

Wrighter Lake  
C/O Mr. Tom Dooley  
6729 Mimosa Lane  
Dallas, Texas 75230

**RE: Wrighter Lake – 2021 SAV Survey  
Thompson, Pennsylvania  
Project #1950.002**

August 4, 2021

Dear Mr. Dooley,

Princeton Hydro is pleased to submit the following letter report detailing the submerged aquatic vegetation (SAV) survey conducted in 2021.

## Introduction

Wrighter Lake is an approximately 87-acre waterbody located in Susquehanna County, Pennsylvania. The immediate watershed surrounding Wrighter Lake is comprised of a mixture of forests, agriculture, and low-density residential which encompasses, primarily, the lake houses immediately surrounding the shoreline. The maximum depth of Wrighter Lake is approximately 11 m (36') with an extensive littoral zone where submerged aquatic vegetation (SAV) flourishes.

Wrighter Lake approached Princeton Hydro to conduct a SAV survey of the lake and to utilize this data to recommend SAV control measures. As such, Princeton Hydro conducted a complete survey of the lake on July 7, 2021. This survey is a follow-up to that conducted on July 7, 2020. The results of this survey, and implications for management, are discussed below.

## Methodology

The SAV survey was conducted by two (2) Princeton Hydro staff scientists on July 7, 2021. During this survey, nine (9) transects were sampled (Figure 1).



