

MEDICINE LAKE CURLY-LEAF PONDWEED TREATMENTS AND EFFECTS

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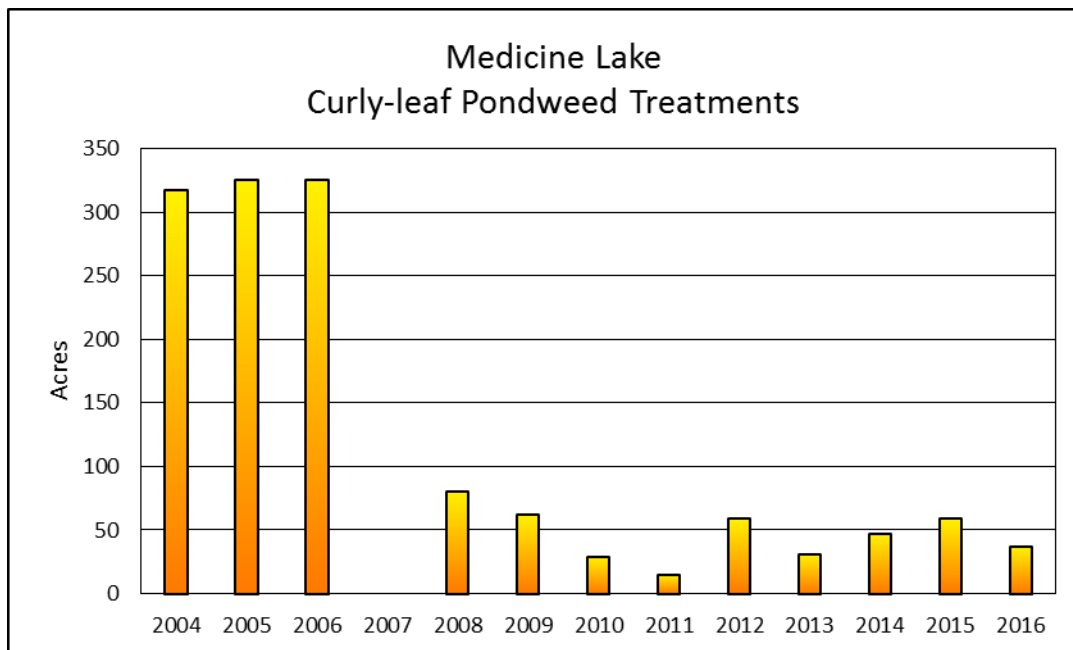
THREE RIVERS PARK DISTRICT

