



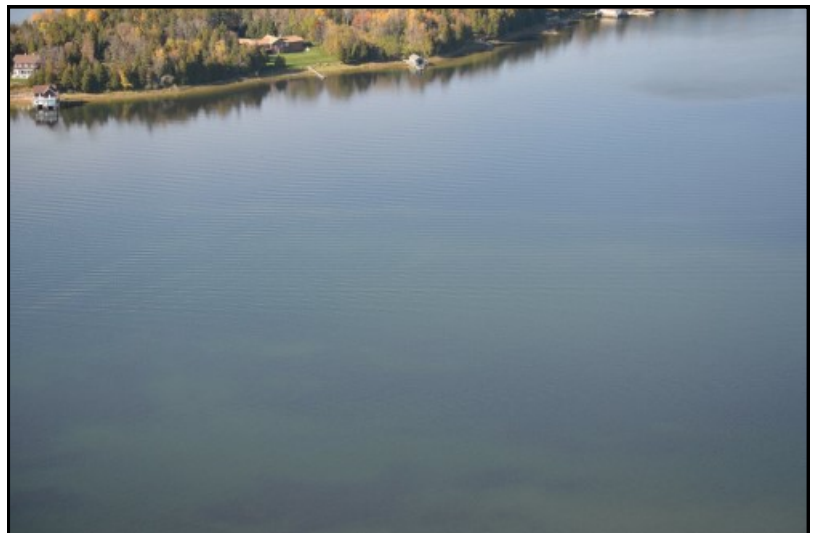
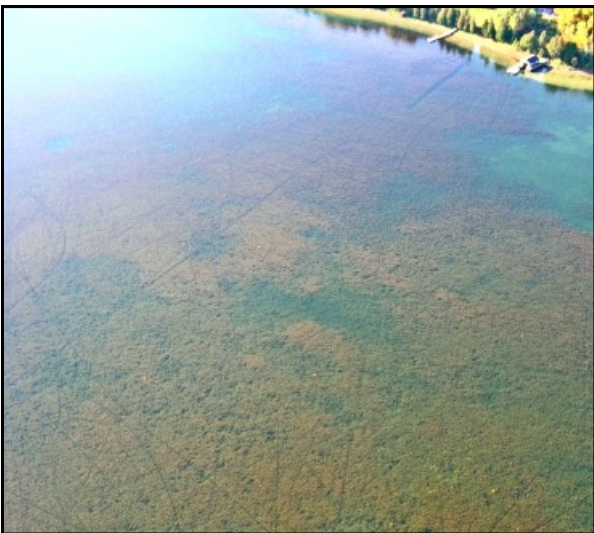
# **Dynamic Aquatic Adaptive Management Plan**

for the

## **Les Cheneaux Watershed Council**

### **2014—2019**

**Prepared by**  
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**June 17, 2014**



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**2013 Vegetation Survey and Eurasian watermilfoil Strategic Biological Control Program**

## CHAPTER 1: INTRODUCTION

### MISSION STATEMENT

The *LCWC Dynamic Aquatic Adaptive Management Plan* is intended to provide a multiple use comprehensive guide to maintaining, and in some cases restoring, a balanced & sustainable aquatic ecosystem for the benefit of human, fish, animal, & plant communities.

It forms a new addition to the Les Cheneaux Watershed Management Plan of 2006, whose focus was dictated by Section 319 of a Clean Water Act grant, specifically non-source point pollution, erosion, water quality monitoring, low-environmental impact recreational opportunities, and preservation of local environmental and social features.

### 1.1: Current and Historic Setting

Nestled in the northwest corner of Lake Huron lies the Les Cheneaux Islands, a 36-island archipelago, characterized by an intricate complex of channels, shallow bays, and rock-studded peninsulas, and boasting almost 200 linear miles of Great Lakes Shoreline. These natural resource attractions make “the Snows” a popular destination spot for tourists, outdoor enthusiasts, and vacation homeowners, as well as home for over 4,000 full and seasonal residents.

The Les Cheneaux watershed drains approximately 115 square miles within the Carp-Pine watershed. The watershed covers all of Mackinac County’s Clark Township (80 square miles) and approximately 35 square miles in both Marquette (Mackinac) and Raber (Chippewa) Townships. It is bordered on the west by the Nunn’s Creek watershed, to the east by several lake drainages near DeTour including Trout and Albany Creeks, and to the north by the Munuscong watershed, which drains into the St. Mary’s River. The most concentrated developments within the watershed are located at the villages of Cedarville and Hessel.



Sandhill Crane



Trilobite fossil near Sunset Point



View of Middle Entrance from above Marquette Island

The northern shoreline of Lake Huron at Les Cheneaux can be considered the area's most fragile biological indicator. It has been identified in a report of the State of the Lakes Environmental Conference (SOLEC), *Land by the Lakes: Nearshore Terrestrial Ecosystems*, as one of the priority "Biodiversity Investment Areas" in the Great Lakes basin.

Due to the size of the water bodies and the delayed phenology of the coast, the forested northern shores of Lake Huron provide important stopover areas where neotropical migrant birds concentrate during fall and spring migrations. The coastal marshes and remaining high quality wetlands are important to the health of Great Lakes' waterfowl and fisheries, where they provide nesting and spawning grounds, forage, and protection for numerous species (TNC 1993). In addition, the area contains several Michigan Department of Environmental Quality designated "environmental areas" which are ecologically unique areas that are maintained in their natural state and sheltered from development.

Historically, recreational, subsistence, and commercial fishing in the area has supported a large tourist trade, year-round residents, and members of both the Sault Ste. Marie and Bay Mills tribes of Chippewa Indians. The benthic substrate adjacent to the island complex is regarded as some of the best spawning habitat for native fish species such as Lake Whitefish, Lake Herring, Smallmouth Bass, and Lake Trout in all of Lake Huron. Abundant coastal wetlands also provide critical spawning and nursery habitat for other fish species and their forage, including the yellow perch, northern pike, and various pan fish. At a spring 2014 Fisheries Workshop, Dave Fielder, of DNR Fisheries, commented that perch & pike numbers were back to 1970's levels, and that LCI currently has "the best pike fishing in the state".

