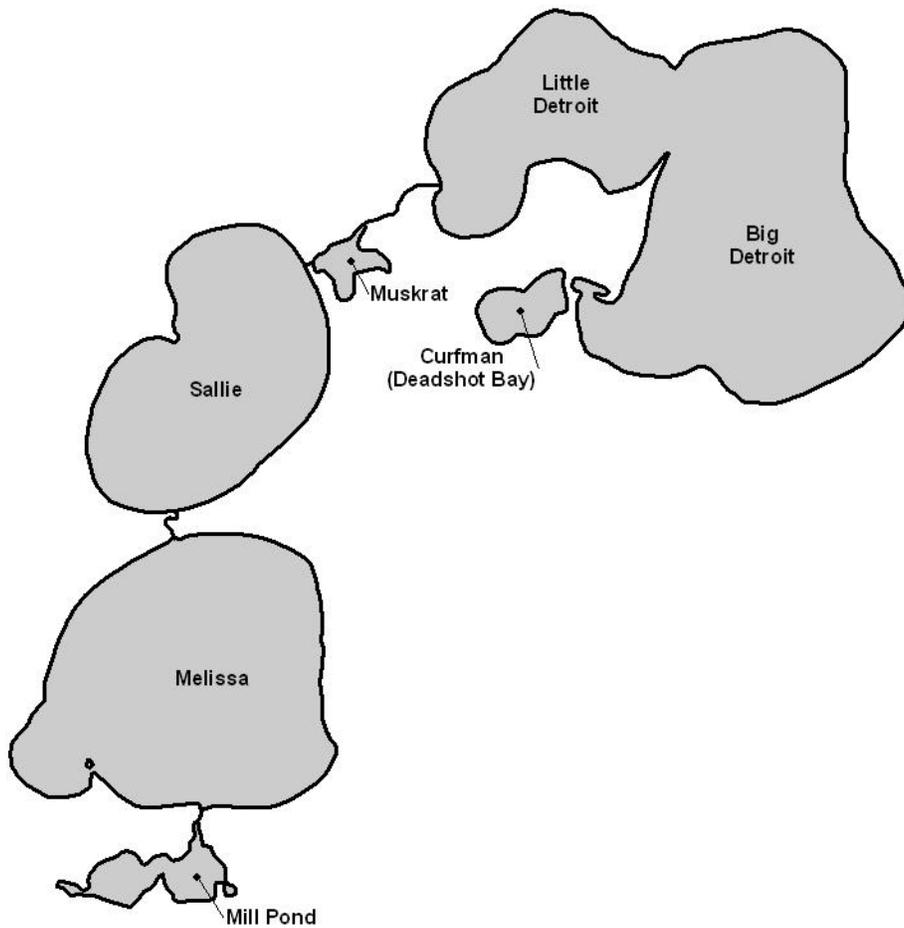


# PRWD Aquatic Plant Management Plan

## for the

### Lower Lake system (DL to Mill Pond)



**3-19-10**

Dick Hecock

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**The Mission of the PRWD is to enhance the quality of water in the lakes within its jurisdiction. It is understood that to accomplish this, the District must ensure that wise decisions are made concerning the management of streams, wetlands, lakes, groundwater, and related land resources which affect these lakes.**

**THE WATER QUALITY OF DISTRICT LAKES  
SHALL NOT BE FURTHER DEGRADED -  
(main goal of the PRWD in the 2005  
Revised Management Plan)**

## **1. Introduction**

*The Pelican River Watershed District's 2005 Revised Management Plan called for preparation of aquatic plant management plans for several of the district's Lake Water Quality Management Areas, including the Big and Little Detroit lakes, Curfman, Muskrat, Sallie, Melissa and Mill Pond. In February 2008, the District's Managers agreed to pursue this planning effort during 2008-2009. The intent was to use such a document to guide the District's actions with respect to aquatic plants for the remainder of the district's 10 year planning period which extends to 2015.*

*Regarding this effort, the Managers agreed that the plan would...*

- take a broad view of aquatic plant management (e.g. may include shoreline habitat measures, shoreline and roadside pickup, preventing exotic species introduction)
- solicit stakeholder inputs in shaping the process, and making recommendations for outcomes
- include specific measures for continued Flowering Rush control, and addressing impacts from Curly-leaved pondweed infestations
- give considerable weight to usage impairment in shaping other treatment actions
- include an educational component (to educate riparian owners and lake users on the values of sustainable aquatic ecosystems)
- include recommendations for administrative and funding mechanisms for implementation

*The planning effort was expected to coordinate with Minnesota Department of Natural Resources (DNR) "aquatic plant management" regulations, which were under revision in 2008 and then implemented in mid-2009. The new rules contained more detailed procedures for the preparation of Lake Vegetation Management Plans (LVMP). It was decided to organize the district's planning efforts to facilitate preparation of those specific LVMP's later.*

### **Planned Schedule**

Summer, 2008 – Obtain aquatic plant data

Winter, 2009 – assemble data on lakes, seek public input, summarize concerns, identify impacts

Spring and summer, 2009 - set goals, outline plan of action

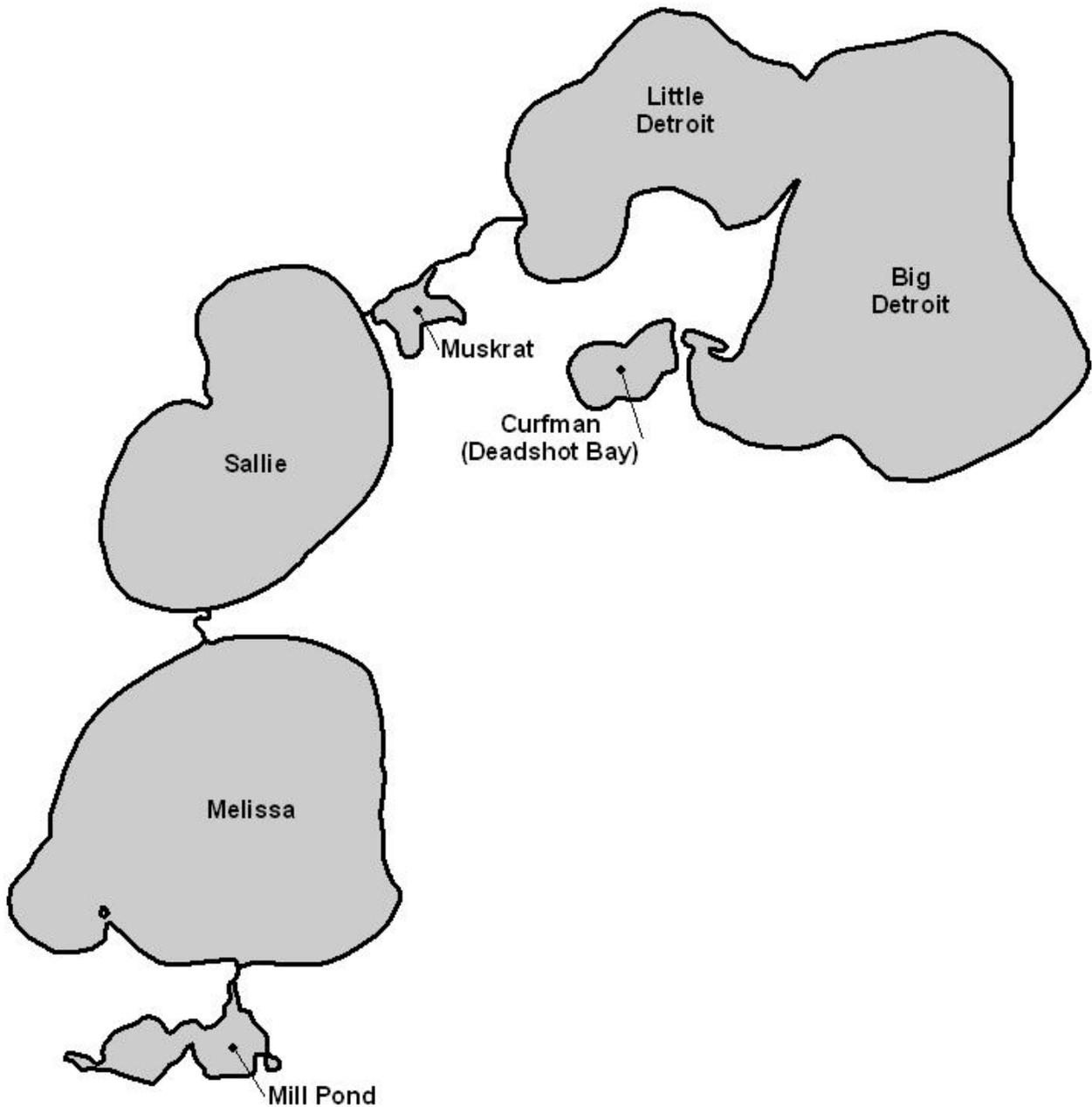
Fall, 2009 – hold additional public meetings; revisions as necessary

