2011 ASIAN CARP Control Strategy Framework

December 2010

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The Asian Carp Regional Coordinating Committee

2011 Asian Carp Control Strategy Framework

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Contributing Members:

City of Chicago
Great Lakes Fishery Commission
Illinois Department of Natural Resources
Illinois Environmental Protection Agency
Indiana Department of Natural Resources
Michigan Department of Natural Resources and Environment
Minnesota Department of Natural Resources
New York Department of Environmental Conservation
Ohio Department of Natural Resources
Pennsylvania Department of Environmental Protection
Pennsylvania Fish and Boat Commission
Wisconsin Department of Natural Resources
Metropolitan Water Reclamation District of Greater Chicago
National Oceanic and Atmospheric Administration
United States Army Corps of Engineers
United States Coast Guard
United States Department of Transportation/Maritime Administration
United States Environmental Protection Agency
United States Fish and Wildlife Service
United States Geological Survey
White House Council on Environmental Quality

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Executive Summary

The Great Lakes food web has been significantly degraded in recent decades by aquatic invasive species (AIS). The migration of Asian carp through the Chicago Area Waterway System (CAWS), Wabash River, Grand Calumet River, and possibly other pathways that can connect the Great Lakes to the outside world is the most acute AIS threat facing the Great Lakes today.

Federal, state, and local agencies, working together as the Asian Carp Regional Coordinating Committee (ACRCC), are responding to this threat to prevent Asian carp from establishing populations in the Great Lakes. The main objectives of the Asian Carp Control Strategy Framework (Framework) are to:

- Outline the immediate actions agencies are taking.
- Integrate and unify the existing and future actions of participating agencies.
- Transition from a single point of defense (e.g., electric barriers) to a multi-tiered defense (e.g., fishery management, structures, biological, etc.).
- Provide general direction while recognizing that agencies require flexibility to best act.
- Identify potential hurdles that might complicate Framework implementation.
- Identify opportunities for stakeholders to contribute in meaningful ways.

The Framework is designed to be updated periodically as needed to reflect an ever-increasing body of knowledge gathered from ongoing research and monitoring. This version differs from the May 2010 version in that it contains updates from ongoing activities and presents new actions either now underway or whose efficacy will be assessed in 2011. Once released for public review a summary of all comments and suggestions received will be provided.

The best science available underpins this Framework. Widespread agreement exists among scientists and stakeholders that preventing the passage of Asian carp into Lake Michigan is critical to reducing the probability of Asian carp establishment in the Great Lakes.

This document describes actions, including those now occurring, scheduled to occur, and potential actions that agencies could collaborate upon.

Federal actions, funds, and projects identified for 2011 are proposed as part of the Fiscal Year (FY) 2011 President's Budget and many of these activities will be funded through the Great Lakes Restoration Initiative (GLRI). However, in FY 2012 and beyond, it is expected that much of the ongoing Asian carp activities will shift out of the GLRI and into agencies' base programs and budgets. In addition, it is important to note that these activities' budgets may change during the course of the year. For example, some budgeted activities identified in the May 2010 Framework were either completed under budget, became a higher priority and received additional funding or were not initiated and therefore not funded.

While several of the actions will be conducted by a single agency or governmental unit, most require cooperation among two or more agencies. The proposed action items are grouped into the following categories according to their anticipated outcome, and all are subject to compliance with applicable laws such as the National Environmental Policy Act:

- **Targeted Monitoring Assessment Activities Above and Below the Electric Barrier System**: Operations to confirm and reduce Asian carp population upstream and downstream of the electric barriers.