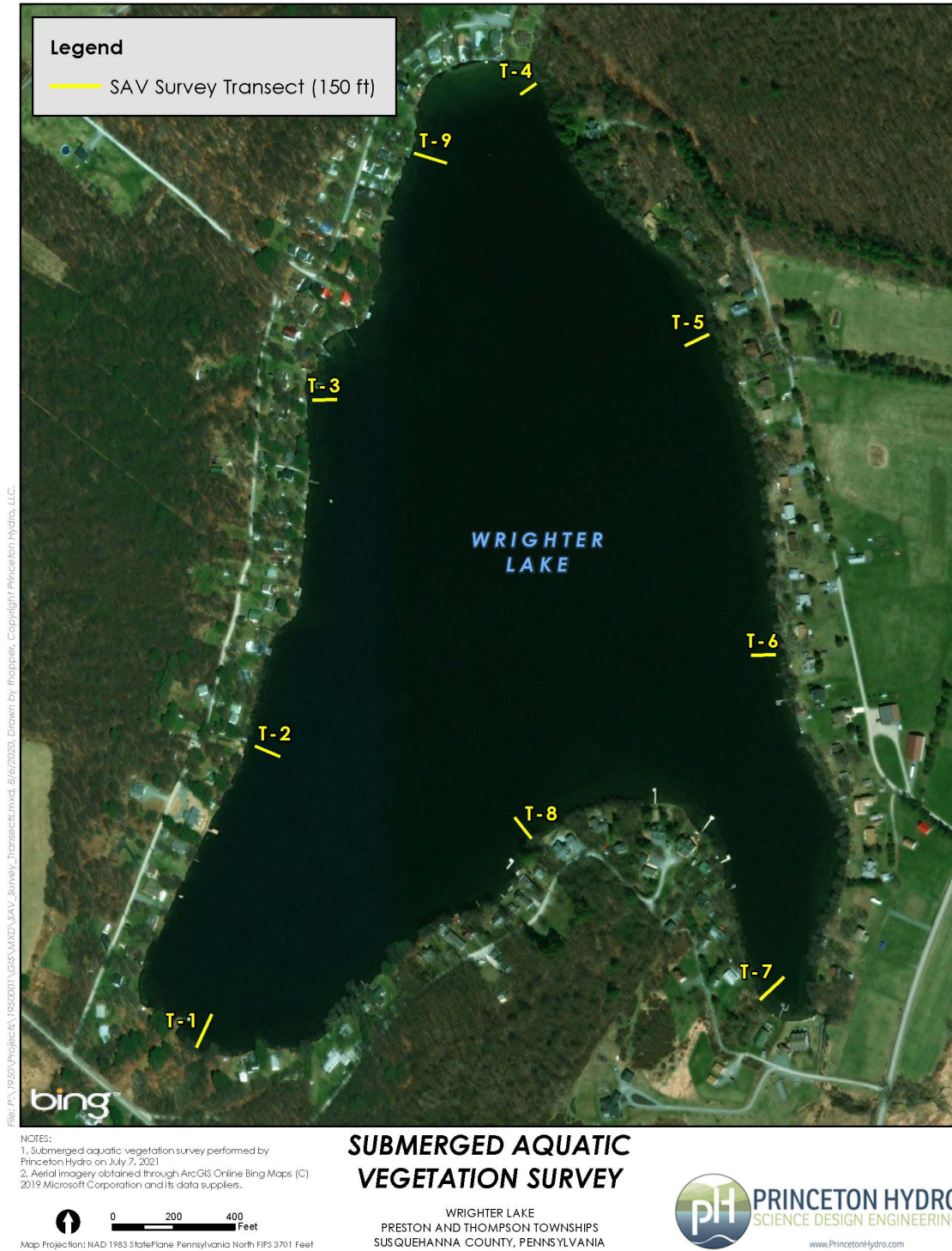


Figure 1: Wrighter Lake – 2021 SAV Survey Locations

Princeton Hydro conducted a SAV survey of nine (9) transects on July 7, 2021. Each transect was established near shoreline with a floating rope which was then extended 150' towards the center of the lake. The start and end point of each transect was then marked via GPS. Along each transect, Princeton Hydro surveyed a 1 m<sup>2</sup> quadrat at 20' intervals for a total of eight (8) distinct quadrats per transect. At each quadrat, Princeton Hydro surveyed all above ground plant biomass and identified each plant to lowest practical taxon; typically, species. At each quadrat, abundance was described utilizing the following protocol: (A) Abundant - > 50% of quadrat area, (C) Common - 20 - 50% of quadrat area, (P) Present - 10 - 20% of quadrat area, (R) Rare - < 10% of quadrat area. Finally, at a representative quadrat at each station, all above ground biomass was harvested and weighed as wet weight.

## Results

The following Table (Table 1) depicts the species list while Tables 2 and 3 provide the survey data.

**Table 1: Species List**

Wrighter Lake - 2021 Species List		
Common	Scientific	Type
Nitella	<i>Nitella</i> sp.	Submerged - Macroalgae
Curlyleaf Pondweed	<i>Potamogeton crispus</i>	Submerged
Tapegrass	<i>Vallisneria americana</i>	Submerged
Water Crow's Foot	<i>Ranunculus</i> sp.	Submerged
Slender Naiad	<i>Najas flexilis</i>	Submerged
Robbin's Pondweed	<i>Potamogeton robbinsii</i>	Submerged
Quillwort	<i>Isoetes</i> sp.	Submerged
Small Waterwort	<i>Elatine minima</i>	Submerged
Thinleaf Pondweed	<i>Potamogeton pusillus</i>	Submerged
White Water Lily	<i>Nymphaea odorata</i>	Floating
Pickrel Weed	<i>Pontedaria cordata</i>	Emergent
Spikerush	<i>Eleocharis palustris</i>	Emergent

**Table 2: Wrighter Lake – 2021 SAV Results**

Wrighter Lake - July 7, 2021 - SAV Survey (1 of 2)											
Transect	Species		Quadrat Distance (*)								Biomass (g)
	Common	Scientific	0'	20'	40'	60'	80'	100'	125'	150'	
1	Nitella	<i>Nitella</i> sp.									
	Curlyleaf Pondweed	<i>Potamogeton crispus</i>				P				R	
	Tapegrass	<i>Vallisneria americana</i>			R						
	Water Crow's Foot	<i>Ranunculus</i> sp.				P					
	Slender Naiad	<i>Najas flexilis</i>				R					
	Robbin's Pondweed	<i>Potamogeton robbinsii</i>					R*	P			
	Quillwort	<i>Isoetes</i> sp.									
	Small Waterwort	<i>Elatine minima</i>									
	Thinleaf Pondweed	<i>Potamogeton pusillus</i>									
	White Water Lily	<i>Nymphaea odorata</i>	P	C	A	P					
	Pickereel Weed	<i>Pontedaria cordata</i>		R							
	Spikerush	<i>Eleocharis palustris</i>									
2	Nitella	<i>Nitella</i> sp.							A	A	
	Curlyleaf Pondweed	<i>Potamogeton crispus</i>		P	R	R		P*		R	
	Tapegrass	<i>Vallisneria americana</i>									
	Water Crow's Foot	<i>Ranunculus</i> sp.		R							
	Slender Naiad	<i>Najas flexilis</i>									
	Robbin's Pondweed	<i>Potamogeton robbinsii</i>		R							
	Quillwort	<i>Isoetes</i> sp.		R							
	Small Waterwort	<i>Elatine minima</i>									
	Thinleaf Pondweed	<i>Potamogeton pusillus</i>									
	White Water Lily	<i>Nymphaea odorata</i>			C						
	Pickereel Weed	<i>Pontedaria cordata</i>	A								
	Spikerush	<i>Eleocharis palustris</i>									
3	Nitella	<i>Nitella</i> sp.									
	Curlyleaf Pondweed	<i>Potamogeton crispus</i>		R	R	P	C		C	A*	
	Tapegrass	<i>Vallisneria americana</i>									
	Water Crow's Foot	<i>Ranunculus</i> sp.									
	Slender Naiad	<i>Najas flexilis</i>			C	C	C				
	Robbin's Pondweed	<i>Potamogeton robbinsii</i>								P*	
	Quillwort	<i>Isoetes</i> sp.									
	Small Waterwort	<i>Elatine minima</i>									
	Thinleaf Pondweed	<i>Potamogeton pusillus</i>									
	White Water Lily	<i>Nymphaea odorata</i>						P			
	Pickereel Weed	<i>Pontedaria cordata</i>	A								
	Spikerush	<i>Eleocharis palustris</i>		A							
4	Nitella	<i>Nitella</i> sp.									
	Curlyleaf Pondweed	<i>Potamogeton crispus</i>		R	P	R	C	A	A*	A	
	Tapegrass	<i>Vallisneria americana</i>									
	Water Crow's Foot	<i>Ranunculus</i> sp.									
	Slender Naiad	<i>Najas flexilis</i>		R							
	Robbin's Pondweed	<i>Potamogeton robbinsii</i>			P	P		R	R*		
	Quillwort	<i>Isoetes</i> sp.									
	Small Waterwort	<i>Elatine minima</i>									
	Thinleaf Pondweed	<i>Potamogeton pusillus</i>									
	White Water Lily	<i>Nymphaea odorata</i>									
	Pickereel Weed	<i>Pontedaria cordata</i>									
	Spikerush	<i>Eleocharis palustris</i>									

