GUIDELINES REGARDING SEDIMENT REMOVAL, LOGJAM REMOVAL, AND INVASIVE PLANT AND ANIMAL CONTROL

LAKE AND RIVER ENHANCEMENT (LARE) PROGRAM
INDIANA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH, WILDLIFE, & NATURE PRESERVES

Indiana Code 9-18.1-14.5-6 authorizes the collection of boat registration fees by the Bureau of Motor Vehicles as well as noting the portion to be deposited into the lake and river enhancement fund established by IC 14-22-3.5. This fee is paid by boat owners as part of their annual watercraft registration and is used to pay costs incurred by the Department of Natural Resources (DNR) in implementing lake and river enhancement projects such as biological, engineering, construction and watershed land treatment projects, as well as projects to:

(A) remove sediment;
(B) control exotic or invasive plants or animals; or
(C) remove logjams or obstructions

These guidelines detail how the Department will perform these tasks.

For the purposes of the LARE program, the definition of invasive species is adapted from US Executive Order 13112, signed by the President on February 8, 1999:

"Invasive species" means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.

"Alien species" means, with respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem.

I. General Guidelines Applicable to Sediment Removal, Logjam Removal and Invasive Species Control

Philosophical Foundation

The LARE Fund is administered by the Director of the Department of Natural Resources. The program is implemented by the staff of the LARE Program in the Division of Fish, Wildlife, & Nature Preserves (DFWNP). These aspects are accomplished through LARE grants awarded by the Director of DNR to provide funding for rational, scientifically based, broad-scale remedial actions, the cost of which would otherwise hinder them from being carried out. The ultimate goal is to improve the ecological health and aquatic

habitat of public lakes and rivers, and to enhance their use for various purposes, including recreation.

Funding Considerations

Funds for sediment removal, logjam removal, and control of invasives shall be prioritized toward those that benefit waters accessible to the general public. Projects prioritized for funding should directly or indirectly benefit waterbodies able to support watercraft required to be registered with the Indiana Bureau of Motor Vehicles or otherwise provide significant recreational or ecological benefit to the broader public. Lakes and rivers with free public access sites will be granted higher priority than those that can be accessed only by paying a fee or via commercially operated sites.

The range of requests for funding varies annually; therefore, no specific division of the funds between sediment removal and planning, logjam removal, and invasive species control will be performed until all applications have been evaluated and prioritized. LARE funds are not intended to replace existing sources of funding and should primarily be used for purposes for which no other funding is available. However, LARE funds may be used to match funding from other sources, such as federal grants, which may fulfill the local sponsor's financial stake in the project.

Applications for funding will not be accepted from individuals, but only from entities exhibiting the capability to properly represent the interests of a lake's or river's residents and users, without any financial profit motive. Therefore, any applicant for LARE Grant Funding must be a non-profit organization, or county, municipal, or other local government entity in good standing with the Indiana Secretary of State Office.

Applications must be completed and submitted by the project sponsor. Contractors or consultants completing an application on behalf of a project sponsor will not be eligible for project bidding and award. All project sponsors must be registered as a Vendor with the State of Indiana before an award can be granted. LARE staff will work with the sponsoring entity to help develop the requirements for the project. Due to the complexity of some LARE projects, it is recommended that potential applicants contact LARE staff *prior* to applying for funding to determine the details and needs of the project.

Projects awarded for funding must have a minimum of three bids requested to determine appropriate projects costs. Though one or more bids may be solicited during the application process to determine approximate project costs, bids should be requested after funding has been awarded. All bids must be reviewed by both the project sponsor and LARE staff to ensure all aspects of the project are included, though final contractor selection is deferred to the sponsor.

Funds will be made available for projects in the form of grants. All grant awards will require a local matching contribution of at least 20%. Please see project type information below for specific cost-share rates for each. "In-kind services" may be allowed as a portion of the local matching share, depending on the project type and where appropriate.

A separate document on the current in-kind match policy is available on the LARE website. Any in-kind services will be at the discretion of the selected consultant or contractor and must be coordinated with the project sponsor prior to the commencement of work.