Winter, 2009-2010 – present plan for review

## Planning Area

The district has been involved in aquatic plant management since its inception. Initially such activities were focused on lakes Melissa and Sallie, but with the introduction and rapid spread of the exotic Flowering Rush, management expanded to include Big and Little Detroit Lake and Curfman. Flowering Rush has moved down the Pelican chain and is now found in the Pelican River, in Muskrat Lake, and in Mill Pond. These waterbodies also contain the main Curly-leaved pondweed infestations. Other lakes in the district do not currently exhibit significant problems with invasive species.

Accordingly, the planning effort here is confined to the waterbodies depicted below.



## History of Aquatic Plant Management in Area Lakes by PRWD

The perception that water quality was deteriorating on certain of the area's lakes led to the creation of the PRWD by the Minnesota Water Resources Board in 1966.

*"principal bodies of water in the upper reaches of the watercourse of the Pelican River, Detroit Lake, Lake Sallie and Lake Melissa, have become at certain times during the summer recreational months, unhealthy and unsightly due to excessive weed and algae growths. Such undesirable growths along the shores of the above lakes have interfered with boating, fishing and swimming; and have denied lake home owners the enjoyment of water scenery. In addition, weeds and algae growths have affected lake property value." (MWRB, 1966)*

Weed problems and weed control are not new to district lakes. Concern about lake weeds was a principal reason for the formation of both Lake Detroiters and Melissa-Sallie Improvement Association in the 1940's. At various times these organizations, as well as the City of Detroit lakes, used chemical and mechanical methods to control aquatic vegetation growth. The failure of those efforts to solve the "weed problem" had a good deal to do with the 1966 formation of the Pelican River Watershed District.

Cutting and removal ("harvest") of lake vegetation has been a part of the district's activities since its inception. The district purchased its first harvester in 1967 using grant fund and local contributions from the City of Detroit Lakes, Lakeview Township and the two lake associations.

The initial harvest project goals included nutrient reduction (on the theory that removing plant debris containing nutrients would be beneficial), as well as removal of plants considered a recreational nuisance. However, research conducted on Lake Sallie (1970-1972) showed that the nutrient reduction component was relatively small compared to the available in-lake nutrients, so in subsequent projects that purpose was given less attention compared to recreational usage, navigation, water quality, and property value enhancement.

Harvesting occurred on Melissa and Sallie almost every year after 1967. As Flowering Rush (FR) became more of a problem on Curfman and the Detroiters, pressure mounted for the district to commence treatment on those lakes too. After a couple of years of sporadic attempts at chemical treatment and some mechanical harvesting, a project was established that began in 1991 with new equipment. Spurred by a DNR Management Plan which called for FR control by means of multiple cuttings each year, aquatic plant harvesting grew each year from 1994 to 2002 (see Appendix 1).

It became clear towards the end of this period that the repeat-harvest approach had failed to curtail the FR spread. For a few seasons thereafter (2003-2005), harvesting was conducted mainly for purposes of providing navigation and access. Since 2005, harvesting has been utilized almost exclusively to deal with curly-leaf pondweed (see Appendix 1 for 1992-2009 history of plant removal).

Shoreline and Roadside Pickup of vegetation material is a PRWD service has offered to riparian residents of project lakes. These procedures involved the removal of aquatic plants which have come ashore. Shoreline pickup has diminished over the years, in part because of equipment access problems. In recent years, roadside pickup has been the main approach and remains a popular program, though it is not specifically mentioned as a project purpose.

In 2003 the district began experimenting with herbicides as a means of FR control. Several chemicals were tried, including various formulations of 2-4D,(granular and liquid), Glysophate, and Diquat, together with several surfactants. Eight 100x100 sites on Curfman and Big Detroit were treated by a commercial applicator in 2003. Three additional sites were treated by “handwicking”. These sites were re-treated again in 2004, but in that year Habitat (Imazapyr) was also tested on an additional site. Stem Counts and photographic evidence showed considerable variations in treatment success. Habitat showed exceptional promise, and in 2005 was used to treat additional sites on Curfman and Detroit as well as on Melissa and Sallie, while experiments with other chemicals was abandoned.

Once again from those tests Habitat appeared to offer FR control, and it was permitted for widespread use in those same lakes from 2006 through 2009. The lack of evidence of consistent treatment efficacy during these years was thought to be related treatment timing, and changing environmental conditions (water levels, temperatures, etc.). Having learned that FR had spread downstream from Melissa, Mill Lake was added to the treatment list in 2008.

## 2. Background Information on Lakes and Rivers

### 2.1 Watershed Description.

The land area which drains directly to these water bodies includes about 36,000 acres, approximately half the size of the district. The main drainage feature is the Pelican River, a tributary to the Otter Tail River. Only upper portions of the Pelican River are included in the Pelican River Watershed District. The seven lakes of interest here are among the major lakes in the district. The lakes are connected by short-segments of the Pelican River. Wetlands and small lakes also drain to these lakes by way of short, sometimes intermittent streams.

The area is contained in Minnesota's North Central Hardwood Forest eco-region.

### 2.2 Physical Attributes of Waterbodies.

Most of these are "Ice-block" lakes located within an outwash plain, the gravels of which are more than 100 feet thick near these lakes. Mill Pond and Muskrat owe their existence to late 19<sup>th</sup> century modifications to water levels to promote navigation. Both are reservoirs of the shallow valley of the Pelican River, and spill over to occupy adjacent wetlands.