- **Commercial Harvesting and Removal Actions Below the Electric Barrier System**: Actions intended to reduce populations of potential invaders on the electric barriers.
- **Barrier Action and Waterway Separation Measures**: Actions to further separate the Great Lakes and Mississippi River Basin thereby decreasing the opportunity for Asian carp to enter the Great Lakes.
- **Great Lakes Mississippi River Inter-Basin Study (GLMRIS) and Connecting Channel Activities**: Studies to further identify potential routes for entry into the Great Lakes and assessment of risk for Asian carp in the Great Lakes.
- **Research and Technology Development**: Short- and long-term projects to identify novel control methods or movement patterns of Asian carp.
- **Environmental Deoxyribonucleic Acid (eDNA) Analysis and Refinement**: Actions aimed at refining the use of eDNA as a viable monitoring tool for Asian carp and to increasing agency capability in analysis.
- **Enforcement Activities**: Actions to further decrease the transport of live Asian carp into new waterways and to inform the public of their risks.
- **Funding Opportunities and Agency Preparation Activities for AIS**: Projects that provide funding opportunities to further collaborative efforts with state, local, and federal agencies and further agency AIS planning and preparation with all stakeholders beyond those with jurisdictional authority.
- **Other Asian Carp Support Activities**: Actions to further the development and progression of Asian carp efforts.

Environmental considerations, including minimizing impacts on resident aquatic life, will be integrated into the decision-making process and appropriate environmental review will occur as necessary for all proposed actions.

1.0 Introduction

The Great Lakes food web has been significantly degraded in recent decades by aquatic invasive species (AIS). The migration of Asian carp through the Chicago Area Waterway System (CAWS), Wabash River, Grand Calumet River, and possibly other pathways that can connect the Great Lakes to the outside world is the most acute AIS threat facing the Great Lakes today.

The Asian Carp Control Strategy Framework (Framework) has been prepared by the Asian Carp Regional Coordinating Committee's (ACRCC) participating agencies, states, and stakeholders to outline the actions that will be implemented to control Asian carp migration.

This section briefly presents the problem of the Asian carp migration toward the Great Lakes ecosystem, reviews the purposes of the Framework, identifies the agencies and stakeholders that play a role in the Framework, and presents additional work proceeding outside of this Framework. Section 2.0 presents the Fiscal Year (FY) 2011 unified actions for prevention of Asian carp migration. Some actions have been continued from 2010 and other new actions were developed for FY 2011. The actions are grouped into like categories:

- Targeted Monitoring Assessment Activities Above and Below the Electric Barrier System
- Commercial Harvesting and Removal Action Below the Electric Barrier System
- Barrier Action and Waterway Separation Measures
- Great Lakes Mississippi River Inter-Basin Study (GLMRIS) and Connecting Channel Activities
- Research and Technology Development
- Environmental Deoxyribonucleic Acid (eDNA) Analysis and Refinement
- Funding Opportunities and Agency Preparation Activities for AIS
- Other Asian Carp Support Activities

Section 3.0 discusses the Great Lakes states' involvement in protecting the Great Lakes against Asian carp. Section 4.0 describes the stakeholder actions likely to supplement the Framework by involving the public and providing for communication and outreach to parties outside the immediate circle of participating agencies. The coordination structures of participating agencies and organizations are presented in Section 5.0.

1.1 Purpose

The Framework is a dynamic document, reflecting an ever-increasing body of knowledge gathered from ongoing research and monitoring, and builds on the efforts which began in December 2009 with the deployment of federal, state, local, and Canadian resources to conduct an eradication effort in the Chicago Sanitary and Ship Canal (CSSC), which is part of the CAWs (see Figure 1 below). Many actions described in this Framework, such as research and feasibility studies, are expected to provide additional data that may serve as building blocks for future mitigative activities. However, the main objectives of this Framework are to:

- **Outline the actions participating agencies are taking to apply full authorities, capabilities, and resources in order to prevent establishment of Asian carp in the Great Lakes.** Experience has shown that controlling populations of AIS, once introduced and then established in a new environment, is far more expensive and difficult than preventing their entry to the Great Lakes in the first place.
- **Integrate and unify the current and future actions of participating agencies.** While agencies have coordinated significantly in the past, this Framework is a comprehensive, integrated

approach to address the Asian carp threat to the Great Lakes, and helps to further unify the participating agencies by:

- Describing actions to prevent establishment of carp.
- Identifying lead agencies.
- Establishing funding for actions.
- Determining the most effective approach for implementing actions.