LARE payments are made in arrears, either incrementally during a project, or as a whole upon project completion. Sponsors are expected to contribute to their portion of the cost from the beginning of the project with each request for grant disbursement. Additionally, project progress reports should be provided with each request. As the project nears completion, generally, 15% of the entire LARE grant award will be held until the project is completed, including the provision of reports, site stability is established, and no further expense is envisioned. Project progress will be closely monitored by LARE staff to ensure consistency with LARE guidelines and procedures. Final reports are required for all projects.

Project Contracting

Grants are awarded to project sponsors via State of Indiana Purchase Orders (PO). Contracting for the proposed project is conducted between the project sponsor and selected contractor. However, though DNR is not a party to the contract, it is essential that contracts clearly reflect the spirit and terms of the grant awards and that they do not contain language that conflicts with State policies. It is therefore critical that proposed contracts be reviewed by LARE Program Managers prior to acceptance and sponsor signatures.

Standard Terms and Conditions:

Confidentiality - All information provided to the client or LARE staff becomes public information. Sensitive information may be restricted in distribution during the project but must be made available at any time upon request of state staff. This includes correspondence, field notes, data analyses, and draft documents.

Ownership and use of documents - All products created as a result of the project are owned by the State of Indiana. The contractor may not charge the client or agency for reuse of products paid for with state funds. The contractor is not liable for misuse of products.

Termination of contract – LARE program participants should be aware that funding of projects is contingent upon the LARE program receiving appropriations through the state budgeting process. LARE grants are awarded only after appropriations occur, to ensure that the monies are available in the LARE account. However, although highly unlikely, it is possible that in times of budgetary distress state officials might freeze certain accounts to prevent a budget deficit. If that were to occur with respect to the LARE fund, DNR staff would likely be unable to process contractor invoices and provide reimbursements for services rendered to the sponsor. It would then be the responsibility of the project sponsor and the contractor to determine whether to proceed with the project at the

sponsor's expense or cancel the contract. In anticipation of such an occurrence, it would be in the sponsor's best interest to consider inserting a clause in the contract that would indicate what would occur if funds became unavailable.

Payment Processes

A W-9 form and Direct Deposit information must be provided to the Auditor of State to set up a payment conduit for the project sponsor, since all payments will be made electronically to the sponsor's bank account. This information is purged from the Auditor's database and must be refiled, if it has been two years or longer since the last payment was processed. These two forms must be completed and submitted to a LARE representative for processing. If the sponsor changes the name and/or address of their contact (treasurer) for mailing invoices and payments, a new W-9 and Direct Deposit form must be submitted.

Invoices are sent from the contractor to the association. The sponsor may then forward approved invoices to their LARE Program Manager for review and processing through the IN DNR Purchasing Department. Payment to the sponsor via direct deposit generally takes approximately two weeks. If the sponsor is experiencing delays in receiving payment, a LARE Program Manager can inquire internally to try to accelerate the process.

The LARE program maintains a record and/or tracking spreadsheets for all state payments for each project that is available upon request.

Authorized Use of Awarded Funds

Grant funds must be used solely for the activities described and approved during the application and award process. Any deviation from the approved scope must be discussed in advance with a LARE Program Manager. Substantial project modifications—particularly those that could result in environmental harm or conflict with Department missions or guidelines—may lead to reevaluation of the award and possible rescission of funding.

General Procedures/Guidelines

Application forms to be used are posted on the LARE website under the tab "Applying to the LARE program". The application deadline for all grants will be **December 31,** annually. Sponsors will have 24 months to complete sediment removal and logjam removal projects and 12 months to complete invasive species control projects, once funds have been awarded and encumbered with a state Purchase Order (PO).

II. Guidelines Specific to Sediment Removal

The goal of LARE sediment removal projects is to restore and enhance aquatic habitat as well as recreational usage of the lake where sediment deposition has impacted it. The

source of the sediment and prevention of continued sedimentation should be addressed before dredging commences to help ensure effective use of limited funds. LARE funds may not be used for the deepening of naturally shallow areas of lakes, the excavation of ecologically beneficial wetland areas, removal of emergent vegetation beds or nuisance vegetation, or other activities inconsistent with the Department's non-rule policy guidelines for dredging on public freshwater lakes. River dredging projects are rarely feasible as sediment transport in these systems is a dynamic and natural stream process. As a result, dredging projects on rivers or streams are often seen as low priority for the program.