Unfortunately, the Les Cheneaux Watershed Management Plan and Michigan Department of Environmental Quality (MDEQ) surveys have documented several threats to water quality. Les Cheneaux is considered one of the most sensitive ecosystems in the world, hosting a diversity of rare plants and animals. Since 1997, the Les Cheneaux Watershed Council (LCWC) has been working to preserve and protect the local watershed. During the past few years priority areas have been identified that require attention if our high standards of environmental quality are to be maintained:

"As mentioned, another threat to water quality and the aquatic life on which it depends, is invasive species. " (Les Cheneaux Watershed Plan, 2006) Periods of low water have contributed to increased nuisance weed growth in the past. Dense weed growth occurred during low water years of the early 60s. There are, however, significant differences between the dense weed growth of the 60' s and the intense, growth experienced in some recent years. In addition to record low water levels allowing light to penetrate deeper and contribute to greater weed growth, today we have zebra mussels that make the water even more clear due to their filter-feeding habits; and, finally, we experienced years of highly concentrated plant nutrients being dumped into Cedarville Bay in the form of Clark Township Wastewater Treatment plant discharges. These are the primary factors that have encouraged dense weed growth in Cedarville Bay and adjacent areas.

Prevention always costs less than restoration. This Plan to protect the high quality waters of northern Lake Huron is an investment that will provide long-term protection of both the Les Cheneaux aquatic resources and the surrounding region. The projects endorsed in the Plan will also benefit recreational users, which in turn will benefit the local community, and the local economy, which is dependent upon high water and natural resource quality. This Plan will ultimately protect threatened and endangered species habitat, fisheries habitat, and terrestrial habitat.

## Chapter 1.2: Socio-Economical Character

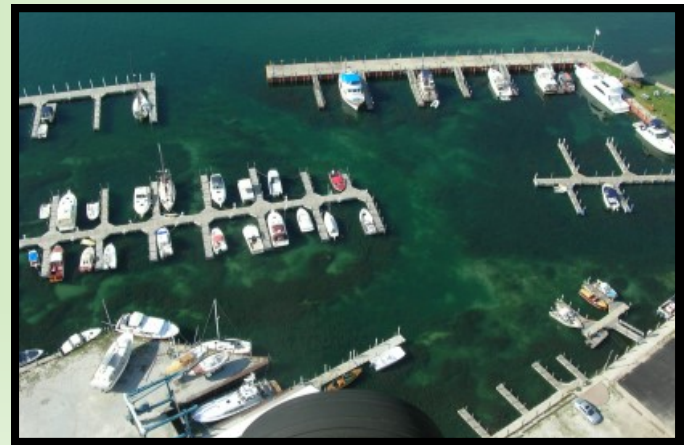
According to the U.S Census Bureau, Eastern Upper Peninsula Regional Planning and development Commission, the Clark Township Master Plan, and Corporation for Enterprise Development (CFED), the Les Cheneaux watershed's economic prosperity is directly linked to the beauty, abundance, and health of the area's natural resources. Over 60% of the community's employment centers on resource utilization and recreation. Traditional economic factors in the watershed include a limestone extraction operations, lumbering and other wood-related operations, as well as recreation and resort-oriented economic activities. In the past, a thriving perch fishery drew fishermen and helped sustain the economy. However, in the 1980's the bottom dropped out of the fishery, ultimately changing economic resources. The change spurred community leaders into planning for sustainable growth with the desire to protect natural resources. This sustainable development planning revealed the dependency of the local economy on the areas' natural resources.

Despite the change in the local economy, the resident population has changed little over the past few decades. The full-time resident population of the Les Cheneaux watershed is approximately 2,200 people, with approximately equal numbers male and females, with a median age of 44.6 years. Over 88% of the residents have at least a high school diploma with almost 20% attaining a bachelor's degree or higher (Census Bureau). According to EUPRPDC, there are 739 seasonal dwellings in the watershed, with an approximated 3.2 visitors per dwelling, or 2,364 tourist visitors. On a beautiful summer day, the 59 resorts, motels and campgrounds, consisting of 1,295 rental units could bring that total up by 2,000 people (EUPRPDC-Clark Plan updates).

The US Corps of Engineers have stated that the: "recreational boating sector and (Cedarville) harbor supports 400 jobs and \$7.4M in personal income."



**Cedarville Launch & Harbor**



**Hessel Harbor**



**Triple Cockpit Runabout**

The Les Cheneaux Community is comprised of a significant tribal community that will benefit greatly from the successes of many LCWC projects. Les Cheneaux fisheries habitat has a direct impact on both subsistence and commercial tribal fishermen, and this is a well known tribal community concern.

The Les Cheneaux area has established a significant infrastructure around the channels that generates income from users and area visitors. The channels provide access to approximately 900 island homes and support approximately 2,800 recreational boat slips, throughout the 36 Les Cheneaux Islands.

The Cedarville Bay was once a hub of commerce and community activity in Clark Township. The community has expressed a keen desire to restore the waterfront to an attractive place to do business and offer enhanced access to the islands and channels. Over the past 20 years there have been numerous studies made, surveys conducted, plans submitted and reports rendered that have addressed the appearance and character of downtown Cedarville and Cedarville Bay. Many of these efforts offered sound recommendations and viable solutions to pressing economic and community challenges.

Historically boating and fishing have been primary activities in both Cedarville and Hessel. They remain a central focus of the community today. The restoration of Cedarville Harbor is viewed as a critical component in strengthening a Cedarville's core commercial area. A Michigan Waterways Grant of \$1.1 million, supporting a Cedarville Harbor Restoration Project, has been authorized and is currently in the final planning stages. This project has been designed to develop and improve Cedarville Harbor with:

- Additional boat docks
- Seawall dock for emergency vessels and vehicles
- Boardwalk to Hodeck
- Landscaping and benches
- Harbor building including restrooms showers, and fish cleaning station

A common and recurring theme from both the community and the township is the protection and preservation of the area's natural resources. Clark Township is acquiring former MDNR properties on Marquette Island at both Duck Bay and Voight Bay, which are contiguous to 1420 acres of Little Traverse Conservancy (LTC) properties. Through the cooperation with LTC, approximately 6 miles of nature trails will be developed on its property with the township providing for minimal amenities. Collectively, the area will be dedicated as the Aldo Leopold Park and Nature Preserve. As access to Marquette Island is only available by boat, and relies on public water access points.

Projects such as these integrate well with the waterways management aspects of DAAMP.

### Chapter 1.3: Les Cheneaux Watershed Council and Community Involvement

The Les Cheneaux community comprises many people with diverse interests, yet shares in common a close relationship with the local ecosystem of Lake Huron and the Les Cheneaux watershed. Specific Information/Education activities are commonly met with interest and acceptance by households, homeowners, riparian/shoreline owners, tourists, contractors/developers/realtors, students of Les Cheneaux Community Schools (K-12), and Clark Township officials alike.

During the course of implementing early projects of the Les Cheneaux Watershed Council, the local community has been involved throughout. Local volunteers assisted with a stream crossing watershed survey. Les Cheneaux Community Schools assisted with chemical and biological surveys, as well as creating a web page. Lake Superior State University assisted with several chemical analysis projects, and with analysis of water samples by other local volunteers. The Les Cheneaux Watershed Council meets every month to direct projects and evaluate their progress. Technical advisors including local, state, and federal agency personnel who often assist in LCWC Projects.

