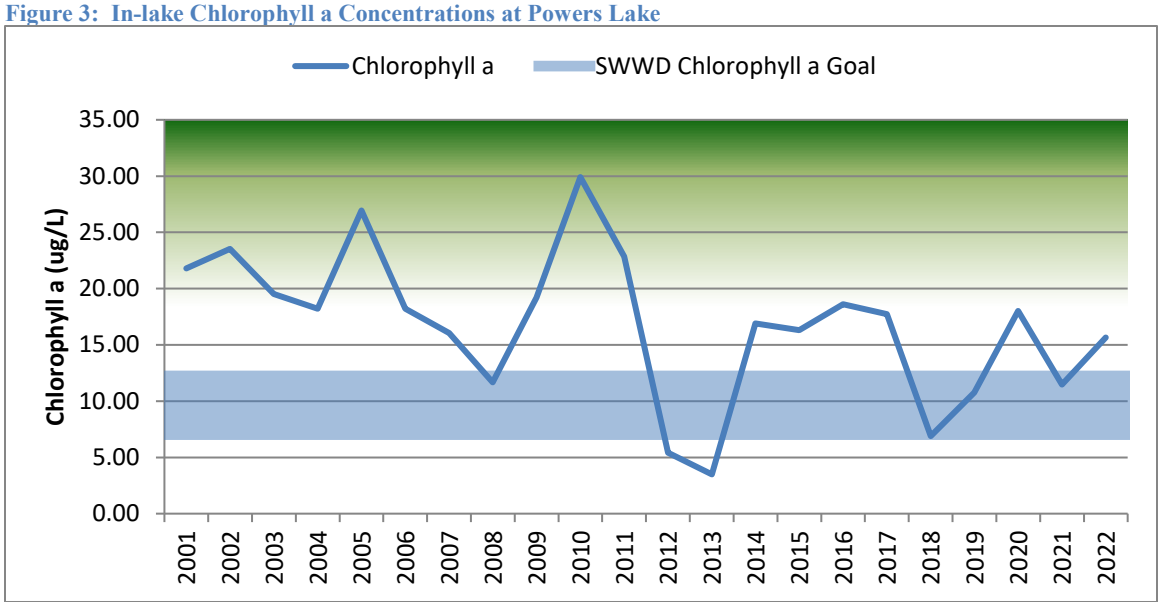


Figure 4: In-lake Secchi Transparency at Powers Lake

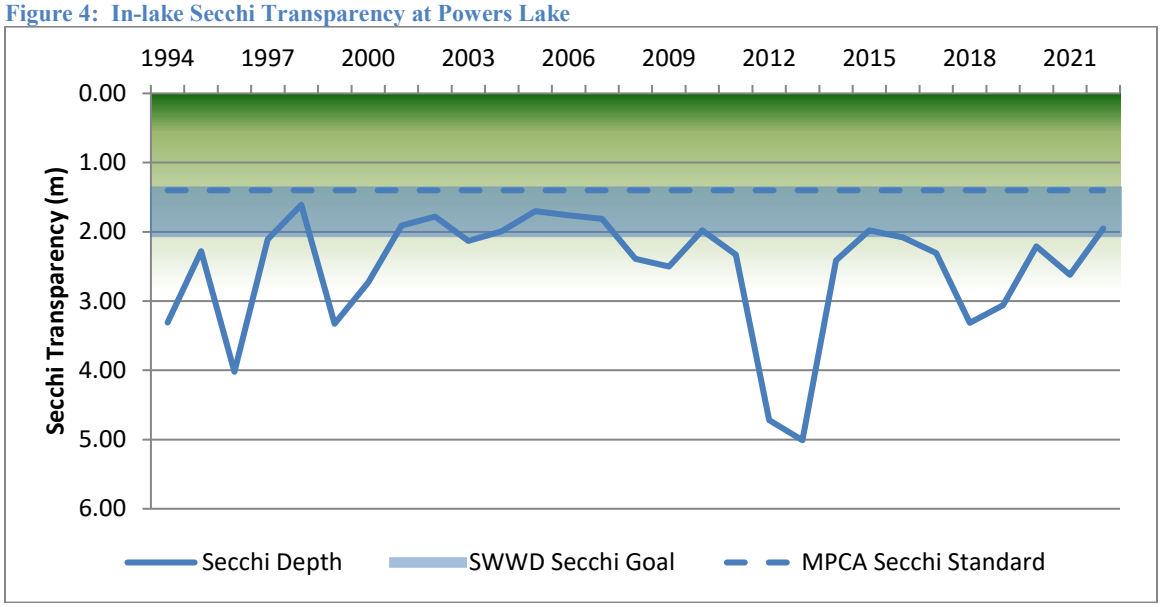


Figure 5: Chloride Concentrations at Powers Lake

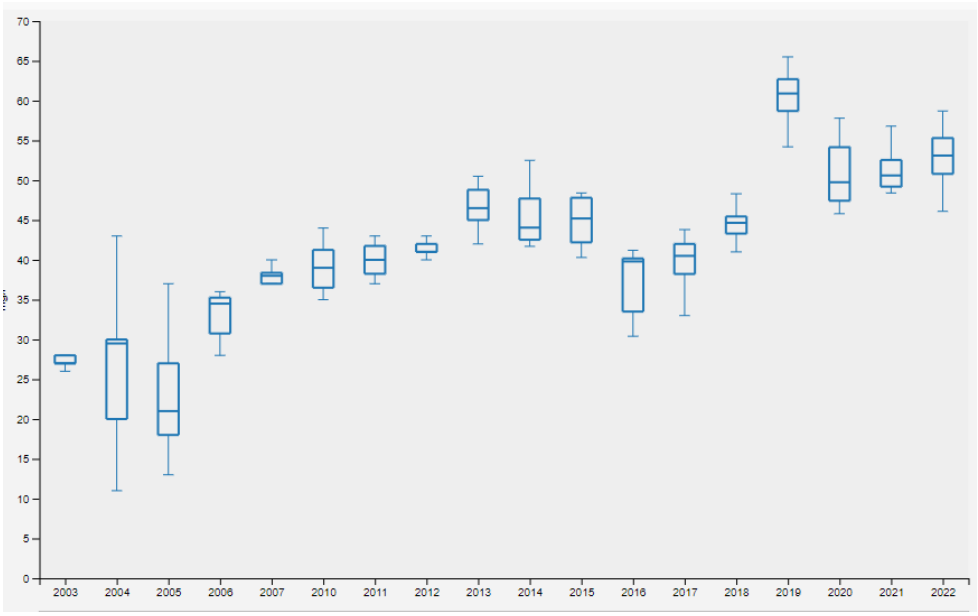


Table 1: Historic Lake Grades for Powers Lake

		Lake Grade																						
Parameter	Current Trophic Status	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22
Total Phosphorus	55; eutrophic	B	C	B	C	C	C	C	C	B	B	C	C	B	B	B	B	B	B	A	B	B	B	B
Chlorophyll	58; eutrophic	B	C	C	B	C	C	C	C	B	B	C	C	A	A	B	B	B	B	A	B	B	B	B
Secchi Transparency	50; mesotrophic	B	C	C	B	C	C	C	C	B	B	C	B	A	A	B	C	B	B	A	A	B	B	C
Overall	eutrophic	B	C	C	B	C	C	C	C	B	B	C	C	A	A	B	B	B	B	A	B	B	B	B

Note: Lake Grades are based on comparison with other lakes in the Minneapolis-St. Paul metropolitan area. Criteria for assigning lake grades are established by the Metropolitan Council.

SWWD in cooperation with the Washington Conservation District and City of Woodbury have completed a Subwatershed Retrofit Analysis that identifies the most cost-effective projects for reducing phosphorus loading to Powers Lake. Implementation of the identified projects is ongoing. To track effectiveness of those efforts, SWWD periodically monitors loading from various parts of the Powers Lake watershed. Below, are data (Table 2) collected at the Powers East inlet which provides a measure of water quality leaving the Dancing Waters residential