**Table 1. Physical/Hydrological Attributes of LVMP Lakes**

	Muskrat	Sallie	Melissa	Big Detroit	Little Detroit	Curfman	Mill
DNR DOW Lake ID (03 0xxx00)	360	358	476	381 (a)	381 (b)	363	377
Type	Reservoir	Lake	Lake	Lake	Lake	Lake	Reservoir
Surface area (acres - GIS)	62	1,256	1,820	2,076	941	111	159
Shoreline Length (feet)	8,982	29,300	38,280	40,900	25,295	9,239	18,615
Shoreline length (miles)	1.7	5.5	7.3	7.7	4.8	1.7	3.2
Shoreline Ratio (acres/mile)	37	226	251	268	196	63	53
Fetch (feet)	2,616	10,525	12,185	13,140	9,620	1,031	1,674
Littoral Acres	59	540	930	830	846	65	159
Volume (acre feet)	365	20,772	32,906	37,589	8,003	1,309	640
% more than 20 feet	0.0%	16.7%	24.6%	25.5%	0.0%	8.1%	0.0%
% more than 30 feet	0.0%	0.9%	6.5%	9.0%	0.0%	0.0%	0.0%
Average Depth (ft)	5.75	16.34	18	18.4	8.5	11.38	4
% less than 15 feet deep	96	43	51	40	90	58	100
% less than 10 feet	82	42	38	38	73	52	95
Maximum Depth (ft)	17	52	32	82	16	21	10
Mixing Pattern	Dimictic	Polymictic	Dimictic	Dimictic	Polymictic	Polymictic	Polymictic
Outlets	1	1	1	1	2	1	1
Inlets	1	2	2	4	1	0	1
Inflow (annual acre feet)	28,000	28,000	28,000	6,000	6,000	NA	26,000
Residence time in days	5	271	429	2287	487	NA	8

## 2.3 Shoreline Development.

Except for some segments of the Pelican River and Muskrat and Mill Pond, the shores of these waterbodies are heavily populated with summer and permanent residents. Shorelines and riparian portions of the littoral zone have been greatly modified with rip-rap, retaining walls, sand blankets and weedrollers. In addition to large numbers of docks there are numerous other structures in the shore impact zone. The number and density of boats and boatlifts are high.

Second-tier development is common around these lakes, and in some instances residents from such developments have direct legal access to the lakes through designated “commons”, parks, or easements.

Mill, Muskrat and Curfman do not have formal public boat accesses, but these are accessible by boating from other lakes. In addition to formal public access points, there are several informal ones (“commons”) and many more that are private.

Big and Little Detroit each have several shoreline condominium developments, and additional motels and other establishments which provide high-density shoreline impacts. Approximately one-half mile of Little Detroit shoreline is a heavily used public beach.

**Table 2. Shoreline Development Attributes of LVMP Lakes**

	Melissa	Sallie	Big Det	Lit Det	Curfman	Muskrat	Mill
	2008	2008	2008	2004	2007	2007	2007
Parcels	502	227	329	260	29	39	61
Parcel Length	36,099	30,172	42,594	25,245	3,922	11,361	15,999
Lake Surface Acres	1820	1260	2076	940	111	62	
Shoreline Length	38,280	29,300	40,900	25,295	9,239	8,982	
Avg Lot frontage	72	133	129	97	135	291	262
Total docks & Lifts	583	476	683		20	13	17
per 100 shoreline ft	1.6	1.6	1.6		0.5	0.1	0.1
Total Boats	319	292	474	270	6	5	8
Per Surface Acre	5.7	4.3	4.4	3.5	18.5	12.4	0.0
Structures in SIZ	65	62	60	40	24	8	8
% lots greatly disturbed	67%	78%	69%	71%	0%	5%	8%
% lots with rip/rap	32%	58%	39%	33%	10%	0%	5%
%lots with sandblanket	38%	26%	33%	28%	24%	0%	0%

1/ “Greatly Disturbed” includes removal native shoreline vegetation (replacement with grass), topographic alterations, rip-rap, etc.

The lakes are under use pressure during the winter time too. In addition to fishing, all are heavily used for snowmobiling.

**Table 3 Results of Annual DNR Fish House Survey**

	Muskrat	Sallie	Melissa	Big Detroit	Little Detroit	Curfman	Mill
Fish Houses (DNR 2009 data)	2	29	28	18	128	11	3

## 2.4 Fisheries

All of these water bodies are important fisheries, summer and winter. DNR Section of Fisheries conducts surveys on a 5-year cycle and prepares **Fisheries Management Plans** accordingly.

Stocking is an important fish management tool on Sallie, Melissa, and Detroit. Stocking on Detroit has increased diversity. Walleye stocking on Sallie and Melissa is done to supplement natural reproduction which is insufficient to accommodate the fishing pressure.

Sallie and Melissa have seen recent improvements in fish diversity as a result of better water quality. Muskrat's fish populations have been enhanced by the replacement of a dam with an "engineered" rapids, allowing fish passage to and from Sallie. Sports fishermen have greatly benefited by the introduction of Muskellunge into Detroit.

An important annual walleye egg harvest is conducted at the outlet of Muskrat Lake to Sallie.

**Table 4 Summary of Fisheries Management on Study Lakes**

	Ecological Classification Type	Latest Fisheries Mgmt Plan (survey)	Northern Pike Fishery Enhancement Goal	Walleye Fishery Enhancement Goal	Current Stocking	DNR Fisheries Goals
Muskrat	39	2003 (2008)	x		no stocking	maintain a sustainable centrarchid and northern pike fishery (Muskrat is subject to winterkills)
Sallie	27	2002 (2004)	x	x	Annual walleye	Larger Northern Pike, more abundant walleyes, continued walleye egg removal, improved bluegill fishery
Melissa	27	2002 (2004)	x	x	annual walleye stocking	Larger Northern Pike, more abundant walleyes, continued walleye egg removal, improved bluegill fishery
Big, Little Detroit and Curfman	22	(2007)			Annual sturgeon muskie walleye	Improved bluegill; maintain a trophy muskellunge fishery; slight increase in yellow-perch; larger northern pike
Mill	42	(2005)			no stocking	provide fishing opportunities for black crappie, bluegill, largemouth bass, northern pike and yellow perch; subject to occasional winterkill

## 2.5 Aquatic Plants

### *DNR Fisheries Vegetation Surveys*

Vegetation surveys have been routinely been conducted on these lakes in connection with DNR fish surveys.

**Table 5 DNR Aquatic Vegetation Surveys on Study Lakes**

Lake	Most Recent Survey Year	Survey Type	Abundant or Common Emergents	Abundant or common Submergents	Invasives
Curfman, Big & Little Detroit	1999	Transect	None	Chara	Flowering Rush, Curly-leafed pondweed, purple loosestrife
Muskrat	2003	Transect	duckweeds, filamentous algae, cattail	Coontail, pondweeds watermilfoil	Flowering Rush
Sallie	2000	Transect	None	Muskgrass, Northern water milfoil, Sago Pondweed	Flowering Rush, Curly-leafed Pondweed, Purple Loosestrife
Melissa	2000	Transect	None	Coontail, Northern Water Milfoil bladderwort, Muskgrass	Flowering Rush. Purple loosestrife
Mill	2005	Transect	Water lily, duckweeds, cattail, pondweeds	Milfoil, bladderwort, coontail, pondweeds Canada waterweed,	Flowering Rush

Several informal surveys have been conducted by PRWD over the years. In the 1990's staff prepared maps of the spread of Flowering rush. Also, a 2005 survey of Curlyleaf Pondweed was conducted on Big Detroit lake.

A 2006 Vegetation Point-Intercept Survey was conducted of Flowering Rush on Big Detroit Lake by the DNR's Nick Proulx.