LCWC addresses ecological concerns through observations, research reports, and technical advisor consultations. LCWC has formulated a number of ongoing goals for the management of the watershed:

- Establish, promote, and execute land and water management practices that conserve and protect the natural resources of the watershed
- Protect body contact recreational use
- Protect drinking water quality
- Protect the integrity of aquatic and terrestrial ecosystems within the watershed
- Protect navigation opportunities
- Provide appropriate opportunities for public enjoyment of aquatic/terrestrial resources including but not limited to walking trails, scenic overlooks, boat launches, and public access areas



Contestant in the Cedarville Jersey Mud Race



LCWC sponsored Frog Fest Day



Area children enjoying a magic show at the Library

- Establish and promote education/information programs that promote stewardship and low impact recreational enjoyment of aquatic and terrestrial resources
- Preserve the unique nature-based aesthetic character of the Les Cheneaux Islands area
- Identify and protect priority habitat for threatened and endangered species

In addition, Community Education Projects focused on invasive species control and other watershed concerns have been presented to the many business and civic groups throughout the community. Groups that have supported the efforts of the Les Cheneaux Watershed Council in past efforts have included:

Chippewa and LMAS Health Department, Clark Township officials, EUP Regional Planning and Development Commission, Lake Superior State University, Les Cheneaux Chamber of Commerce, Les Cheneaux Community Schools, Les Cheneaux Community Foundation, Les Cheneaux Islands Association, Islands Wildlife Association, Les Cheneaux Lions Club, Les Cheneaux Sportsman's Club, and the Mackinac County Commission

Several research activities continue throughout the watershed to gain more insight into the local influences of water quality. There have also been comprehensive programs active in the watershed that used a broad array of personnel and activity to pursue information about many facets of water quality.

Also, there exist regulations and local controls to maintain the natural character of the watershed. Included here are just a few projects, programs, controls and local initiatives that are underway and will be supported by the watershed project.

The US Corps of Engineers recently undertook a dredging project in the Les Cheneaux Channels, sponsored in part by the Les Cheneaux Watershed Council, that was completed in 2011. In a fact sheet they state that: "Loss of local jobs pertaining to the recreational boating sector; harbor supports 400 jobs and \$7.4M in personal income." The local regional area has established a significant infrastructure around the channels that generates income from users and area visitors.

The Les Cheneaux Watershed Council is participating in the US Fish and Wildlife Double-Crested Cormorant Control Program in the Les Cheneaux Islands. This program has been instrumental in several recent successful spawning years for Yellow Perch (*Perca flavescens*) and a comeback in recreational sport fishing. Cormorant populations have now stabilized at targeted levels. Large flocks of these non-native birds, of often over 1000 birds, once disrupted the spring spawning cycle of Yellow Perch, and resulted poor year classes from 1985 through 2000. They also each consume an average of 2.2 pounds of fish per day, reducing the biomass of the local fishery by many tons in each of those years.

The Les Cheneaux Watershed Council has sponsored and funded a Community Hazardous Waste Campaign, resulting in the removal of over two tons of hazardous waste from the communities of Cedarville and Hessel.



The annual FrogFest Program, sponsored by the Les Cheneaux Watershed Council, is an opportunity for watershed education, outreach, and a very fun day for a family outing. (FrogFest is discussed in Section 2.8)

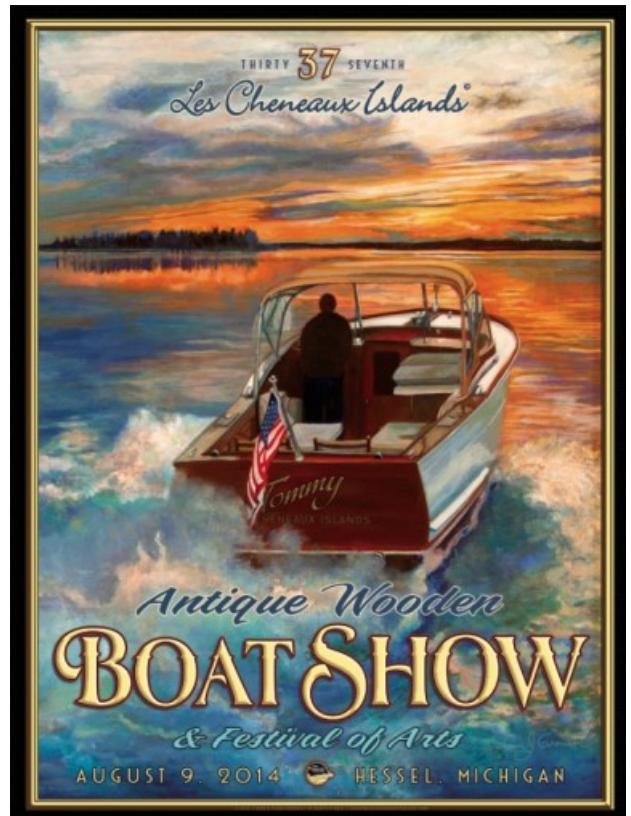
The Les Cheneaux watershed supports fish species characteristic of both warm and coldwater fisheries. The area has a high quality Perch & Pike fishery, as well as Lake Trout and Whitefish. Quality creek habitat is priority to maintaining populations of game and forage fish in area creeks, as well as macro-invertebrates on which they depend. Development near coastal marshes and creek riparian corridors threaten perch population recovery and creek species, as well as other indigenous wildlife. Regulations are in place to minimize impacts, such as priority habitat encroachment and sedimentation.

Other pollutants have threatened the local fishery that LCWC has addressed in resource management projects, including excessive nutrients from municipal wastewater discharge, failing on-site septic systems, and stormwater. In addition, sediments are threatening the fishery from shoreline and riparian areas, failing road/stream crossings, construction/development and stormwater. Hydrological changes from stormwater and road/stream crossings can limit fish migration. Lastly, invasive species and toxins are growing threats as activity grows in the watershed.

LCWC has an informational booth at the annual Antique Wooden Boat Show & Festival of Arts, where volunteers share updates on projects and answer questions from spectators.



A variety of FrogFest signs are hand made each year



Annual Boat Show poster depicting a Hessel sunset

## Chapter 1.4: LCWC Partnerships and Outreach

### *Les Cheneaux Islands Association - Phosphorus and Chlorophyll Analysis*

Bob Smith, the chairman of the LCIA environmental committee, has been studying the occurrence and effects of nutrients in various locations in the Les Cheneaux Islands. The project, which began with Mike Grant and Aqua Terra Labs in 1994 as a result of concern over the effects of the Clark Township municipal discharge into Lake Huron. The research continues to add weight to that same concern and the watershed project will continue with any support possible to alleviate that concern.