LARE sediment removal projects are not intended to deal with sediments contaminated by pollutants to the extent that special measures would be required for their removal and disposal. Any potential project involving such contaminated sediments will require special consideration by the Department.

A meaningful plan describing all aspects of a sediment removal project will be required before a sponsor can apply for funds to dredge. Guidance has been developed by the LARE staff for sediment removal plans, and LARE funds are available for the development of such plans. These plans help determine the amount of accumulated sediment present, ensure that sites planned for dredging will be permittable, and that the disposal areas are secured and will meet approval by associated regulatory agencies. Requirements for the development of a sediment removal plan are provided in a draft Scope of Services document on the LARE website. A final Scope of Services tailored specifically to the subject lake and its current needs or issues will be developed in coordination with LARE Program Managers prior to project bidding.

A grant of $7,500 will generally be the maximum available for development of a sediment removal plan. Applications for larger sums may be considered, depending on the lake's particular circumstances and the availability of funds. A minimum of 15% of the total cost of the plan must be contributed by the project sponsor. The sponsor's involvement in the development of the plan should help affected residents become better aware of the issues associated with the sedimentation problem.

The efforts of local residents to map and quantify sediment deposits, develop bathymetric maps, acquire dewatering and disposal sites, obtain necessary permits and other approvals, and provide services necessary to conduct a sediment removal project may count toward the required local match contribution for the grant as in-kind services.

The sediment deposits should be evaluated to determine their origin, i.e., whether they are decomposing aquatic plants that originated on the site or if they consist of eroded soil transported to the lake by an inlet stream.

Sponsors and contractors associated with sediment removal projects are expected to comply with applicable laws, rules and permits in conducting the work and must take steps to ensure that adverse impacts, either direct or indirect, to the natural resources of

the lake are minimized during the project. Hydraulic dredging may be favored over mechanical dredging in regard to minimizing impacts to natural resources; however, factors such as site location(s) or proximity to dewatering basins should be taken into account when determing which method may be more approrpiate.

The extents to which the public benefits and/or the ecological health and aquatic habitat of a water body have been impacted by sediment deposition may all be considered during funding prioritization process. Consideration for funding for sediment removal may also be contingent upon demonstrated efforts to apply upstream erosion control measures and assurance of long-term erosion control in the watershed and in the stream channel itself.

Projects having greater overall public benefits will have higher priority than those that benefit only a few residents. For example, removal of sediment deposits from the mouth of an inlet stream will generally receive greater consideration than a project on a manmade channel into which no stream inlets. As such, sites with a direct stream inlet (channel or inlake delta) or navigational channels will be cost-shared at a rate of 80%-20% (LARE/Sponsor) while channels with no direct stream inlets will be cost-shared at a rate of 65%-35%, respectively.

A watershed diagnostic study will not be a prerequisite for site-specific sediment removal project applications, but the extent to which a problem site and its greater environs have been scientifically analyzed will be considered in the application review process. Further, the extent to which a study's recommendations are implemented will impact an application's priority ranking. Whole-lake sediment removal projects are generally not feasible for LARE funding though review of specific sites within a whole lake sediment removal proposal may be reviewed and considered.

In some situations, LARE funding may be granted for some, but not all, sites applied for on a water body. In these cases, residents willing to use private funds for removal of the sediment from such sites may coordinate their efforts with the LARE project sponsors and the contractor to have the work performed at the time the contractor is conducting the LARE-funded work. This could help reduce duplication of costs for mobilization and demobilization of equipment and construction of the dewatering basin. Acquiring all necessary federal, state, and local permits and other approvals will be required by participating residents for privately funded dredging.

Similarly, those persons on lakes proximal to one another that are conducting independent sediment removal projects – whether or not they are LARE-funded – may consider taking advantage of economic benefits to be derived by hiring the same contractor and/or using common dewatering and/or disposal sites in order to avoid duplication of costs.

A maximum of $150,000 will be available for the removal of sediment from a particular site on a water body. For each project, a minimum of 20% or 35% of the total project cost must be contributed by the project sponsor. A portion of the local match may be in the form of "in-kind" services, including the value of efforts to develop the required sediment

removal plan. Such contributions will be set forth before the project begins in consultation with LARE staff and the contractor. Sediment removal projects should also include post-dredging mapping of the project site to document the lake bottom after dredging has been completed.