\*Denotes harvested quadrat

**Table 3: Wrighter Lake – 2021 SAV Results**

Wrighter Lake - July 7, 2021 - SAV Survey (2 of 2)											
Transect	Species		Quadrat Distance (*)								Biomass (g)
	Common	Scientific	0'	20'	40'	60'	80'	100'	125'	150'	
5	Nitella	<i>Nitella</i> sp.								R	77
	Curlyleaf Pondweed	<i>Potamogeton crispus</i>			R	C	A*	C			
	Tapegrass	<i>Vallisneria americana</i>									
	Water Crow's Foot	<i>Ranunculus</i> sp.				R					
	Slender Naiad	<i>Najas flexilis</i>									
	Robbin's Pondweed	<i>Potamogeton robbinsii</i>			R	R	P*	A		R	
	Quillwort	<i>Isoetes</i> sp.									
	Small Waterwort	<i>Elatine minima</i>									
	Thinleaf Pondweed	<i>Potamogeton pusillus</i>									
	White Water Lily	<i>Nymphaea odorata</i>									
	Pickereel Weed	<i>Pontedaria cordata</i>									
Spikerush	<i>Eleocharis palustris</i>		R								
6	Nitella	<i>Nitella</i> sp.									150
	Curlyleaf Pondweed	<i>Potamogeton crispus</i>		C*	R						
	Tapegrass	<i>Vallisneria americana</i>									
	Water Crow's Foot	<i>Ranunculus</i> sp.									
	Slender Naiad	<i>Najas flexilis</i>									
	Robbin's Pondweed	<i>Potamogeton robbinsii</i>			R		R				
	Quillwort	<i>Isoetes</i> sp.									
	Small Waterwort	<i>Elatine minima</i>									
	Thinleaf Pondweed	<i>Potamogeton pusillus</i>									
	White Water Lily	<i>Nymphaea odorata</i>									
	Pickereel Weed	<i>Pontedaria cordata</i>	C	A*							
Spikerush	<i>Eleocharis palustris</i>										
7	Nitella	<i>Nitella</i> sp.								R	117
	Curlyleaf Pondweed	<i>Potamogeton crispus</i>	C	C		A	A*	A	P	P	
	Tapegrass	<i>Vallisneria americana</i>				R					
	Water Crow's Foot	<i>Ranunculus</i> sp.									
	Slender Naiad	<i>Najas flexilis</i>				R		R			
	Robbin's Pondweed	<i>Potamogeton robbinsii</i>			P						
	Quillwort	<i>Isoetes</i> sp.	R								
	Small Waterwort	<i>Elatine minima</i>									
	Thinleaf Pondweed	<i>Potamogeton pusillus</i>									
	White Water Lily	<i>Nymphaea odorata</i>		P							
	Pickereel Weed	<i>Pontedaria cordata</i>									
Spikerush	<i>Eleocharis palustris</i>						R				
8	Nitella	<i>Nitella</i> sp.			R	R	P*	C	A	A	4
	Curlyleaf Pondweed	<i>Potamogeton crispus</i>					R*				
	Tapegrass	<i>Vallisneria americana</i>									
	Water Crow's Foot	<i>Ranunculus</i> sp.									
	Slender Naiad	<i>Najas flexilis</i>			R						
	Robbin's Pondweed	<i>Potamogeton robbinsii</i>				R					
	Quillwort	<i>Isoetes</i> sp.									
	Small Waterwort	<i>Elatine minima</i>									
	Thinleaf Pondweed	<i>Potamogeton pusillus</i>						C			
	White Water Lily	<i>Nymphaea odorata</i>									
	Pickereel Weed	<i>Pontedaria cordata</i>		P							
Spikerush	<i>Eleocharis palustris</i>										
9	Nitella	<i>Nitella</i> sp.						R	R		128
	Curlyleaf Pondweed	<i>Potamogeton crispus</i>						R*	R	R	
	Tapegrass	<i>Vallisneria americana</i>								P	
	Water Crow's Foot	<i>Ranunculus</i> sp.									
	Slender Naiad	<i>Najas flexilis</i>									
	Robbin's Pondweed	<i>Potamogeton robbinsii</i>			A	A	A*	P	R		
	Quillwort	<i>Isoetes</i> sp.									
	Small Waterwort	<i>Elatine minima</i>									
	Thinleaf Pondweed	<i>Potamogeton pusillus</i>									
	White Water Lily	<i>Nymphaea odorata</i>									
	Pickereel Weed	<i>Pontedaria cordata</i>									
Spikerush	<i>Eleocharis palustris</i>										