**2008 Vegetation Point-Intercept Surveys.** PRWD contracted with Professional Lakes Management, Ltd (PLM) to undertake population assessments for all lakes. Point Intercept Surveys were conducted twice, in June (or early July), and August. They produced results that were consistent with the DNR Fisheries findings, but provide somewhat more detail about the occurrence and extent of plant populations in these lakes.

Of special interest are the results for Curlyleaf Pondweed and Flowering Rush.

**Table 6 Summary of Point Intercept Results: Curlyleaf Pondweed and Flowering Rush**

	CurlyLeaf Pondweed		Flowering Rush	
	% of Littoral Zone points	total lake acres	% of Littoral Zone points	total lake acres
<b>Melissa</b>	7	63	<1	<1
<b>Sallie</b>	27	160	12	69
<b>Muskrat</b>	29	18	1	<1
<b>Mill</b>	3	5	<1	<1
<b>Curfman</b>	12	9	16	12
<b>Little Detroit</b>	1	12	4	42
<b>Big Detroit</b>	13	155	9	102

**Delineations.** In addition to these point intercept surveys, there have been several delineations, especially in connection with FR treatments in 2007, 2008, and 2009. Because of its similarity to FR, and the desire to provide it special protection during treatment, Hardstem Bulrush also was delineated in 2009. Most of this work has been done by the DNR in support of the PRWD efforts to control invasive species. See Appendix for 2009 Maps prepared by DNR.

## 2.6 Special Aquatic Nuisances

See also Section 1.

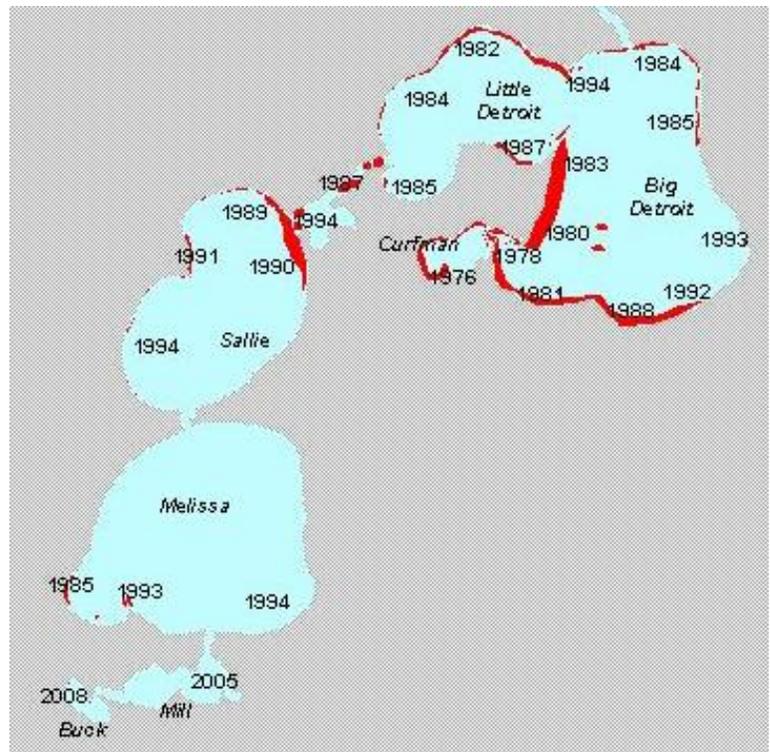
Outbreaks of swimmer's itch are encountered on most of these lakes each year. Several lakes are infested with Chinese Mystery Snails. Purple Loosestrife is found in some adjacent wetlands; biological control efforts are in process. There is concern that other invasives, especially Zebra Mussels could, infest some or all of these waterbodies.

However, *Chara*, a native aquatic plant, and the two exotics, *Curlyleaf pondweed* and *Flowering Rush* are the three plants which rise to the level of "nuisance" in the minds of residents, recreationists and visitors.

**Chara** is abundant in all the subject lakes and is found in the Pelican River too. It reaches nuisance levels for swimmers and boaters in shallow areas at some locations on each lake.

**Curlyleaf Pondweed (CLP)** has been in district lakes since the 1960's; a major blow-in occurred on the North Shore of Big Detroit Lake in 1963. Though CLP is found scattered in many parts of these lakes, major infestations are confined to relatively small portions of Big Detroit, Muskrat, and Sallie (see Table 6 and Appendix ). Major infestations interfere with boating, and to some degree fishing. Large floating mats of dead CLP also cause minor fish kills; but most of impacts are associated with beaches when the mats reach shore. Here they cause odor problems, prevent swimming, and are costly to remove.

**Flowering Rush (FR)** is generally considered to be the most serious problem on area lakes. Dense stands of the emergent form are found in shallow waters along many segments of the shoreline. Emergent stands, some as much as one-quarter acre, are also found offshore, in water depths up to four feet. The submerged form, usually with less extent, are located offshore in water depths from three to six feet. These infestations interfere with boating, fishing and swimming. Boats also dislodge the plant, fragments of which sometimes accumulate along shorelines, and start new colonies. In general the situation is more critical in Curfman and Detroit, and is less of a concern in the downstream lakes.



**Flowering Rush Spread**

### PRWD Experience with Flowering Rush

	1980's	1990-1995	1996-2000	2001-2005	2006-present
Recognize Problem					
Lobby for prohibited harmful invasive species designation					
Handdigging, deflowering					
Harvest as principal management effort					
Shoreline cleaning and roadside pickup					
Herbicide tests					
Herbicide as principal management effort					

Since the 1980's, PRWD has spent more than a million of local tax dollars to address the management of the Flowering Rush problems. The Table offers estimates of the types of expenditures which are obtained by assessment of riparian shoreline property-owners. In addition, the City of Detroit Lakes spends approximately \$100,000 per year for beach clean-up and plant debris removal each year. Shoreline residents also spent money and considerable energy to remove the plant debris from their properties.

Types of costs	Years	PRWD
Shoreline Cleanup, Roadside Pickup	1990-2008	\$200,000
Harvesting	1990-2005	\$400,000
Herbicide tests, treatment	1990, 2003-2008	\$125,000
Research, planning, Administration	1990-2008	\$250,000

### **Impacts from Nuisance Plants**

Aquatic Invasive Plants are recognized by the Minnesota DNR as having three main types of impacts: ecological, social/recreational, and economic. Following is a table summarizing the impacts of the main nuisance plant problems in the district.