December 2016

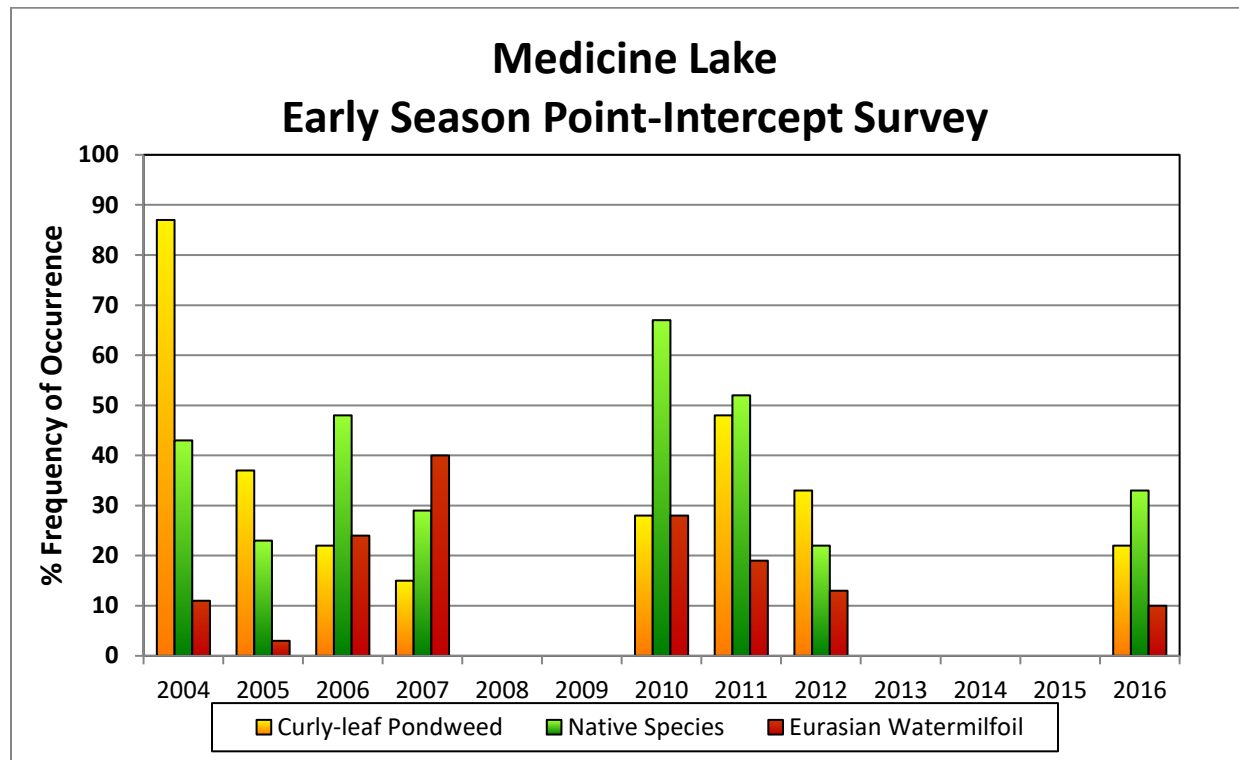
- Medicine Lake was one of the first lakes in the state to get a variance for a whole lake treatment for control of curlyleaf pondweed. The project was a collaborative effort between the City of Plymouth, Minnesota Department of Natural Resource, Army Corp of Engineers, and Three Rivers Park District. The lake historically had 300 acres of moderate to heavy nuisance growth of curlyleaf pondweed. The whole lake treatments occurred for three consecutive years from 2004 through 2006.
- It was initially thought that three years of consecutive herbicide treatments occurring early season prior to turion development would reduce the residual seed bank within the sediments. Consequently, there was no herbicide treatment conducted in 2007. Surveys indicated that there was still nuisance growth of curlyleaf pondweed within some areas of the lake in 2007. It was recommended that spot treatments occur each consecutive year depending on the amount of nuisance growth of curlyleaf pondweed. The areas treated within the lake were determined from stem density surveys performed by Steve McComas of Blue Water Science. The amount of nuisance growth varied from year to year. The acreage that was treated ranged from 15 to 80 acres from 2008 through 2016.
- Point intercept surveys were conducted by the Army Corp of Engineers, Minnesota Department of Natural Resources, and Three Rivers Park District. The early season surveys indicated that there was a decrease in the percent frequency of curlyleaf pondweed during the period of the whole lake treatments (2004-2006). The percent frequency of curlyleaf pondweed following the whole lake treatments varied each year. Medicine Lake has a relatively diverse native plant community, which typically has approximately 12 different native plant species present within the lake during the year. There did not seem to be an improvement in the % frequency of the native plant community for both the early season and late season surveys. There was concern that there would be an increase in Eurasian Watermilfoil as a secondary consequence of controlling curlyleaf pondweed. The percent frequency of Eurasian watermilfoil did increase from 2004 through 2006, and the percent frequency continued to remain high in 2007 and 2009. However, the percent frequency of Eurasian watermilfoil has been variable from year to year since 2009 and does not seem to be increasing within the lake. It should be noted that there does not appear to be any negative impacts to the native plant community during those years in which there has been curlyleaf pondweed control and increases in Eurasian watermilfoil.
- The growing season averages for total phosphorus, chlorophyll-a, and secchi depth suggest that there does not appear to be any changes in water quality for Medicine Lake from 2004 – 2016. Medicine Lake receives a significant amount of nutrient loading from the watershed (50%) as well as internal loading from nutrient release from the sediments during anoxic conditions (47%). Internal loading from curlyleaf pondweed is a small amount relative to these other sources of nutrient loading.
- There have been several projects implemented in the watershed to reduce external nutrient loading. Medicine Lake also has the potential to mix (de-stratify) several times within a year. Prevailing winds from the north and south for extended time periods of time can temporarily de-stratify the lake and exacerbating internal loading processes. Consequently, nutrient load reductions due to curlyleaf pondweed control may not be significant enough to notice any water quality improvements, and is most likely off-set due to these other sources of nutrient loading.
- Based on curlyleaf pondweed biomass samples analyzed for total phosphorus concentration, it was estimated that the total phosphorus load from senescence of curlyleaf pondweed was approximately 1050 pounds. This load attributed to the senescence of curlyleaf pondweed represented approximately 12% of the total load and 25% of the internal load that was identified in the Medicine Lake TMDL.