III. Guidelines Specific to Removal of Logjams from Rivers

The goal of logjam removal projects is to reduce erosion and sedimentation in rivers and streams due to logjams. Logjams that redirect water energy toward streambanks, potentially undercutting roads and other features, can cause great concern, as can those that markedly affect stream channel patterns. In some streams, logjams also have the potential to reduce recreation and stream use.

Woody debris provides valuable habitat for fish, wildlife, and other aquatic organisms, so removal of logjams must be weighed against the impacts on fish and wildlife habitat. Expertise within DNR will be used to help determine these potential impacts. If approved, the removal of such logjams must be conducted in a manner that minimizes impact on both the aquatic habitat and the land used to access the stream for logjam removal. Planned activities for logjam removal must comply with all local, state, and federal laws, rules and/or regulations.

Legislation guiding the LARE program does not allow funding for these specific types of projects to address issues on county-regulated drains where an annual assessment fee is collected. Logjams on regulated drains should be addressed by the local or county drainage boards.

Similarly, logjams associated with roadway or railroad bridges or other man-made structures are not eligible for LARE-funded projects. Those projects must be addressed by the federal, state, county or local authorities over the roadway or other man-made structures, or the company responsible for the railroad bridge.

Waterways on the list of navigable rivers maintained by the Natural Resources Commission (https://www.in.gov/nrc/nonrule-policy-documents-npd/navigable-waterways-roster/) will receive the greatest consideration for LARE-funded logjam removal projects, as will rivers and streams with public access.

Logjam removal projects in waterways that are included in the Natural Resources Commission's listing of Indiana's natural, scenic, and recreational river systems in 312 IAC 7-2 must comply with DNR permit requirements to be eligible for LARE funding.

Proposed logjam removal projects on salmonid streams in 327 IAC 2-1.5-5 must comply with rules of the Natural Resources Commission. Work cannot commence without the prior written approval of the DNR Division of Fish & Wildlife. Work in a salmonid stream must comply with the requirements and timeline as specified by 312 IAC 10-5-6.

Logjam project applications must include the condition of the logjam according to the Indiana Drainage Handbook. Priority for funding will be given to projects that address Condition 3 and 4 logjams. Logjams of conditions 1 and 2 will rarely receive priority for funding.

Condition 1 logjams consist of one tree down with minor water flow impedance.

Condition 2 logjams are evidenced by small, isolated logjams that may consist of two to three trees that are interlocked and occasionally span the entire width of the river.

Condition 3 logjams contain large accumulations of lodged trees, root wads, and/or other debris that are interlocked and frequently span the entire width of the stream. Large amounts of fine sediments have not yet covered or become lodged within the obstruction.

Condition 4 logjams contain major blockages that have caused severe and unacceptable flow conditions. Bank erosion and upstream ponding are evident.

Condition 5 logjams occur in waterways that possess unique, sensitive, or valuable ecological resources, including rare plants and animals, and rare habitat. These include scenic or recreational rivers. The extent of obstruction may be similar to one of the four conditions described above.

A maximum of $60,000 will be available for a logjam removal project on an eligible site and waterway. For each project, a minimum of 20% of the total project cost must be contributed by the project sponsor. A portion of the local match (up to half) may be in the form of in-kind services, including, but not limited to, erosion control, site restoration and permitting or approvals, if needed. Such contributions will be set forth before the project begins in consultation with LARE staff and the contractor. LARE grant awards are made to sponsoring entities and not to individual landowners.

Project sponsors for LARE logjam removal projects must adhere to the planned project tasks in a cooperative approach, working with their LARE project manager. Performing actions outside of the planned project tasks may result in reduction of LARE grant funds, and nonpayment for work done incorrectly. If additional work is done that impacts the project area and beyond, that was not planned or coordinated, the project sponsor will be responsible for paying the full cost of any restoration work on areas not agreed upon before work began.

Logjam removal projects may include provisions for site restoration, including erosion control measures and seeding. Final payment on projects will not be issued until the site is restored to the condition specified in the contract or agreement between the project sponsor, project contractor, and LARE staff.