**Table 7 Impacts of Nuisance Aquatic Plants in the Study Area**

	<b>Ecological</b>	<b>Social/Recreational</b>	<b>Economic</b>
<b>Flowering Rush</b> (Invasive exotic species)	<ol style="list-style-type: none"> <li>1. Competition with native plants; reduces diversity</li> <li>2. entraps silt and chara</li> </ol>	<ol style="list-style-type: none"> <li>1. interferes with swimming, boating and fishing use of some riparian properties, and in some cases non-riparian portions of lake;</li> <li>2. interferes with navigation;</li> <li>3. unsightly,</li> <li>4. reduces enjoyment of traditional lake activities</li> </ol>	<ol style="list-style-type: none"> <li>1. Lost business (boating, resort), reduced property values (anecdotal evidence),</li> <li>2. cost of removal and disposal;</li> <li>3. cost of treatments, mechanical and chemical;</li> <li>4. City shoreline cleaning</li> </ol>
<b>Curlyleaf Pondweed</b> (Invasive exotic species)	<ol style="list-style-type: none"> <li>1. Competition with native plants</li> <li>2. Fish kills during senescence</li> </ol>	<ol style="list-style-type: none"> <li>1. During growth stage, thick growth prevents boating in some areas and interferes with fishing;</li> <li>2. mats of senescent plants are hazardous to boaters,</li> <li>3. mats cause odor and unsightly conditions along some portions of shoreline.</li> </ol>	<ol style="list-style-type: none"> <li>1. Discourages boaters and fishermen;</li> <li>2. riparian owners bear cost of removal of senescent mats;</li> <li>3. City and PRWD costs for shoreline and roadside pickup</li> </ol>
<b>Nuisance infestations</b>	In disturbed areas, some natives have become dominant, especially chara.	<ol style="list-style-type: none"> <li>1. Some riparian owners are inhibited from lake use</li> <li>2. In public use areas, safety has been cited (for swimmers caught by weed growth)</li> </ol>	<ol style="list-style-type: none"> <li>1. Some properties devalued; costs of control/treatment</li> </ol>

### ***Lack of Knowledge about Flowering Rush and its Management.***

While management approaches for clearing navigation lanes of nuisance plant infestations, and for the control of Curlyleafed Pondweed are well understood, the situation is quite different for Flowering Rush.

Though the district has been trying to manage FR for more than 20 years, its efforts have generally been unsuccessful. Mechanical harvesting efforts have not controlled the plant, and indeed, may have contributed to its spread. Hand-removal is impractical for large infestations (greater than a few hundred square feet). Dredging (digging and suction) methods are unlikely to produce favorable outcomes over the long-run, and in any case appear to be prohibitively expensive, and unlikely to be permitted.

Unfortunately there is insufficient knowledge about the plant, its phenology, ecology, and susceptibility to various herbicides. Given that FR infestations are not widespread in lakes, FR research has not been a high priority of governments or by herbicide manufacturers.

In late January, 2010, PRWD sponsored a research summit on Flowering Rush. Managers and staff of the Pelican River Watershed District joined DNR Aquatic Invasive Species specialists from throughout the state and experts John Madsen, University of Mississippi, Peter Rice, University of Montana, Michelle Marko, Concordia College in Moorhead, and John Skogerbo, US Army Corps of Engineers. Representatives from the City of Detroit Lakes, and Lake Detroiters Association also were present. A series of presentations by the invited scientists described current FR research, alternative strategies for treatment, and related topics.

Several concepts concerning FR emerged from these presentations and subsequent discussion.

- FR is very difficult to control; among other reasons is that it quickly develops a large reservoir of energy in the rhizomes
- The key to FR control is killing the plant's rhizome
- Because of the rhizome structure and size, mechanical harvesting control is not a means for control; hand-removal will be successful only in small infestations
- Dredging and similar mechanical means (e.g. suction) are likely to produce unfavorable results, would face insurmountable regulatory barriers and are prohibitively expensive.
- Treating only emergent FR has not achieved complete control because of the small part of the plant's biomass that is treatable; future control efforts must include, if not focus upon, submerged plant treatment
- Control of FR will take several years after effective treatment is determined
- A thorough understanding of carbohydrate translocation timing is key to successful treatment of emergent FR
- Herbicides exhibit plant-specific efficacy with respect to application rates, contact times, and other attributes
- Future *operational demonstration studies* should be carefully monitored, evaluated
- Additional research is needed to determine the plant's phenology and ecology, efficacy of different products, and required application rates and concentration/exposure times.

## 2.7. Lower Pelican Chain, Water Quality Conditions and Trends

Overall, the Lower Pelican Chain of lakes has experienced somewhat improved water quality conditions during the last 40 years. Major changes to sewage and stormwater treatment facilities and regulations in upstream portions of the area are believed to be responsible for these improvements by reducing nutrient loads to lakes.

1975	Major upgrade to DLWWTF, include tertiary treatment for phosphorus removal
1972-94	Storm and Sanitary sewers extended around Big and Little Detroit Lakes
1994-2009	Stormwater treatment facilities added; most direct discharges of stormwater to waterbodies are now treated
1991-2009	Increased restrictions on stormwater runoff from landuse developments and highway project; changes in local ordinances and PRWD rules.
1998	Alum Treatment of Lake St. Clair to reduce phosphorus exports

Most dramatic are changes to Lake Sallie as a result of curtailment of phosphorus discharges from the City of Detroit Lakes' sewage treatment plant in the late 1970's. More recently there have been continued nutrient reductions for reasons outlined in the preceding table.

While comparable data are not available over all of this period, the available evidence is clear that phosphorus loads and in-lake concentrations are remarkably lower than before, and there continue to be declines.

The district has acquired fairly detailed data for most of these lakes for 15 years. Data from other sources can be used to supplement these, and to provide a picture which suggests not only that there is improvement over a long period, but that small improvements continue. Most of the lakes fall into the "mesotrophic" category with respect to trophic status.

Anecdotal observations also support the notion that there have been improvements in water quality on several fronts. It is widely perceived by long-term Sallie residents that recreational opportunities have been enhanced and that this has been reflected in increased property values. Some data corroborate these observations, as in the case of the history of ratios of black to yellow bullheads from 1949-2000. Similarly game fish populations in the lake, which had been suppressed during the 1960's and 70's have rebounded in more recent decades.

Mechanical removal of "nuisance" aquatic plant growth has taken place on lakes Sallie and Melissa since 1966. During this period there have been dramatic decreases in such aquatic plant populations. By the late 1990's the practice was nearly stopped altogether because of the reductions in the perception of the presence of such nuisance conditions. A similar conclusion can be reached by an examination of the data on the collection of vegetation that has blown ashore (Appendix 1).

## 2.8 Water Use

Aside from lawn irrigation, and occasional commercial removal of Bullheads from Lake Sallie , no extractive use is being made of these waters. Commercial navigation was stopped by the 1920's. The lakes include some of the most heavily used for various recreational purposes in the district, and in North Central Minnesota.

### Usage Estimates (not quantified)

	<b>Muskrat</b>	<b>Sallie</b>	<b>Melissa</b>	<b>Big Detroit</b>	<b>Little Detroit</b>	<b>Curfman</b>	<b>Mill</b>
Fishing	Med	Heavy	Heavy	Heavy	Heavy	Heavy	Light
Boating	Med	Heavy	Heavy	Heavy	Heavy	Heavy	Light
Swimming	Light	Heavy	Heavy	Heavy	Heavy	Med	Light
Public Beach use				Med	Heavy		
Public Access	no	yes	yes	yes	yes	no	No
Boats (boats per 10 surface acres)	5	209(1.7)	387(2.8)	516(2.5)	397(4.2)	66(5.9)	8
Docks, Lifts (docks/100 linear feet)				694(2.2)	487(3.0)	78(1.0)	

## 2.8 Current Aquatic Plant Management Practices

See also Section 1.

Nearly all aquatic plant management activities in these lakes have been undertaken by the PRWD, especially those under the auspices of Watershed Projects 1B and 1C which were established in the late 1980's. While these projects originally focused on "nuisance" plant growth in general, in the last decade the two projects have been tasked to attempt control of two exotic species, Flowering Rush and Curlyleaf Pondweed. Also reliance on mechanical harvesting has been greatly reduced during this period. At present, mechanical harvesters are almost exclusively used to remove mature infestations of Curlyleaf pondweed for a few weeks in June. Since 2006 the district has focused efforts and resources on the control of Flowering Rush using the herbicide, *Imazapyr*.