- Three Rivers Park District indicated that in-lake water quality improvements in response to nutrient load reductions most likely will not be noticeable in eutrophic lakes until in-lake phosphorus concentrations achieve a “tipping point” of 50 µg/L. After a eutrophic lake has an average in-lake phosphorus concentration of 50 µg/L, then incremental decreases in watershed and internal loading begin to have more noticeable improvements in water quality conditions. Medicine Lake currently has an average in-lake phosphorus concentration of 60 µg/L. Consequently, Medicine Lake has not had many noticeable water quality changes despite the continued efforts to reduce portions of the internal load by controlling curlyleaf pondweed and/or reduce watershed loading through implementation of best management practices.

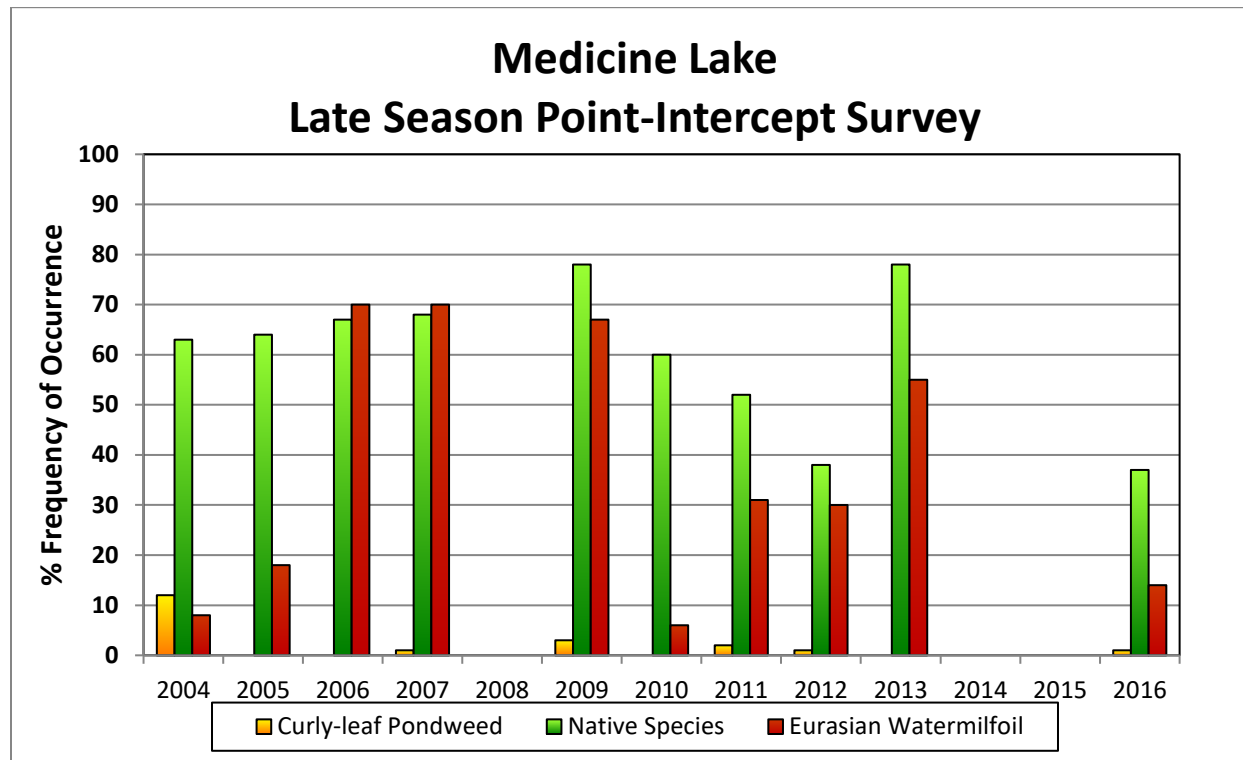
Curly-leaf Pondweed Treatments	
Year	Acres Treated
2004	317
2005	325
2006	325
2007	0
2008	80
2009	62
2010	29
2011	15
2012	59
2013	31
2014	47
2015	59
2016	37