\*Denotes harvested quadrat

The SAV survey showed the only non-native, invasive species to be identified in the lake as curlyleaf pondweed. This species was present at every transect surveyed. The highest densities of curlyleaf pondweed were at Transect 4. Total SAV biomass ranged from a minimum of 4 g/m<sup>2</sup> at Transects 2 and 8 with a maximum biomass of 297 g/m<sup>2</sup> at Transect 4.

SAV biomass was generally lower in 2021 compared to 2020. In 2020, biomass ranged from 3 g/m<sup>2</sup> to 1,577 g/m<sup>2</sup> with a mean biomass of 388 g/m<sup>2</sup>. Mean biomass in 2021 was 101 g/m<sup>2</sup>.

## Recommendations

The data collected as part of the July 7, 2021 event showed low to moderate densities of curlyleaf pondweed but this plant was distributed throughout the entirety of the lake.

For management and eradication, Wrighter Lake can utilize the early-growth timing of curly-leaf pondweed, in conjunction with specific herbicides, to selectively target the eradication of this plant with little to no damage to desirable native macrophytes. A low dose (< 10 ppb) application of Fluridone (Trade name: Sonar) may serve to highly damage curly-leaf pondweed with intermediary or limited effects on desirable SAV including Robbin's pondweed, thin-leaf pondweed, and large-leaf pondweed (Smith et. al., 1997). Fluridone is a systemic based herbicide which is taken up by the plants roots and is distributed throughout the plant tissue. Optimal application timing is in early-May prior to turion formation by curly-leaf pondweed. A multiple (3-5 year) application period may be necessary to eradicate this plant. It is likely that one (1) split treatment is needed per year.

Utilization of a systemic herbicide is a permitted activity in the Commonwealth of Pennsylvania via a joint permit between the Pennsylvania Department of Environmental Protection (PADEP) and the Pennsylvania Fish and Boat Commission (PAFBC). Application is governed under an Aquatic Pesticide Permit with application of areas greater than 80-acres only approved with an additional National Pollutant Discharge Elimination System (NPDES) permit. Given the distribution of the plant, and the mechanism of the herbicide, the entirety of the lake would need to be treated.

Application of Sonar AS includes a zero-day restriction on swimming, drinking, fishing, pet and livestock consumption but does carry a 14-day restriction for use of lake water for irrigation.

Princeton Hydro recommends a follow up SAV survey in July 2022 to assess plant response to any management efforts.

Thank you for your review of this letter report. If you have any additional questions, please contact me at 908-237-5660.

Sincerely,



Michael Hartshorne  
Senior Project Manager – Aquatics; Aquatic Ecologist  
Princeton Hydro, LLC

cc: Dr. Fred Lubnow, Director of Aquatics, Princeton Hydro  
Tyler Overton, Senior Field Operations Manager, Princeton Hydro