In 2008 and 2009, the City of Detroit Lakes also received DNR permits to control Flowering Rush by hand-removal, and in 2009, the City also used a single treatment of *endothol* and mechanical harvesting.

In addition to lake-wide and City efforts, the DNR issues some permits for riparian owners to treat nuisance plant conditions considered to interfere with "reasonable use" or for controlling "swimmers' itch". Those issued in 2008 and 2009 are representative (Table 7).

**Table 7, Permits Issued by DNR for Control of Aquatic Plant Nuisances**

Lake	2009 PERMITS					2008
	AUAPCD		Other		Total	Total
		with other	Mech, Chem			
Detroit	59	3	15		77	72
Melissa	29	1	3		33	34
Sallie	23	1	6		30	26
Curfman	4		1		5	5
Muskrat			1		1	3
Mill			2		2	2
<b>Totals</b>	<b>115</b>	<b>5</b>	<b>28</b>		<b>148</b>	<b>142</b>

Based upon permit data supplied by Leslie George, DNR.

The district continues roadside pickup operations. Residents gather plant material that has blown in along their shorelines, and remove it to a roadway. The district picks up this material once per week from May through September. In this manner, several hundred-thousand pounds of plant material is transferred from riparian properties to composting sites each year.

### 3.0 Aquatic Plant Concerns and Issues

Representing shoreline property owners, both the Lake Detroiters Association, and the Melissa-Sallie Improvement Association were founded in the 1940's, in large part as a reaction to "weed" problems on the lakes. Various chemical and mechanical means were used in the 1950's and 1960's to address these problems. The efforts were largely unsuccessful, and it was frustration with these failed efforts that led directly to the establishment of the Pelican River Watershed District (PRWD). The perception that algae blooms were increasing, and "weeds" were becoming worse on these lakes energized the petitioners, a group of lake-shore owners, fishermen, politicians, business-owners, and others. One of the first actions taken by the PRWD in 1967 was the establishment of a Project to mechanically remove "excessive" plant material from lakes Sallie and Melissa. Mechanical harvesting of plants on those two lakes continued in almost every year until 2006.

An initiative to eliminate septic systems from Big Detroit by providing stormwater and sanitary sewers was begun in 1972. A large part of the enthusiasm for the project was the public's understanding that nutrients from septic systems were exacerbating weed and algae growth.

In 1989 PRWD established another aquatic harvest project upon petition of shoreline residents on Big and Little Detroit and Curfman lakes. Those residents were more specifically concerned about Flowering Rush which had infested many areas in those lake, but the project was broadly targeted at submerged aquatic plants too.

Both the Detroit and Melissa/Sallie projects have been funded through riparian property assessments which are applied each year based upon the project costs.

So there is a 60 year history of citizen concern and action on perceived "weed" problems. It is fair to say that for a long time there has been a widespread and reasonably sophisticated understanding of aquatic plant issues and the perception that something should be done to address those problems.

#### **Formal Public Input**

In anticipation of moving forward with the Aquatic Plant Management Plan process, two public meetings were held in February, 2009. Both written and oral comments were solicited. The following indicate the range of perceived concerns:

- *spread of Flowering Rush infestations*
- *inappropriateness of applying "emergent" plant rules to FR by DNR; too many restrictions on treatment ; arbitrary permitting*
- *FR impacts on native habitat species*
- *Heavy infestations of chara (muskgrass) which interfere with boating*
- *other exotics and invasives, including curly-leafed pondweed (CLP)*
- *nuisance conditions in public use areas (public beaches, boat launches, sand bars)*
- *nuisance and access conditions in private and commercial use areas*
- *blows-ins and roadside pickup*
- *inadequate information available about aquatic plants, AP problems, AP management options, how boaters should behave*
- *ineffectual management (lack of treatment success, unintended spread of FR, etc.)*
- *more aggressive FR treatment needed*

An enumeration of verbatim comments is found in Appendix 4.

### ***Other Interactions with Public***

In November, 2009, a meeting was held to review the Flowering Rush situation in area lakes. Participants included DNR officials, PRWD Managers and Staff, City of Detroit Lakes, Councilors and staff, and state representatives. The General public also was invited, and encouraged to offer comments. Approximately 40 persons were in attendance.

While the main thrust of the meeting was to review progress on Flowering Rush control, and plans for 2010 and beyond, frustrated citizens offered strong views about lack of progress in solving the problem on the part of local governments, and the DNR. The need to have more flexible rules governing private landowners was also a strong undercurrent among the comments. Some proposed changes to DNR permit rules were discussed, and generally favorably received, as were plans to hold a research summit on herbicide treatment of FR.

On January 11, 2010, at a meeting sponsored by the Isaac Walton League in Detroit Lakes, DNR's Darrin Hoverson described the current state of Aquatic Invasive Plant infestations in Minnesota along with methods of prevention and treatment. Once again a major portion of this presentation responded to questions concerning Flowering Rush and other local invasive plants. Approximately 40 persons attended this session.

As the district abandoned mechanical harvesting of Flowering Rush after 2006, the extent of the FR infestations became more obvious and there has been growing public expressions of support for aggressive action. These have included strong feelings at public meetings, letters-to-the-editors, and through other media. A citizen-led "Crush the Rush" campaign attracted a good deal of attention from many citizens, and from the media, including newspapers, radio, and TV broadcasters.

In 2009 Curfman, Detroit, Melissa, and Sallie riparian property owners were asked to provide signed acceptance cards in order to allow treatment of FR within 150 feet of their property. 756 did so, and only 3 denied permission for the district to proceed with treatment near their property – a very clear sign of the public's interest in action to control FR.

Similarly, the recent announcement that Zebra Mussels have been found in nearby lakes (Pelican and Lizzie) has caused heightened concerns from citizens in general, and community leaders in particular.

Taken together, there is considerable evidence for a very high level of understanding, and concern about invasives and the impacts that are associated with them. There is extraordinarily strong support for both control of existing nuisance conditions, and prevention of future infestations. There is also an undercurrent of frustration that the district (and others, including the State and City) have failed to make headway in solving these problems.

### ***Special District Concerns***

Within the DNR, the Fisheries Section is responsible for permitting of district treatment activities, Permits are issued in accordance with Rules that are enabled by Statute and approved through an elaborate rule-making process. Recently there have been changes in the rules or interpretations of the rules, which have made the district's involvement much more time-consuming and expensive.

The requirement that written permissions be obtained for any treatments within 150 feet of a riparian property has caused great hardship in the form of time and money. In 2009 this process required 240 hours of staff time, plus computing, postage and printing. It is estimated that the total costs were approximately \$10,000.

The district opposes this requirement not only because of the hardship it imposes on district staff and finances, but allowing landowner refusals to interfere with control measures is counterproductive to the goal of controlling invasive species, and inconsistently extends the rights of landowners to control public waters.

Another change to the rules increases permit fees and removes the fee-maximum. It is believed that this could result in more than \$75,000 in fees, or roughly 100 times the amount previously paid.

Here too the rule is inconsistent with the way in which permit fees are applied to other invasive species cases within the State.