### *Lake Superior State University*

LSSU students and faculty have performed a variety of research projects in Les Cheneaux area. Everything from coliform bacteria contamination in Cedarville Bay to phosphorus levels in Pearson Creek is studied depending much on the concerns of the people. The Les Cheneaux Watershed Council will continue this partnership, as it provides a vehicle for water chemistry analysis and the knowledge to make informed decisions.

### *Les Cheneaux Community Schools*

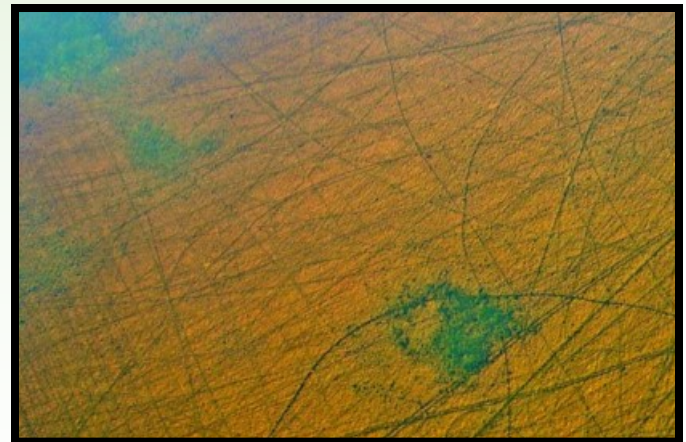
The Les Cheneaux High School (LCHS) science classes have been performing chemical and biological assessments of at least two creeks within the Les Cheneaux Island watershed. Pearson and Beaver-tail Creeks are as different as night and day. One courses through the most urban landscape in the watershed, and the other is a trout stream which has almost no development on its banks. The LCHS teacher provides students with applied learning examples, as well as the building of baseline data to track trends in water chemistry and biological communities. The Les Cheneaux Watershed Council has also empowered LCHS's Alternative Community Education Program (ACE) to participate in watershed monitoring. ACE students have collected macro-invertebrates at each creek in the watershed. They continue to learn various habitats, macro-invertebrate taxonomy and identification, and those things that influence water quality.



Osprey fly's over during aquatic vegetation survey



Rake toss during aquatic vegetation survey



Weevil planting site is the green area in lower right

### *The Nature Conservancy*

The Nature Conservancy has identified the Great Lakes' marsh in the Les Cheneaux area as one of seven ecologically significant natural communities along the northern shore of Lake Huron. Since the early 1990's, the Nature Conservancy has partnered with the Les Cheneaux community through providing resources and collecting biodiversity information along the Lake Huron shoreline. During the 1990's, the Nature Conservancy helped to administer and facilitate funding to be used for beginning wetland plant and animal community descriptions and understanding of the natural and human-created factors affecting them. The University of Michigan (U of M), Michigan State University (MSU), and U.S. Geological Survey (USGS) research team collected data over a three-year period.

The Nature Conservancy and Les Cheneaux community have established a long-term and vital partnership with collegiate and governmental institutions for continuing research and expertise. These projects provide an opportunity for the community to conduct research each year and use the information collected for making empowered decisions regarding shoreline threats. As the Les Cheneaux community begins further development of their economic base through nature-based tourism, monitoring programs such as these will be available for ongoing stewardship and measuring success for maintaining these special coastal marshes (Hadley 2000). The Les Cheneaux Watershed Council is committed to continuing this type of environmental activity in the watershed. It brings community together with technical service providers to work toward protecting our environment.

### *US Environmental Protection Agency (EPA)*

This collaborative project supported the Great Lakes Restoration Initiative and the Great Lakes Water Quality Agreement. The grant allowed for the Les Cheneaux Watershed Council to stock 85,000 milfoil weevils in approximately 16 locations in three bays in the Les Cheneaux Islands to control the invasive Eurasian watermilfoil and restore important perch spawning grounds. The project includes monitoring to assess the long-term effectiveness of this biological control strategy for watermilfoil.

### *Les Cheneaux Lions Club*

Through a generous grant from the Les Cheneaux Lions Club, LCWC was able to hire Enviroscience aquatic biologists to do a week long Aquatic Vegetation Assessment Site Survey (AVAS) and Point Intercept Survey (PI) during 2013. The purpose of this survey was to compile an inventory of all aquatic vegetation species, identify locations of Eurasian watermilfoil (EWM) infestation, and identify additional invasive/nuisance species to provide a baseline for future management practices. A milfoil weevil (*Euhrychiopsis lecontei*) population survey was also conducted in Cedarville, Sheppard's, and Smith's Bays to document the extent to which the weevils have controlled the EWM in the project areas.

### *Other organizations and collaborations*

A number of other watershed and resource management organizations are met with regularly and resources shared in projects of mutual interest. These include:

Chippewa East Mackinac Conservation District, EPA, EUP Cooperative Weed Management Area, Huron Pines, Little Traverse Conservancy, and Tip of the Mitt Watershed Council.

## Chapter 2: Front End Assessments (*Why*)

As an introduction to the planning and work flow process, there are various ways that different groups choose to organize their activities. In general the process starts with *uncertainty* involving a perceived “problem”, that is followed by possible solutions being researched, prioritized and applied with *certainty*, assuming that the perceived “solution” will resolve the “problem”. In short, order is restored from chaos. All too often however, the context is overlooked, and politics or hysteria steer the science, as in the *Ready, Fire, Aim* formula.

When a non-routine problem requiring innovative (Edison) methods is encountered, nobody pays much attention, because “it’s not my job to deal with that”. It gets passed around, but no action is taken, until it gets so bad that something must be done. *Ready, Fire, Aim* is a jocular reference to the fact that, almost by reflex action, the urge to act (*Fire*) tends to take precedence over a clear understanding of the aim of the project. If the project’s purpose was clearly understood, it would have been easy to deal with by routine institutional methods (R2D2).

By striving for transparency in all risk/reward scenarios, and the inclusion of all stakeholders in the process, this Plan seeks to organize the process in clearly defined steps that will lead to measureable outcomes for the benefit of all.