- **Transition from a single-point defense to a multi-tiered approach.** Success in preventing Asian carp from being introduced and then establishing a self-sustaining population in the Great Lakes depends on going beyond reliance on the electric barriers to reliance on the suite of structural solutions, biological controls, eradication response options, and other approaches.
- **Provide direction while recognizing that the history of Asian carp migration demands flexibility by participating agencies.** The Framework is meant to be a living document subject to change as the situation dictates.
- **Identify technical and regulatory hurdles that might complicate Framework implementation.**
- **Identify opportunities for existing participating agencies to actively engage additional stakeholders' cooperation.** The Great Lakes region has a proud and vibrant history of cooperation, as evidenced by the *Great Lakes Water Resources Compact, Great Lakes Regional Collaboration Strategy*, *Great Lakes Restoration Initiative Action Plan*, and the multi-jurisdictional contributions to the December 2009 and May 2010 efforts to evaluate and reduce any potential Asian carp population above and below the electric barriers.

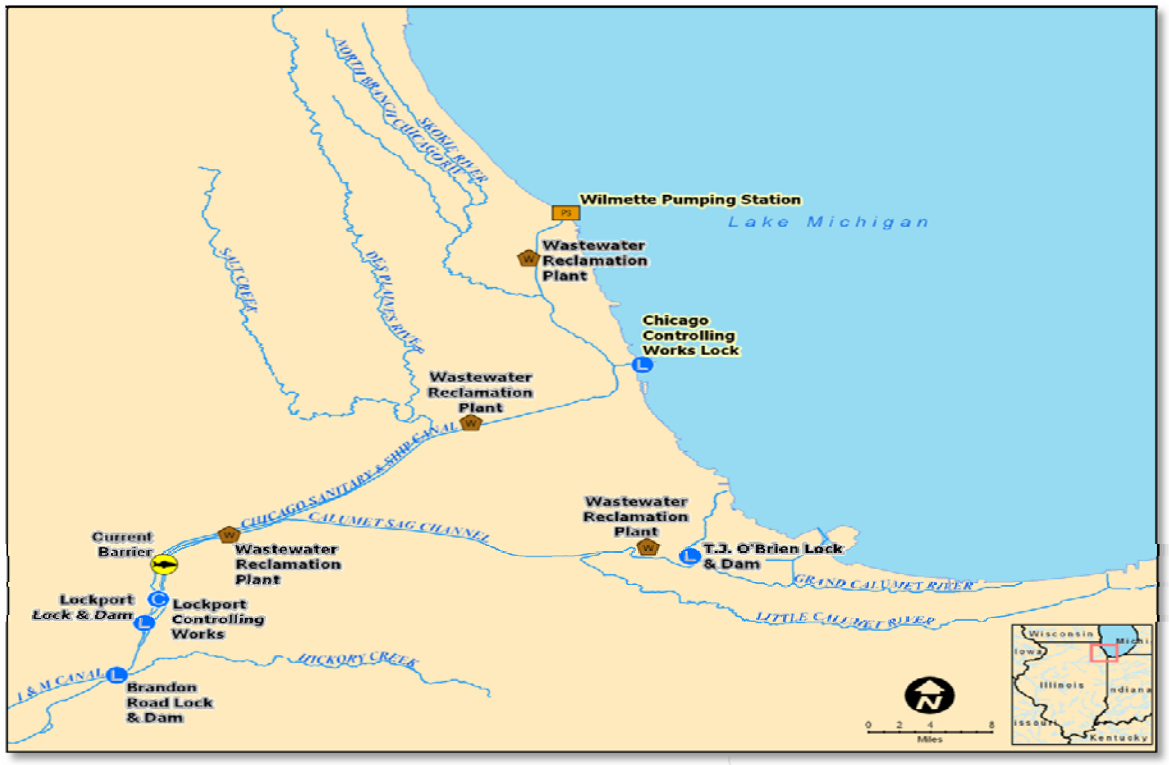


Figure 1. Chicago Area Waterway System

In addition, knowledge gained through the actions in this Framework will also improve future efforts to prevent AIS from migrating through other artificial and/or naturally connecting waterways of the Great Lakes watershed. Figure 2 below identifies 18 locations outside the CAWS where risk of potential AIS transfer exists. These locations are further discussed in the USACE GLRMIS Other Pathways Preliminary Risk Characterization.