IV. Guidelines Specific to Control of Invasive Plants or Animals

The goal of invasive species control projects is to reverse or repair ecological damage, reduce adverse recreational impacts, and prevent the establishment of invasive species in new areas. LARE-funded projects will be in accord with the goals of the State of Indiana's Aquatic Nuisance Species (ANS) Management Plan.

The goals of the LARE aquatic vegetation management program are to:

1) Develop or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality, and is resistant to minor habitat disturbances and invasive species.
2) Direct efforts to prevent and/or controlling the negative impacts of aquatic invasive species.
3) Provide reasonable public recreational access while minimizing the negative impacts on plant and fish and wildlife resources.

There may be situations in which it would be unwise to control a population of an invasive plant species, if there is no likelihood of its replacement by more desirable species, thereby worsening the water quality situation if the site becomes devoid of all vegetation (Valley et al 2004). Such concerns will be considered during the application review process. Furthermore, LARE funds will not be available to control common, ecologically desirable native species, even though some lake or river users may consider them to be a nuisance. LARE funds should not be used in ways that would detrimentally affect native plant and animal species, particularly those that are rare, threatened or endangered. For that reason, the expertise of the Indiana DNR divisions of Fish & Wildlife and Nature Preserves are used in the implementation of the program.

New high-risk invasive species will receive priority for funding, followed by species that pose the greatest risk to both ecological function and recreation. It is important to take steps to prevent the establishment of new invaders, even if that means that some of the more common invasives receive fewer resources for control. An example of this strategy was the program to prevent the spread of hydrilla to other lakes in Indiana when the invasive plant was discovered in Lake Manitou in 2006.

With the exception of starry stonewort, LARE funds will not be available for efforts to control algae. Efforts to reduce sedimentation and nutrient input into public waters may tend to reduce algae problems by reducing its source of nourishment. The existence and progress toward implementation of a watershed plan to address the control of nutrients flowing into a targeted water body will increase the possibility of grant funding for invasive plant control.

The program recognizes that prevention strategies are the most cost-effective means of invasive species control, but that control of established populations of invasive species is also necessary and appropriate. The state program uses a strategic landscape-level approach to prioritize control where:

1) Users comply with strategies to prevent introduction of invasive species;
2) Implementation of controls is likely to reduce negative impacts to recreation and improve ecological health or will contain further spread of invasive species; and
3) The characteristics of the water body are conducive to cost-effective plant control methods.

Aquatic Vegetation Management Plan

Preparation of a long term and comprehensive Aquatic Vegetation Management Plan (AVMP) will be a prerequisite to eligibility for funding to control invasive plant species. Grant funds may be used to conduct an aquatic plant survey and develop an aquatic vegetation management plan (AVMP). The LARE program allows for funding of the development of watershed diagnostic studies, which may incorporate development of an AVMP as an integrated component. A grant of $7,500 will be the maximum for an AVMP, and a grant of $4,000 will generally be the maximum available for development of later updates. After the completion of an AVMP, an update of that plan may be required anytime treatment funding is awarded. Depending on the scale of the treatment and approval by LARE staff, a Tier II survey may be substituted for an AVMP update. Applications for larger sums may be considered, depending on the lake's particular circumstances and the availability of funds in the particular year in which the application is received. A minimum local match of 15% of the total cost is required. Standard sampling protocols and scopes of services are available for such surveys and plans.

Whole-lake Treatment Option

Once an approved AVMP is in place, a maximum of $100,000 may be available, per lake, for a whole-lake treatment with a herbicide, such as Fluridone, to control aggressive, invasive macrophytes (e.g., Eurasian watermilfoil), provided this is determined to be the best course of treatment. Approval of such an effort will be contingent upon the sponsor's commitment to a total of at least three years of professional control of the target species and restoration of the native plant community. Beyond the investment for an initial whole-lake herbicide treatment, up to $35,000 per year may be provided for periodic spot treatments of the target species. After such grants have been awarded for a particular waterbody for two years, additional applications for such grants for that water body will receive a lower priority for funding. A minimum local match of 20% of the total project cost will be required on all grants.

Spot Treatment Option

Once an approved AVMP is in place, a maximum of $35,000 per year will be available, per water body, for control of invasive species infestations not requiring a whole-lake treatment. A local match of no less than 20% of the total cost will be required. After such grants have been awarded for a particular water body for three years, additional applications for such grants for that water body will receive a lower priority for funding.