neighborhood. While Dancing Waters has not been a major focus of retrofit in the past, it is a focus of the Hasenbank stormwater park that will be constructed in 2023. When completed, the new stormwater park will treat flows from Dancing Waters and Fish Lake prior to discharge to Powers Lake. Included in the table are results from 2005-2010 which provides a measure of water quality during the neighborhoods heavy construction period. Also included are results from 2015-2017 which provides a measure of water quality following the bulk of disturbance. SWWD will monitor the Powers East site again following completion of the Hasenbank stormwater park.

Table 2: Annual Loading Summary for Powers East

Year	April-Oct Precipitation (in)	Runoff Yield (cu ft runoff/ in precip)	April-Oct TP (lbs)	TP Yield (lbs/in precip)	April-Oct TSS (lbs)	TSS Yield (lbs/in precip)	April-Oct Chloride (lbs)	Chloride Yield (lbs/in precip)
2005	27	104,331	103	3.8	59,884	2,216	4,986	185
2006	18	245,646	53	2.9	4,403	244	10,217	566
2007	22	107,807	32	1.4	8,369	381	3,119	142
2008	17.5	162,961	23	1.3	3,623	207	8,019	458
2009	16.3	249,878	55	3.4	6,885	423	5,629	346
2010	24.8	589,448	288	11.6	41,102	1,658	25,508	1,029
2015	25.8	447,897	111	4.3	7,067	274	24,323	942
2016	31.8	476,682	102	3.2	9,585	301	25,415	799
2017	26	382,238	73	2.8	8,399	325	25,396	984

All SWWD monitoring data is available through SWWD's web database at http://wq.swwdmn.org/.