### ***Automatic Unattended Aquatic Plant Control Devices (AUAPCD)***

The DNR issues permits to property owners who wish to install such devices, including Weedrollers and similar equipment, to clear limited amounts of beach areas for swimming and boating. DNR rules prohibit installation of such in beach areas infested by Flowering Rush, and require that any plant material dislodged by the devices be contained and removed from the water.

Nevertheless, the district has documented several instances of such devices being used, possibly illegally, in areas where FR is present. In these situations, small FR plants have been uprooted and allowed to float free to re-colonize other areas.

In connection with these situations, enforcement has proven inadequate because the initial action of the machines together with wind and waves, rapidly destroys the evidence. The situation is aggravated by AUAPCD use during the period when FR is just sprouting.

### ***Boating***

Motorized boats driven through FR infestations tend to cut or uproot the plants and either allow the plants, plant fragments, or rhizome parts, to float freely, or be carried on the boat's prop to another area. The situation seems to have worsened as the submerged form of the plant has increased in extent. It is noteworthy that areas where boats congregate, at marinas, boat launch sites, and even at the back of boat lifts, disproportionately heavy FR infestations are found.

## **4.0 District Wide Aquatic Plant Goals and Proposed Management Measures**

The district's managers recognize that various lake users have inherently different views of ideal conditions when it comes to aquatic plants. Thus fisher-persons are known to be attracted to luxuriant aquatic plant growth while swimmers and boaters are not. Others may be indifferent to aquatic plants, so long as they are below the surface, or do not wash up on their shorelines. Most recognize that healthy native plant communities are necessary to main ecosystem integrity and good water quality, regardless of how these are measured. The Managers must rationalize such disparate views as they plan goals and management activities.

In this plan the managers will focus their district-wide efforts on addressing aquatic invasive species.

The following is an enumeration of the district's aquatic plant management goals for the management of aquatic plants throughout the district. Included is a short discussion of management activities associated with each goal.

### **4.1 Continue assessments of aquatic plants communities;**

The district will continue to invest in detailed mapping of exotics, invasive species and native species. There will be coordination with the DNR's Fisheries Management Planning program and with the Aquatic Invasive Species staff. Flowering Rush population assessments (including mapping) will be undertaken in consultation with DNR staff prior to any treatment.

### **4.2 Protect, enhance natural aquatic plant communities**

The district will continue efforts to protect shorelines through rigorous and consistent enforcement of Rules which restrict shore impact zone modifications, and through enhanced education programs. Runoff controls from all Shoreland Zone properties are likewise to be strictly enforced. The district has, and will continue to pursue improved sewage treatment practice, especially in shoreland zones.

### **4.3 Obtain FR Research**

Any demonstration studies will be systematically evaluated by independent professional (not by staff or applicator). Basic research is required, including the phenology and ecology of the FR. Research will focus on controlling both submerged and emergent forms. It will be important to ascertain the concentration/exposure times of various herbicides to FR as well as to Hardstem bulrush (which is sometimes mixed with FR). The dissipation rates and fate of herbicides will be investigated. Single applications, sequential applications, and combination applications (of more than one herbicide) will be addressed. The district will look for bio-control measures. The district will provide some funding for such research, and will seek additional funds.

### **4.4 Increase incentives for Riparian owners to control Flowering Rush**

While acknowledging the hand-removal of FR is not a successful strategy for large infestations, or those in deep water, the district will continue to work closely with the DNR to remove restrictions on Riparian owners who wish to hand-remove Flowering Rush from their shorelines. In particular, there should be no area limitations or distance from shore limitations imposed on willing private owners. We will urge that there be no fees for such citizen efforts.

#### **4.5 Scrutinize AUAPCD use in waters infested with Flowering Rush**

The district will advocate for more strict supervision of the use of AUAPCD (automated unattended aquatic plant control devices) in or near established FR infestations. Such devices as Weedrollers have been shown to spread FR. The District will work with DNR staff to minimize such problems.

#### **4.6 Educate lake residents and others about aquatic plants, aquatic plant management options, and prevention and treatment of exotic infestations, both existing and potential**

The district acknowledges that a significant part of its job will be to see that residents are knowledgeable about the importance of aquatic plants, especially natives. Emphasis also will be given to understanding Invasive Species, the mechanisms for their spread, and prevention of infestations, including Flowering Rush and Curly-leaf pondweed. It will continue to provide lake associations, residents, boaters and the general public with the latest information on prevention techniques. It will assist in working through schools to extend the impact of its message.

#### **4.7 Develop alternate management structures (revise PRWD projects to include Muskrat and Mill Pond, change in PRWD funding mechanisms, new roles for City and townships, etc**

Since the district's Harvesting projects were developed 25 years ago, the understanding of aquatic plants, aquatic plant problems, the funding needs, treatment methods, and other aspects of the projects have changed greatly. Also Roadside pickup, an important activity now, was not contemplated in the 1980's. By 2012 the District will amend or redo the projects based upon those changes.

#### **4.8 Continue to press for Rules changes that will reduce the hardship of obtaining signature cards from riparian owners who own shoreline near invasive species, and to reduce the permitting costs for controlling invasive species.**

The district will petition the DNR concerning this hardship, and will develop and propose alternative methods to inform the public, and an on-going process to ascertain those property owners who object to treatment.

#### **4.9 Improve Coordination and communication among various units of government who have interests in, or responsibility for, Aquatic Plant Management in area lakes.**

Some form of coordinating committee, including representatives from the DNR, PRWD, the City of Detroit Lakes, townships, and lake associations, will be established.

## 5.0 Lake Vegetation Management Areas (LVMA's): Specific Goals and proposed Management Measures

Aquatic invasive species have reached nuisance levels in the water bodies enumerated in Section 1. However, the extent and nature of the problems, the lake conditions, and the resultant treatments vary among them. Acknowledging these differences, the Managers have identified Lake Vegetation Management areas, and propose different treatment goals and management activities for each.

### 5.1 Lake Vegetation Management Areas

The 7 lakes and 3 stream segments included in this planning effort lend themselves to grouping into four Lake Vegetation Management Areas on the basis of proximity, similarity of problems, and administrative considerations.

**Table 8 Lake Vegetation Management Areas**

Lake Vegetation Management Area	District Project 1/	Main Aquatic Problems	Water Acres	FR Infested Acres	CLP infested acres
Detroit (Little, Big Detroit and Curfman)	Yes	Flowering Rush, CLP, Chara	3100	156	176
Pelican R and Muskrat L.	No	Flowering Rush, CLP; scattered with emergents	75	<1	16
Sallie and Melissa, PR connection	Yes	Flowering Rush CLP	3000	70	223
Pelican River and Mill Pond	No	Scattered FR	200	<1	5

1/ Are these included in current district Harvesting Projects?.

### 5.2 Detroit LVMA; includes Big Detroit, Little Detroit and Curfman

1. In short term, identify “operational test sites” for *in situ* experimentation with treatments for submerged FR sites; arrange for evaluation by professional.
2. Identify and treat major isolated areas of homogeneous offshore Curlyleaf Pondweed infestations as resources permit
3. Undertake “lake-wide” treatments of submerged and emerged FR as treatment and research outcomes dictate.
4. Seek to alter Minnesota Aquatic Invasive Species (AIS) Rules to enhance riparian owners’ ability to manage current, and curtail new, FR infestations through hand-removal.
5. Develop additional criteria to be used by riparian owners to manage infestations of natives and exotics to facilitate reasonable shoreline use and boat access
6. Partner with City of Detroit Lakes to manage public beach swimming and boat-launch areas through existing chemical means in order to offset social/recreational and economic impacts
7. Protect native plant communities, especially emergent plants, such as Bulrush
8. Modify District Project 1C as needed, to reflect changes implicit in this plan.