Maintenance Treatment Option

After an approved AVMP and three years of LARE-funded treatments designed to reduce invasive species, a lake or river may be eligible for maintenance treatments. Maintenance treatments are designed for lakes or rivers that have a reoccurring problem with invasive species for which large-scale treatments have been unsuccessful at controlling those populations. This treatment may also be appropriate in highly eutrophic water bodies that lack diversity in which the replacement of invasive species by more desirable native species is unlikely. In these unique situations a vegetation management plan is required; however, three years of treatments designed to reduce invasive species may be waived. Maintenance treatments are designed to treat only high-priority areas of a water body and therefore are not likely to reduce the overall abundance of an invasive species over time.

The primary goal of maintenance treatments will be to improve public recreation on a seasonal basis. Man-made channels are not eligible for maintenance treatment unless they are used for navigating between two water bodies. Funding requests for maintenance treatments will be considered on a case-by-case basis and will be dependent upon the availability of funds. If approved, a maximum of $5,000 per year will be available, per lake or river, for control of invasive species. A local match of at least 20% of the total cost will be required. In most circumstances, neither a Tier II survey nor an AVMP update is required in combination with a maintenance treatment; however, both can be considered for funding if requested by the project sponsor or deemed necessary by LARE staff. A grant of $1,500 will generally be the maximum available for a Tier II survey, and a grant of $4,000 will be the maximum available for an AVMP update. A local match of 20% of the total cost will be required for either a survey or update. There is no guarantee that maintenance funding will be continued indefinitely, and such grants will be determined annually, on the basis of available funds and LARE-funded project priorities. If such grants have been awarded for a particular water body for two consecutive years, additional applications for such grants for that water body will receive a lower priority for funding the next year.

Treatment for Starry Stonewort

Starry stonewort is a recent invader to Indiana and despite its resemblance to a vascular plant, it is a macroalga. Due to its ability to spread throughout a body of water and the lack of herbicides available to control it, starry stonewort can be difficult and expensive to manage. Because of this, starry stonewort treatments will be designed to treat only high-priority areas of a water body, and to improve public recreation on a seasonal basis. These treatments will resemble maintenance treatments and are not likely to reduce the overall abundance of starry stonewort over time. If approved, a maximum of $5,000 per year will be available, per lake or river, for control of starry stonewort. A local match of at least 20% of the total cost will be required. An AVMP update is not required in combination with a starry stonewort treatment, and there is no guarantee that funding will be continued indefinitely. Such grants will be determined annually on the basis of available funds and LARE-funded project priorities. If such grants have been awarded for a particular water body for two consecutive years, additional applications for such grants for that water body will receive a lower priority for funding the next year. Man-made

channels are not eligible for starry stonewort treatment unless they are used for navigating between two water bodies.

All applicable permits for herbicide treatments must be on file with the DNR before control activities. The AVMP includes a permit application form, with the required information, which the local sponsor submits along with the appropriate permit fee. The aquatic vegetation permit biologist plays an important role in the evaluation of the vegetation treatments and reviews all permits. Any applicator of herbicides must possess a valid and current Category 5 (Aquatic Pest Management) Certification with the Indiana Office of the State Chemist (http://oisc.purdue.edu/). The LARE program also requires those persons or firms who develop the AVMP to possess the same certification because those plans offer recommendations for chemical plant control.

Projects using proven plant-control methods will be eligible for grants. Reasonable consideration will also be given to new, potentially cost-effective techniques, such as biological controls. These could ultimately have broad economic public benefits. This is particularly applicable if they have the potential to supplant the use of chemical treatments without affecting water bodies lower in the watershed.

Funding requests will also be considered for both plant and animal control projects that would have a regional or statewide application, such as funding the management of a cost-effective, innovative biological control effort for a particular invasive species. Requests might also be considered for monitoring methodologies that would allow for evaluation of program performance and sampling or treatment protocols. Funding requests for the control of invasive animals in individual water bodies will be considered on a case-by-case basis.