The Plan presented here will use the following outline in organizing the mission priorities of LCWC:

- I. Mission (outcome benefit & scope)
  - A. Goal (specific & measurable outcome)
    - 1. Objective (project/output action)
      - a. Strategy (design)
        - i. Activity (means)

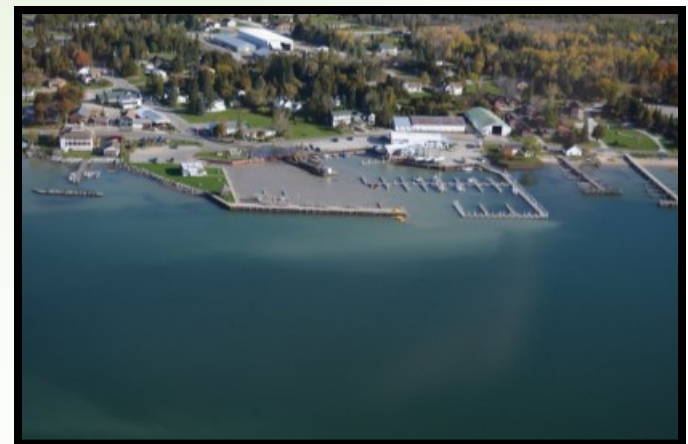
The term “Adaptive Management”, as used here in this plan, is prevention oriented and refers to the goal of having a management solution to meet each of the varied problems the local aquatic ecosystem may exhibit. (See Appendix A: *Adaptive Management Models*)



Lily Pad in Duck Bay



Not sampled here during aquatic vegetation survey



Hessel Harbor during fall 2013 dredging

## Chapter 2a: Aquatic Management Zones

The Les Cheneaux Islands are an open ecosystem with three major and a number of minor interacting watercourses. In order to accommodate the variability that exists more effectively, the entire Les Cheneaux Watershed has been subdivided into multiple management zones. The inner islands are numbered, and those outside to the west, south, and east are lettered as follows:

1. West Entrance, including Marquette, Wilderness, & Mismar Bays
  2. Inner Hessel Bay
  3. Hessel Harbor
  4. East Hessel Bay, including Liberty beach, John Smith Bay, Les Cheneaux Club, & Mackinac Bay
  5. Snow's Channel
  6. Musky Bay, including Duck Bay, Middle Entrance, Peck Bay, & Voight Bay
  7. Sheppard Bay, including Urie Bay, & Bosley Channel
  8. Cedarville Bay, including Islington Channel, & extending eastward to Bay Point.
  9. Cedarville Harbor
  10. Hill & Moscoe Channels
  11. Government Bay, including McAlpin's Channel, & Scammon's Harbor
  12. East Entrance, including Lakeside Landing, McKay Bay, & Bush Bay
- A. Nunn's Creek, including St. Martin's Bay extending westward to Ponchartrain Shores
  - B. Search Bay
  - C. Goose Island, including Goose Island Shoal
  - D. Prentiss Bay, including Scotty Bay, Beavertail Bay, & Dudley Bay
  - E. Albany Bay, including Stevenson Bay, and Big & Little Trout Lakes
  - F. Cranberry Lake, including Joe Straw Creek, Caribou Lake & Creek, Bear Lake, and St Vital Bay
  - G. DeTour, including Carlton Bay, Seymour Bay, Roggs Bay, Olmstead Bay, & extending to DeTour Village



Damselfly's mating in Hessel Harbor



Hessel Bay meets Mackinac Bay at Hessel Point



Hessel Mill Pond

## Chapter 2.1: Mission #1

### Limit Adverse Impact of Nuisance Aquatic Weeds

Biological control organisms serve to suppress their host plant's density and expansion, while allowing native plants to fill in as nuisance plants drop out of the water column.

The role of native plants in the success of the biological control process cannot be overstated. Their expansion is considered a positive sign as they facilitate the demise of the nuisance plants through increased competition for light from above and nutrients in the lake sediment.

A number of bays and channels have been impacted by aquatic nuisance species over the past decade. Most prominent among them is Eurasian Watermilfoil (EWM). EWM was first introduced in North America in the 1930s and has since spread to virtually every state in the U.S. and half of Canada. This aggressive invader interferes with all forms of recreation in the lake and chokes out desirable native vegetation, often resulting in a dense monoculture.

A project in Cedarville Bay, 2007-2008, initiated by the Les Cheneaux Watershed Council, demonstrated the first successful implementation of Milfoil Solution® in one of the Great Lakes, Lake Huron. By the August 2008 final survey, EWM density had reduced dramatically from June 2007 in both stocking sites by 96% in S1 and 87% in S2. As the percent EWM decreased, all sites experienced an increase in native plants, where EWM once grew. These dramatic changes in one year encouraged additional interest in pursuing this technique.

A second invasive species control project, funded by the EPA/Great Lakes Restoration Initiative, and carried out by the LCWC, involved additional weevil plantings in 3 bays. This project also included an aquatic vegetation survey throughout the Islands.

LCWC teams are currently conducting field trial projects with a native biopathogen, along with the utilization of mechanical harvesting, dredging, and bottom dragging equipment. Proven devices are also being utilized to control nuisance plants and include benthic tarping and raking.



Drag device testing in Sheppard Bay



Rake after toss during aquatic vegetation survey



Milfoil Weevil

## Chapter 2.2: Mission #2

### Support Harbor Improvements and Boater Access to Commercial Waterfront Districts

Through efforts of the Les Cheneaux Islands Waterways Restoration Group (a subcommittee of LCWC), working along with the Clark Township Board of Trustees, Michigan's Department of Natural Resources Waterways Division (with approval from our State legislature), has awarded Cedarville Harbor a grant of \$1,020,000 toward development and improvement of Cedarville Harbor.

The permitted project includes: additional boat docks, a designated seawall dock for emergency vessels & vehicles (to reduce critical response time during an emergency), an additional boat launching ramp, a boardwalk northerly to Hodeck Street, landscaping along with benches, pumpout facility, a Harbor building complete with restrooms, showers, fish cleaning station, and possibly laundry facilities.

This is a 50/50 matching funds grant, with a window of development for 3 years, with timely extensions. This allows our community time to raise necessary matching funds, to develop the harbor facilities in phases.

Our hope is to raise adequate funds to construct a downscaled facility with a few docks, and the boardwalk toward the village, this year ... with the complete project constructed during the next few years.

We believe this harbor facility expansion will help to enhance Cedarville's downtown waterfront, creating better infrastructure, and attract sound business investment into our community:

- Enhanced access for emergency services
- Restore Cedarville as the viable waterfront community it once was
- Cedarville is the Port on Navigation Charts & CG Buoys
- Harbor Improvement would restore docking 1950 level for both local & transient boaters



Are we having fun yet?



Cedarville Harbor and Boat Launch



Les Cheneaux islands Assoc. dock at Hossack's Store

## Chapter 2.3: Mission #3

### Stimulate the Campaign for Balancing Lake Level Extremes

Human activities over the last 80 years have increased outflows through the St. Clair River, causing lakes Michigan and Huron to be at least 20 inches lower today than they should be. This permanent change is due to dredging and sand/gravel mining in the St. Clair River.

Outstanding agreements exist between the U.S. and Canada to install “compensation measures” in the St. Clair River, including submerged sills (or “speed” bumps) and other structures to offset past human activities. Installation of these compensation measures is now long overdue.