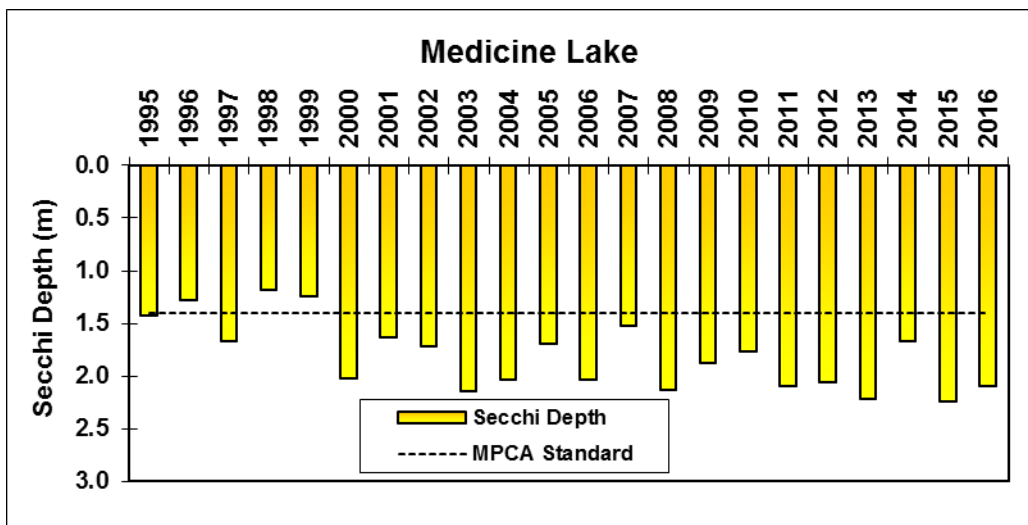
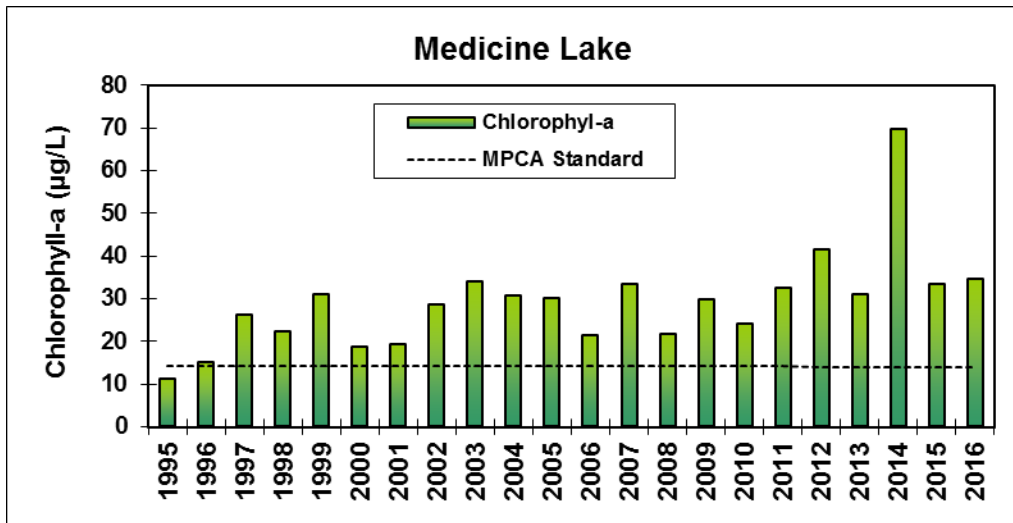
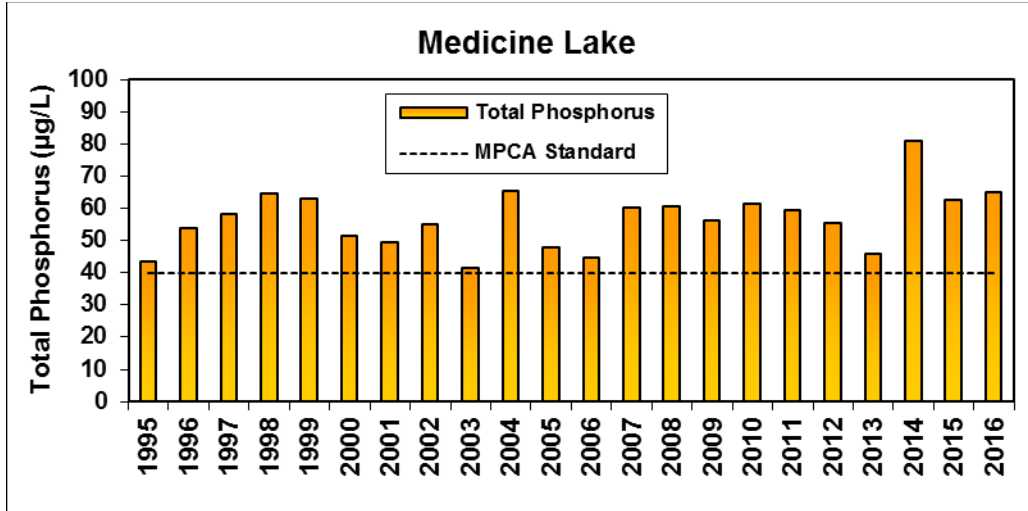