LARE funds may not be used to contract the use, purchase or lease of aquatic plant harvesters. While harvesters may be useful in removing vegetation in some circumstances, such removal is temporary and can be detrimental to the ecology of the body of water. Although it varies among species, the effectiveness of harvesting generally only lasts four to six weeks and requires multiple cuts throughout the summer to achieve desired control (Engel 1990). Many species, most notably Eurasian watermilfoil, can reproduce and spread by fragmentation. Fragmentation is the process of smaller pieces of a plant breaking off and establishing new plants. This form of vegetative reproduction has shown to be effective at spreading and establishing new plants and is likely responsible for the dispersal of some plants over great distances (Nichols and Shaw 1986, Smith and Barko 1990, Madsen and Smith 1997). While harvesters are designed to collect plants, they have been shown to leave behind fragments that can become established and form new plants. A study completed on a river system in Texas confirmed a significant increase in the amount of invasive species fragments observed downstream of a dam after upstream harvesting (Owens et al. 2001). Additionally, a study completed by the Arizona Game and Fish Department concluded that harvesting activities likely spread Eurasian watermilfoil throughout Arizona reservoirs (Robinson et al 2007). Invasive species in Indiana that can spread by

fragmentation include Brazilian elodea, Eurasian watermilfoil, hydrilla, parrot feather, and starry stonewort.

In addition to spreading invasive species through fragmentation, aquatic plant harvesters are not selective and will harvest native beneficial plants as well as invasive species. Most invasive species are more tolerant of this type of disturbance, giving them a competitive advantage and increasing the likelihood that they will become more abundant and cause a long-term shift toward undesirable species in the plant community. In addition to removing native vegetation, harvesters can remove large numbers of fish, turtles, frogs, and other amphibians, as well as macroinvertebrates (Engel 1990, Booms 1999, Robinson et al 2007). Although many of the larger fish can escape, it has been estimated that 25% of all fry within a harvested area are removed (Engel 1990), while a separate study estimated that 8 pounds of fish ranging from ½ to 7 ½ inches were removed per acre harvested, over half of which were yellow perch (Wile 1978).

Although a goal of the LARE program is to reduce adverse recreational impacts caused by invasive species, this needs to be accomplished without causing negative impacts to fish, wildlife, and botanical resources. Although some short-term improvement in recreation may be accomplished, the harvesters do nothing to improve or repair ecological damage caused by invasive species and have the potential to do more harm than good.

LITERATURE CITED

Booms, T.L. 1999. Vertebrates Removed by Mechanical Weed Harvesting in Lake Keesus, Wisconsin. Journal of Aquatic Plant Management 37:34-36.

Engel, S. 1990. Ecological Impacts of Harvesting Macrophytes in Halverson Lake, Wisconsin. Journal of Aquatic Plant Management 28:41-45.

Madsen, J.D. and D.H. Smith. 1997. Vegetative Spread of Eurasian Watermilfoil Colonies. Journal of Aquatic Plant Management 35:63-68.

Nichols, S.A., and B.H. Shaw. 1986. Ecological Life Histories of Three Aquatic Nuisance Plants, Myriophyllum spicatum, Potomogeton crispus, and Elodea canadensis. Hydrobiologia 131:3-21.

Owen, C.S., J.D. Madsen, R.M. Smart, and R.M. Stewart. 2001. Dispersal of Native and Nonnative Aquatic Plant Species in the San Marcos River, Texas. Journal of Aquatic Plant Management 39:75-79.

Robinson, A.T., J.E. Fulmer, and L.D. Avenetti. 2007. Aquatic Plant Surveys and Evaluation of Aquatic Plan Harvesting in Arizona Reservoirs. Technical Guidance Bulletin No. 9. Arizona Game and Fish Department, Phoenix, Arizona.

Smith, C.S. and J.W. Barko. 1990. Ecology of Eurasian Watermilfoil. Journal of Aquatic Plant Management 28:55-64.

Valley, R.D., T.K. Cross, and P. Radomski. 2004. The Role of Submersed Aquatic Vegetation as Habitat for Fish in Minnesota Lakes, Including the Implications of Non-native Plant Invasions and Their Management. Special Publication 160. Minnesota Department of Natural Resources, St. Paul, Minnesota.

Wile, I. 1978. Environmental Effects of Mechanical Harvesting. Journal of Aquatic Plant Management 16:14-20.