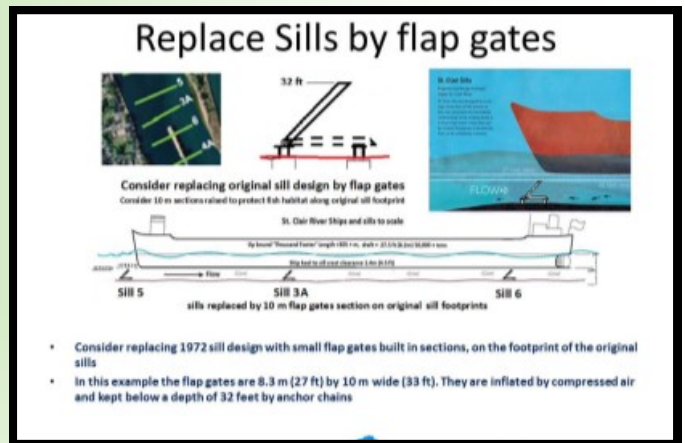
LCWC, as a member of ROW, Int’l, is engaged in seeking a permanent solution to the lower water crisis on the upper Great Lakes, including the following immediate actions:

1. Push the U.S. Army Corps of Engineers (USACE) to initiate a reevaluation of necessary dredging compensation for the St. Clair River.
2. Expand the current Congressional authorization to allow the USACE to assess the full range of compensation measures to provide at least 20 inches of water level restoration to lakes Michigan-Huron through a new provision in the Water Resources Development Act of 2013
3. Promote water level restoration for lakes Michigan and Huron as a key component of the currently funded Great Lakes Restoration Initiative.

What needs to happen is a proper study of real solutions to protect the Great Lakes from historic as well as expected ongoing climate change impacts as identified in the Upper Great Lakes Study. This study must include a detailed engineering examination of contemporary water management technologies and look at all sites identified for possible deployment using the integrated, system-wide approach needed to solve this problem.



Low water left this dock high & dry



One option for restricting St. Clair River water flow



ROW,I Poster



## Chapter 2.4: Mission #4

### Maintain and Enhance Boating Navigation Lanes

Extension of the Federal Channel into Cedarville's Downtown Shorefront is permissible for appropriation, under Continuing Authorities Program (Section 107, of the Rivers & Harbors Act).

After a USACE Feasibility Study is funded and completed, a USACE Appropriation will be sought to complete this much needed project.

- USACE created our federal channel 2,000 feet away from Village Shorefront during 1967.
- In the early 1950's city fathers requested the original federal channel be dredged near Cedarville's downtown district, not across Bay as it is presently located.
- Historically Cedarville was the center of Islands Commerce, whereby cruise ships brought the original settlers into our islands community.
- Cedarville is the U.S. Coast Guard designated Islands Homeport. Aids to navigation (channel buoys) direct all vessels to Cedarville (red-right-returning).
- Les Cheneaux 36 Islands presently shelter approximately 900 cottages along with boat docks mooring over 2,400 vessels.

A permit was received by Clark Township and LCWC to maintain the Federal Navigation Channel through Sheppard Bay, where the channel has been most effected, and also this section was not included in the 2010 dredging operation. Dredging, Harvesting, and experimental dragging activities are included in the permit.



Dredging EWM in Federal Navigation Channel



EWM prototype Drag Device test



EWM Harvester in Cedarville Bay

## Chapter 2.5: Mission #5

### Maintain Exceptional Surface Water Quality

From a water quality perspective, there is no better ecosystem than the coastal marsh. Marshes act as sponges to soak up water at times when it is abundant such as the spring melt off, or during large storms.

While the marsh is soaking up excess water, it is also cleaning the water at the same time. Thus, the marsh acts as a filter for incoming water from streams as they empty into the lake. In fact, if you look at our municipal sewage treatment plants, they are basically modeled after a wetland. Most sewage plants follow this type of general pattern in treatment:

- They screen and slow water down to allow solids to filter or settle out.
- They use bacteria to digest organic wastes that are present in the sewage.

Wetlands follow this same method of “water treatment” naturally. First, when water flows from a stream or river into a marsh, the natural vegetation screens particulates from the water and slows the flow of the water down, allowing solids and particulates to settle out of the water.

Then, natural aerobic and anaerobic bacteria in the marsh water and sediments go to work on organic wastes that may be in the water. Bacteria can even break down petroleum products that may have reached the water.

In fact, scientists used bacteria to clean up oil from the shorelines that were affected by the spill of the Exxon Valdez on the coast of Alaska. Therefore, marshes have been called “living machines” because they can do the work of manmade waste treatment plants naturally as a part of the ecosystem.



**Reef outcropping on Moscoe Channel**



**Taking the plunge into the Crescent**



**Liberty Beach, Marquette Island**

## Chapter 2.6: Mission #6

### Enhance the Local Fishery, and grow Recreational, Subsistence & Commercial Fishing Opportunities

The Les Cheneaux Islands have long been revered as a haven for fishermen, waterfowl hunters, wildlife enthusiasts, boaters, and scientists. Much of this stems from the vast diversity of wildlife that is produced in our coastal marshes.

Local people, and people from miles away visit our marshes to enjoy the wildlife that they hold. One could write an entire book on this topic alone, so we will touch on just a few topics that many will relate to.

To many fishermen, the Les Cheneaux Islands are synonymous with the Yellow Perch. While many will attest that the Perch fishery is not what it used to be, there seems to be an increase in Perch numbers recently, due to a number of factors that we don't have time to discuss.

Our coastal marshes are vitally important nurseries for the Yellow Perch and a large number of other popular species such as Northern Pike, Smallmouth Bass, and Largemouth Bass. Yellow Perch use the shallow water marshes for spawning every spring right around the last part of April. They drape their egg masses over submerged bulrush stems, or weave them through under water vegetation.

The marsh vegetation gives the Perch fry cover from predators, while the plankton that are produced in the marsh provide a food source for the young fish. Later, the Perch will feed on larger macro invertebrates such as freshwater shrimp and midges. This relationship between Yellow Perch and coastal marshes is but one example of how the marshes provide the base of the food chain while providing necessary habitat for the development of juvenile fish.

Students at Cedarville High School have been studying the spawning habits of Yellow Perch in Flower Bay since 1998. This study has generated a lot of data and knowledge concerning spawning times, locations, and the number of perch that spawned in the bay each spring.



Osprey with catch-of-the-day



Pike winner at Steve Tassier Memorial Fish Derby



Small boat Yellow Perch fishing

## Chapter 2.7: Mission #7

### Create & Promote Outdoor Recreation Experiences

#### *Peek-a-boo Ski Trail*

Peek-a-boo Ski Trail located north of Cedarville Track on Blindline Road. Includes 2.16 miles of groomed ski trail, trails have various terrains. The Les Cheneaux Ski Club maintains these trails. Used for hiking in summer. Parking available.