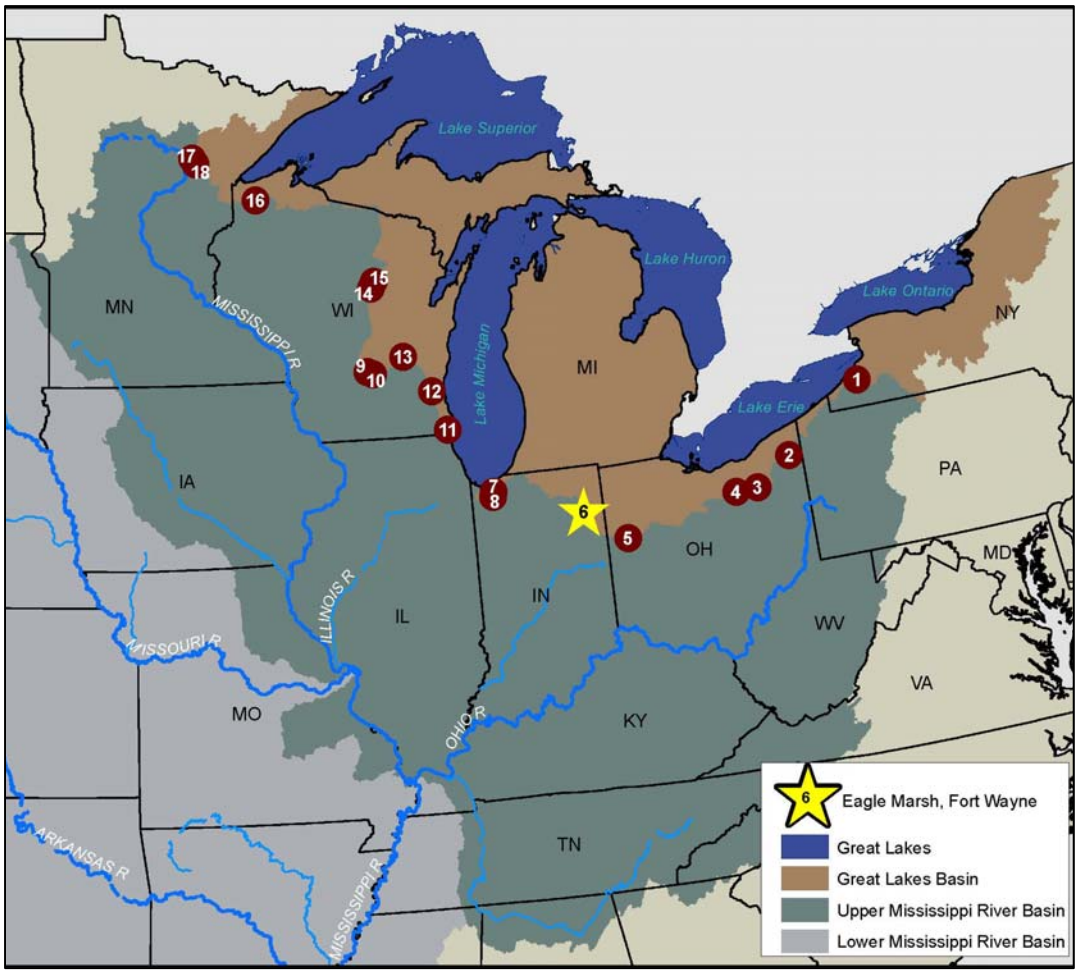


Figure 2. Other Pathways

The overall intent of this Framework and the actions presented herein remains to facilitate cooperation by all agencies and organizations to achieve the common goal of preventing the introduction and establishment of Asian carp in the Great Lakes.

1.2 Problem Statement

The potential invasion of Asian carp into the CAWS and the Great Lakes poses numerous ecological and economic impacts.

See the 2010 *Asian Carp Control Strategy Framework* for detailed information on Asian carp and their potential ecological and economic effects on the Great Lakes.

Background

In North America, Asian carp usually refers to bighead, silver, black and grass carp. They all are members of the family *Cyprinidae*. The three species identified for action are the silver carp, bighead carp and black carp. These fish were originally imported, along with grass carp, to southern United States aquaculture and wastewater treatment facilities to keep retention ponds clean and to serve the food fish industry. There are many potential ways by which Asian carp may have escaped, including inadvertent releases, overland flooding events, or intentional releases. During 2002, monitoring efforts, Asian carp were detected in the upper Illinois River just 60 miles from Lake Michigan. In 2009, a bighead carp was retrieved considerably closer, within the Lockport Pool of the CSSC, 43 miles from Lake Michigan. This event and additional monitoring in the area triggered a rapid response rotenone operation during barrier maintenance in December 2009 to block Asian carp passage through this area. In June 2010, through enhanced monitoring operations, one bighead carp was found in Lake Calumet, 5 miles from Lake Michigan though its origin and route of entry is unknown.