### **5.3 Muskrat and Pelican River (downstream from Little Detroit)**

1. identify and treat major isolated areas of homogeneous offshore Curlyleaf Pondweed infestations
2. As soon as possible undertake “lake-wide” treatment of submerged and emerged FR as research outcomes dictate.
3. Protect native plant communities, especially emergent plants, such as Bulrush, and floating-leaved species
4. Evaluate feasibility of handremoval to control isolated FR infestations, especially in the River.

### **5.4 Sallie/Melissa LVMA( includes small segment of Pelican River at Shoreham)**

1. identify and treat major isolated areas of homogeneous offshore Curlyleaf Pondweed infestations as resources permit
2. Curtail spread of FR – aggressively confront new infestations by chemical/hand-removal means
3. Undertake “lake-wide” treatments of submerged and emerged FR as treatment and research outcomes dictate.
4. Alter regulations to enhance riparian owners’ ability to manage current, and curtail new, FR infestations through hand-removal
5. Develop additional criteria to be used by riparian owners to manage infestations of natives and exotics to facilitate reasonable shoreline use and boat access
6. Protect native plant communities, especially emergent plants, such as Bulrush
7. Modify District Project 1B as needed, to reflect changes implicit in this plan.

### **5.5 Mill Pond and Pelican River LVMA**

1. Continue selective hand-removal to control isolated infestations of FR
2. As soon as possible undertake “lake-wide” treatment of submerged and emerged FR as research outcomes dictate.
3. Protect native plant communities

## 6.0 Administration and Funding

Though governed by MNDNR rules and their interpretation by DNR staff, previously PRWD has assumed operational responsibility for the vast majority of aquatic plant management activities in this area. To facilitate reach goals as enumerated in Sections 4.0 and 5.0, the district will enter into an agreement to allocate management responsibilities among three groups: (1) PRWD, (2) City of Detroit Lakes and (3) riparian property owners. The DNR continues to maintain its overall statutory authority.

**Table 9 Partners for Managing Aquatic Plants in the Study Area**

	<b>General Responsibilities</b>	<b>LVMA</b>
<b>Pelican River Watershed District</b>	“lake-wide” treatment of invasives, Flowering Rush and Curlyleaf Pondweed; take lead in developing research program for FR control	All
<b>Minnesota Department of Natural Resources</b>	Oversight and permitting of all treatment activities; assist in preparing LVMP’s	All
<b>City of Detroit Lakes</b>	Treatment of public beach, and other public use areas to control nuisance species that interfere with boating and swimming	Detroit/ Curfman
<b>Lakeview Township</b>	Treatment of public access areas and other public use areas to control nuisance species that interfere with boating and swimming	Melissa/Sallie, Muskrat, Mill
<b>Riparian Property Owners</b>	Hand removal of FR; control of nuisance infestations that prohibit reasonable use	All

**An Aquatic Plant Management Coordinating Committee**, comprised of representatives from DNR, PRWD, City of Detroit Lakes, Lakeview Township, and Lake Associations (representing the interests of riparian owners), will advise on specific management activities, serve to coordinate them and assist in permit preparation.

PRWD representatives will be appointed by the Managers.

### Implementation Phasing and Costs

In recent years annual harvest project assessments have ranged from \$110,000 to \$140,000; expenditures have been somewhat less, \$80,000 to 96,000 per year (these amounts include roadside pickup). Currently there are balances totalling approximately \$170,000 in the Harvest Project Implementation Fund and the two project accounts.

There will be substantial costs associated with implementing this plan. While the exact costs are not known, and the scheduling very tentative, **Table 10** on the next page depicts a generalized ten-year timetable and cost

estimates for planning purposes. (This is offered as guidance and general planning only; in particular, it is not meant to be prescriptive).

This schedule suggests commencement of a five-year Curlyleaf pondweed treatment starting in 2012. Lake-wide treatment of Flowering Rush will be delayed pending 2009 treatment results or the outcomes of research initiatives.

In the meantime, based upon outcomes from the Research Summit held January 27-28, 2010, "Operational Demonstration" (OD) sites will be treated on Curfman and Detroit in 2010 and 2011 and the Research program conducted by Dr. Marko at Concordia, will commence immediately including evaluation of the OD sites. Treatment of the City's public beach is expected to continue in 2010, and beyond. Since its management and funding is not a PRWD responsibility, it is not included in this cost projection or timetable.

## **Sources of Funding**

It is tempting to use balances from current Harvest Projects and the Project Implementation Fund to underwrite the costs of implementing this plan; it is possible that with these funds plus increased future assessments, implementation costs of the plan could be met indefinitely.

However, for various reasons, the harvest projects were not intended for purposes described in this plan. Moreover, since the existing projects' boundaries exclude Muskrat, Mill Pond and the segments of the Pelican River, an alternative funding mechanism must be found for the components of the plan associated with those water bodies.

Therefore, the Managers seek to obtain an alternative funding source under the provisions of MS 103D.905, Subd. 3 if a City, County or Township initiated the project. Such an approach would allow the District to pay for maintenance of projects of common benefit. Funds would come for up to 15 consecutive years from an ad valorem levy, not to exceed .00789% of taxable market value. For 2009 that would generate \$138,000.

The approach also would allow the district to distribute costs more widely and appropriately, to some degree reflecting the fact that benefits from treatments extend beyond well beyond the shores of the infected lakes as outlined in Section 5. Education, research, prevention and protection activities must be considered on a district-wide basis, not limited to those living around the infected lakes. Indeed, the infected lakes already extend beyond the jurisdictional boundaries of the existing projects, and in the future infestations could spread to more lakes.

Under the circumstances described above, the Managers may wish to propose funding and operational modifications to the existing harvest projects to reflect future activities.

**Table 10: Aquatic Plant Management Plan 10 Year Implementation Schedule and Funding Estimate**

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Totals
PRWD											
CLP Treatment in Det, Sal/Mel LVMD's			\$40,000	\$40,000	\$40,000	\$40,000	\$40,000				
Operation Demos, Curf Detroit	\$20,000	\$20,000									\$680,000
FR Treatment in all LVMD's	\$30,000	\$30,000	\$40,000	\$60,000	\$60,000	\$60,000	\$60,000	\$60,000	\$60,000	\$60,000	
Eval of Oper Dem, Curf, Detroit (Marko)	\$5,000	\$5,000									
Phenology, Ecology of FR (Marko)	\$12,500	\$12,500									
FR treat. alt.Conc/Exp times (ACE/ERDC)	\$50,000	\$50,000									\$215,000
Emergent FR Foliar trials (ACE/ERDC)			\$50,000								
FR Symposium	\$5,000		\$5,000								
Sequential Treatment efficacy (Rice)	\$10,000	\$10,000									
Roadside Pickup	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000	\$400,000
Administration	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000	\$100,000
<b>PRWD Total</b>	<b>\$152,500</b>	<b>\$147,500</b>	<b>\$185,000</b>	<b>\$150,000</b>	<b>\$150,000</b>	<b>\$150,000</b>	<b>\$150,000</b>	<b>\$110,000</b>	<b>\$110,000</b>	<b>\$110,000</b>	<b>\$1,395,000</b>