Medicine Lake Point-Intercept Survey													
Early Season Spring/Summer Survey													
Taxa Category	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
<i>Curly-leaf Pondweed</i>	87	37	22	15			28	48	33				22
<i>Native Species</i>	43	23	48	29			67	52	22				33
<i>Eurasian Watermilfoil</i>	11	3	24	40			28	19	13				10



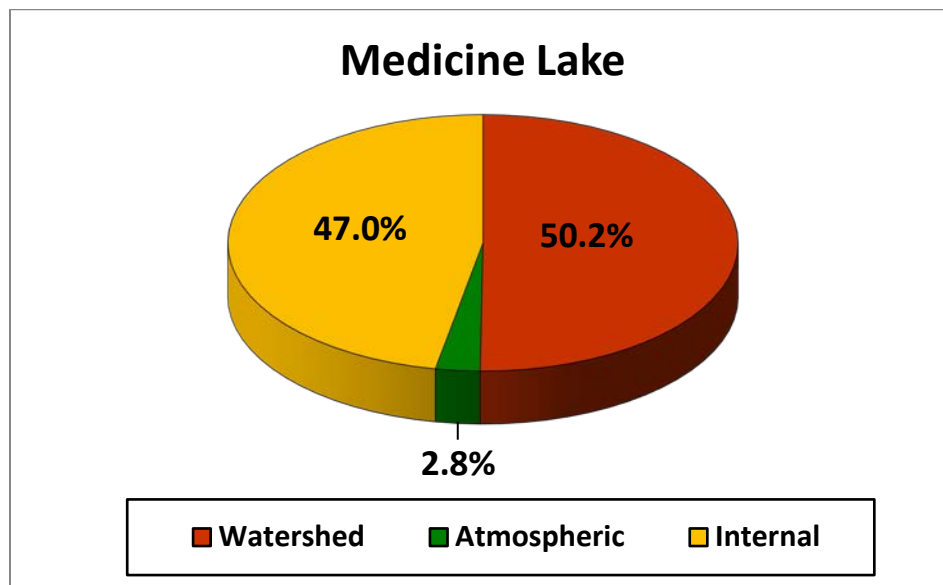
Medicine Lake													
Late Season Summer/Fall Survey													
Taxa Category	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
<i>Curly-leaf Pondweed</i>	12	0	0	1		3	0	2	1	0			1
<i>Native Species</i>	63	64	67	68		78	60	52	38	78			37
<i>Eurasian Watermilfoil</i>	8	18	70	70		67	6	31	30	55			14





Medicine Lake TMDL

TP Source	TP Load (lbs/yr)			% Reduction
	Current	TMDL	Reduction	
Watershed	4517	3230	1287	28%
Atmospheric	253	253	0	0%
Internal	4232	0	4232	100%
Total	9002	3753	5519	61%



Medicine Lake Curly-leaf Pondweed Phosphorus Load					
Site	Acreage	Average			TP Loading (pounds)
		Biomass (g dry wt/m ²)	TP Concentration (mg/g dry wt)	Unit Area Load (lbs TP/Acre)	
1	147.3	83.4	4.80	3.19	469.8
2	42.2	92.1	2.29	1.86	78.4
3	136.3	92.8	3.73	3.08	419.7
4	50.0	38.6	4.91	1.65	82.6
Total					1050.0

- Curly-leaf pondweed phosphorus load represented approximately 12% of the total load, and 25% of the total internal load.