#### *Snowmobile Trails*

The State of Michigan manages several hundred miles of snowmobile trails in the Eastern Upper Peninsula. One hundred eight miles are groomed and maintained by the Les Cheneaux Snowmobile Club from the Red Creek Bridge (I-75) to [ ]. 50 of those miles are in Clark Township proper. These trails are open for snowmobiles from December 1st though April 1st.

#### *Government Island*

Government Island is 206 acres wooded island that is located on Lake Huron approximately one mile east of Cedarville Boat Launch. This recreation area has three cleared picnic area and rustic campsites are on the north side of the island. These areas have picnic tables and fire rings. Two vault type toilets are located in surrounding areas. LCWC is helping expand & maintain hiking trails throughout the wooded area in the memory of Mike Mahoney. Only accessible by small boat, canoe, or kayak.

#### *Birge Nature Preserve*

The Birge Nature Preserve offers 435 acres of cedar wetland and upland hardwood forest, 1.2 miles of Lake Huron frontage at Mismar Bay, and a boardwalk trail leading to a viewing platform overlooking Loon Lake. This is a good place to see eagles, beavers, osprey, and other wildlife. Preserve is located on both sides of Point Brulee Road 2 miles west of Hessel.

#### *Les Cheneaux Water Trail*

Spans over 75 miles of the northernmost shores of Lake Huron from the Carp River near St. Ignace through the Les Cheneaux Islands and on to DeTour Village. The trail is designated for paddle craft. Camping sites and small resorts are located along the trail. Map available at Les Cheneaux Welcome Center.



Ice Boating off Fishery Point



Water skiing up Snow's Channel



Ensign Race from Voight to Boot

## Chapter 2.8: Mission #8

### Facilitate Education and Outreach Capacities

#### *Frogfest*

Frogfest originated as a project within the Les Cheneaux Community Schools to help educate students about the importance and fragility of our surrounding environment and the vital role frogs play. By 2004, it became a successful collaboration between LC Community Schools and the Les Cheneaux Watershed Council (LCWC), and is now hosted solely by LCWC.

Frogfest continues as an opportunity for watershed education, outreach, and a very fun day for a family outing. This year it continued with emphasis on educating the community about the relationships between water quality, wildlife, and land use. It has grown to be a project of the entire Les Cheneaux community! Frogfest is a fun event that provides a learning opportunity for everyone of all ages. Activities included field trips, exhibits, entertainment, and kids games.

The big kick-off is the “Marsh Hopper” 5-K Fun Run/Walk, and will start at 9:00 am at the tented location on M-134. Exhibitors, displays, kid’s activities and contests include live reptiles and lessons on trout fly tying; they will all be on hand from 11:00 am until 3:00 pm, with field trips in the earlier morning.

There will also be a special evening kayak paddle into Duck Bay with reservations made at FrogFest.



Turtles enjoying Frogfest



EWM Microbial pump testing



Enviroscience Biologist identifying vegetation species

## ADAPTIVE MANAGEMENT MODELS

### 1d Model: Status Quo

#### *Passive Adaptive Management*

"This is the way we've always done it"; "We have no control over climate change", etc.

### 2d Model: Trial & Error

#### *Active Adaptive Management*

Communication & coordination - "steering" is possible; alternatives now "discussable"

### 3d Model: Run-Break-Fix

#### *Scientific Adaptive Management*

Emphasis placed on rules & means, successful adaptive measures are "institutionalized"

### 4d Model: Viable System Model<sup>1</sup>

#### *Cybernetic Adaptive Management*<sup>©</sup>

Dynamic: Policies balance management decisions with complexity of system demands

Sustainable: Ongoing monitoring of systemic adaptive needs enables long term viability

Symmetric: Resources are matched to requirements<sup>2</sup>

**The most successful form of Adaptive Management is Prevention, where the adaptive system design has as much variety in its response options, as the ecosystem being managed may exhibit.<sup>3</sup>**

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<sup>1</sup> The Viable System Model (VSM) was described by British cybernetician Stafford Beer in his books *Brain of the Firm* (1972), *The Heart of Enterprise* (1979), and *Diagnosing the System for Organizations* (1985). The VSM is a model of organizational structure that is based on the structure of the human nervous system.

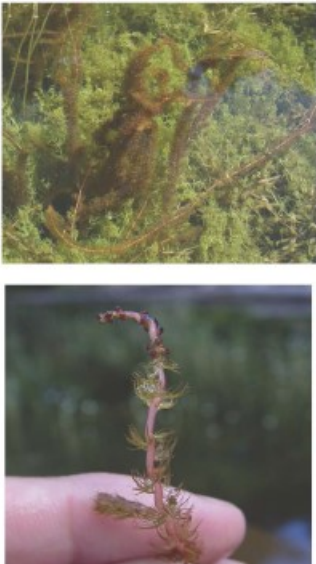


<sup>2</sup> Newton's 3rd Law of Motion: "for every action (force) in nature there is an equal and opposite reaction"

<sup>3</sup> Adaptation of Ashby's Law of Requisite Variety, which instructs that responses available to the system controls must have as much variety as the disturbances engaging the system may exhibit



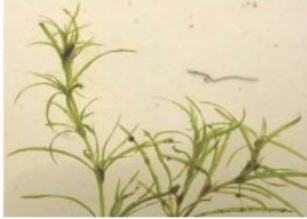



APPENDIX B: AQUATIC PLANT GUIDE





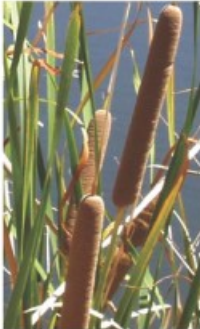



Appendix B



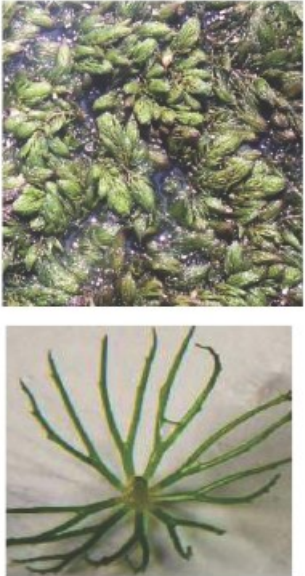
<p><b>Alternate watermilfoil</b> <i>Myriophyllum alterniflorum</i></p>	<p><b>Arrowhead</b> <i>Sagittaria spp.</i></p>	<p><b>Bladderwort</b> <i>Utricularia macrohiza</i></p>
		