Potential Ecological and Economic Impacts to the Great Lakes

The Great Lakes cover more than 94,000 square miles and, while estimates may vary, host an invaluable sport fishing industry. Under conditions in the Great Lakes (especially their tributaries and estuaries), such as water temperature, food abundance, slow moving wetland regions, expansive area for migration, and lack of natural predators, Asian carp populations could expand quickly. These species could impact local ecosystems.

While the results of various scientific studies suggest a varied range of impacts from Asian carp infestation, the potential threat supports precautionary actions. State, local, and federal agencies are taking pre-emptive actions to prevent Asian carp from establishing a population in the Great Lakes or their tributaries.

1.3 Participating Agencies – Jurisdiction / Authority / Role

This section generally describes the jurisdictions, authorities, and roles of the agencies and governmental units participating in this Framework. This is meant to be an informal description of these agencies with respect to the actions discussed in this Framework, and is not meant to restrict or assign responsibilities and authorities belonging to the agencies under their implementing statutes and regulations.

- **City of Chicago**

  Jurisdiction: Exercises home rule authority within municipal limits.

  Authority: Municipal.

  Role: Supports the work of other agencies, particularly those actions within the City of Chicago, and performs law enforcement, patrol, and emergency response duties along the lakefront and inland waterways within the City's jurisdiction.

- **Great Lakes Fishery Commission (GLFC)**

  Jurisdiction: Great Lakes Fishery Convention Act allowing implementation of a convention of Great Lakes Fisheries between Canada and the United States.

  Authority: Bilateral treaty.

  Role: Coordinate, communicate, and conduct fishery resource management actions on the Great Lakes.

- **Illinois Department of Natural Resources (IL DNR)**

  Jurisdiction: Investigations pertaining to the natural history, entomology, zoology, and botany of the State; the geology and natural resources of the State; the water and atmospheric resources of the State; and the archeological and cultural history of the State of Illinois.

  Authority: State.

  Role: Lead agency for work relating to monitoring, sampling, fish removal actions, and rapid response activities within the State.

- **Illinois Environmental Protection Agency (IEPA)**

  Jurisdiction: IEPA's mission is to safeguard environmental quality, consistent with the social and economic needs of the State, so as to protect health, welfare, property and the quality of life.

  Authority: State.

  Role: Ensure that Illinois' rivers, streams and lakes will support all uses for which they are designated including protection of aquatic life, recreation and drinking water supplies.

- **Indiana Department of Natural Resources (IN DNR)**

  Jurisdiction: May investigate, compile, and disseminate information and make recommendations concerning the natural resources of Indiana and their conservation; and may cooperate with other governmental entities and public and private institutions in carrying out these powers.

  Authority: State.

  Role: Lead agency for work relating to monitoring, sampling, fish removal actions, and rapid response activities within the State of Indiana.

- **Michigan Department of Natural Resources and Environment (MI DNRE)**

  Jurisdiction: In the state's waters, the Department is responsible for management and protection of the Great Lakes fishery resources in regards to recreational, commercial, and tribal fisheries interests and for the conservation and protection of biodiversity and aquatic habitats.

  Authority: State.

  Role: Provide leadership for strategic monitoring assessment, response, and public communication in Michigan as they pertain to Asian carp. Assist other states as requested in these activities.

- **Minnesota Department of Natural Resources (MN DNR)**

  Jurisdiction: Mission is to work with citizens to conserve and manage the state's natural resources, to provide recreational opportunities, and to provide for commercial uses of natural resources in a way that creates a sustainable quality of life.

  Authority: State.

  Role: Managing, protecting, and regulating the state's fish and wildlife resources.