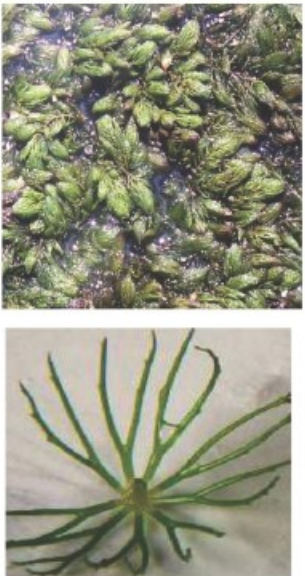


<b>Blunt-leaf pondweed</b> <i>Potamogeton obtusifolius</i>	<b>Bulrush</b> <i>Scirpus sp.</i>	<b>Bushy pondweed/Slender Naiad</b> <i>Najas flexilis</i>
		
		




<b>Buttercup/Water Buttercup</b> <i>Ranunculus longirostris</i>	<b>Cattail</b> <i>Typha latifolia.</i>	<b>Cattail (Narrow-Leaved)</b> <i>Typha angustifolia</i>
		
		









<p><b>Chara/Muskgrass</b> <i>Chara sp.</i></p>	<p><b>Clasping-leaf pondweed</b> <i>Potamogeton richardsonii</i></p>	<p><b>Coontail</b> <i>Ceratophyllum demersum</i></p>
 <p>The top image shows a cluster of green, spiky Chara/Muskgrass plants. The bottom image is a black and white botanical drawing of a similar plant structure.</p>	 <p>The top image shows a single stem of Clasping-leaf pondweed with several leaves. The bottom image is a close-up of a leaf showing its characteristic clasping shape.</p>	 <p>The top image shows a dense patch of Coontail plants in a pond. The bottom image is a close-up of a single Coontail plant, showing its characteristic whorl of eight narrow leaves.</p>




<p><b>Chara/Muskgrass</b> <i>Chara sp.</i></p>	<p><b>Clasping-leaf pondweed</b> <i>Potamogeton richardsonii</i></p>	<p><b>Coontail</b> <i>Ceratophyllum demersum</i></p>
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<p><b>Elodea</b> <i>Elodea canadensis</i></p>	<p><b>Eelgrass/Wild Celery</b> <i>Vallisneria americana</i></p>	<p><b>Eurasian watermilfoil</b> <i>Myriophyllum spicatum</i></p>
		

<p><b>Flat-stem pondweed</b> <i>Potamogeton zosteriformis</i></p>	<p><b>Floating-leaf pondweed</b> <i>Potamogeton natans</i></p>	<p><b>Fries' pondweed</b> <i>Potamogeton friesii</i></p>
 <p>(C) Paul Skawinski, 2009</p>		



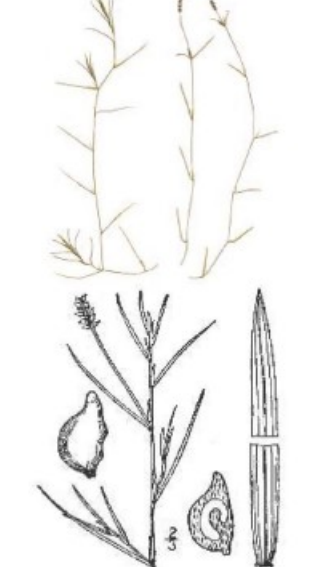
<p><b>Illinois pondweed</b> <i>Potamogeton illinoensis</i></p>	<p><b>Large-leaf pondweed</b> <i>Potamogeton amplifolius</i></p>	<p><b>Lobelia/Water Lobelia</b> <i>Lobelia dortmanna</i></p>
	<p>(C) Paul Skawinski, 2009</p> 	

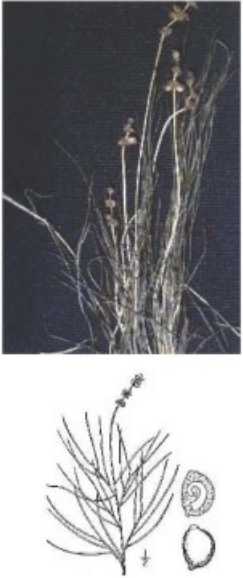
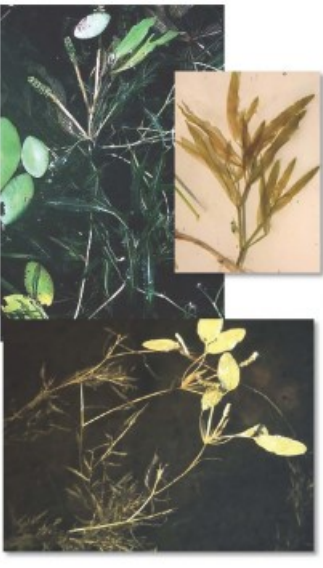

<p><b>Mare's tail</b> <i>Hippuris vulgaris</i></p>	<p><b>Marigold/Water marigold/Crow's foot</b> <i>Bidens beckii</i></p>	<p><b>Nitella/Stonewort</b> <i>Nitella sp.</i></p>
		




<p><b>Northern watermilfoil</b> <i>Myriophyllum sibiricum</i></p>	<p><b>Phragmites</b> <i>Phragmites australis</i></p>	<p><b>Pickerelweed</b> <i>Pontederia cordata</i></p>
		

<p><b>Pipewort</b> <i>Eriocaulon aquaticum</i></p>	<p><b>Purple loosestrife</b> <i>Lythrum salicaria</i></p>	<p><b>Reed canary grass</b> <i>Phalaris arundinacea</i></p>
		

<b>Robbins/Fern pondweed</b> <i>Potamogeton robbinsii</i>	<b>Sago pondweed</b> <i>Potamogeton pectinatus</i>	<b>Sedge</b> <i>Juncus spp.</i>
 <p>(C) Paul Skawinski, 2009</p>		

<b>Spadderdock</b> <i>Nuphar variegata</i>	<b>Spikerush/Needle spikerush</b> <i>Eleocharis acicularis</i>	<b>Stiff pondweed</b> <i>Potamogeton strictifolius</i>
		

<p><b>Thread-leaf pondweed</b> <i>Potamogeton filiformis</i></p>	<p><b>Variable pondweed</b> <i>Potamogeton gramineus</i></p>	<p><b>Water stargrass</b> <i>Heteranthera dubia</i></p>
		

<p><b>White-stem pondweed</b> <i>Potamogeton praelongus</i></p>	<p><b>White water lily</b> <i>Nymphaea odorata</i></p>	<p><b>Whorled watermilfoil</b> <i>Myriophyllum verticillatum</i></p>
		

<p><b>Wild rice</b> <i>Zizania palustris</i></p>		