- **New York Department of Environmental Conservation (NY DEC)**

  Jurisdiction: Mission is to conserve, improve and protect New York's natural resources and environment and to prevent, abate and control water, land and air pollution, in

order to enhance the health, safety and welfare of the people of the state and their overall economic and social well-being.

Authority: State.

Role: Responsible for the conservation and enhancement of New York State's abundant and diverse populations of freshwater fishes while providing the public with quality recreational angling opportunities. Serves as the lead agency for work involving the prevention and control of invasive species in New York's waters. Cooperation and coordination with other jurisdictions in the Great Lakes fisheries arena is routinely pursued through the GLFC.

- **Ohio Department of Natural Resources (OH DNR)**

  Jurisdiction: Responsible for the protection, development, conservation and management of Ohio's natural resources, including: managing the state's natural resources for sustainable productivity; protecting Ohio's native plant and animal species; developing industry and tourism opportunities and supporting the present and future economic health of the state; providing recreational opportunities for the public at all levels; and protecting health, safety and biodiversity through fair and consistent law enforcement.

  Authority: State.

  Role: Lead agency in Ohio for fish research, fish sampling and monitoring, rapid response actions, as well as operation and maintenance of certain canal lands within the state.

- **Pennsylvania Department of Environmental Protection (PA DEP)**

  Jurisdiction: Lead agency for enforcement of the Pennsylvania Clean Streams Law, Pennsylvania Water Quality Standards (25 PA Code Chapter 93) and delegated portions of the federal Clean Water Act. Water Quality Standards consist of both Protected Water Uses (including Aquatic Life Uses) as well as the Water Quality Criteria necessary to protect them. PA DEP's Coastal Resources Management Program has various policies to prevent the introduction and spread of AIS.

  Authority: State.

  Role: Permitting of pesticide applications needed for Asian carp response; monitoring and surveillance for Asian carp; supporting Asian carp rapid assessment and response; general scientific support as needed.

- **Pennsylvania Fish and Boat Commission (PA FBC)**

  Jurisdiction: Responsibility for all aquatic organisms in the Commonwealth of Pennsylvania and shares enforcement responsibilities regarding aquatic resource issues with the PA DEP.

  Authority: State.

  Role: Primary responsibility for threat assessment and monitoring of all Pennsylvania AIS occurrences, including Asian carp, and has lead responsibility for initiating the state AIS rapid response plan when deemed necessary.

- **Wisconsin Department of Natural Resources (WI DNR)**

  Jurisdiction: Natural resources, conservation, outdoor recreation, and environmental quality in the State of Wisconsin.

Authority: State.

Role: Cooperate and support any activities which lead to a timely and complete ecological separation of the Mississippi River and Great Lakes Basins in the Chicago area, and as appropriate in areas where such threats exist in Wisconsin.

- **Metropolitan Water Reclamation District of Greater Chicago (MWRD)**

  Jurisdiction: Surface water, municipal wastewater treatment for the metropolitan Chicago area (including almost all of Cook County), control of combined sewer overflows, dry and wet weather operation of the CAWS.

  Authority: Regional.

  Role: Supports the work of other agencies and implements designated action items to the extent allowed by its statutory wastewater and stormwater authority.

- **National Oceanic and Atmospheric Administration (NOAA)**

  Jurisdiction: Implementation of technical assistance and management-oriented research programs that support coastal zone management.

  Authority: Coastal Zone Management Act of 1972 (16 U.S.C. § 1456c.)

  Role: Funding of research studies and activities.

- **United States Army Corps of Engineers (USACE)**

  Jurisdiction: Planning, construction, and operation of navigation and flood damage reduction projects; hydropower operations; environmental protection and restoration; water conservation, recreation, and disaster assistance.

  Authority: Federal.

  Role: Operation of the CAWS Lock and Dam System and the Electric Barrier System.

- **United States Coast Guard (USCG)**

  Jurisdiction: Navigable waterways.

  Authority: Federal Authority; Port and Waterways Safety Act of 1972 and other legislation.[1]

  Role: Ensure the safety, security, and environmental protection of the Great Lakes and the Western Rivers. The Coast Guard manages waterways through Regulated Navigation Areas, and safety and security zones. Regulates the marine industry and supports the marine transportation system.

- **U.S. Department of Transportation (US DOT)/Maritime Administration (MARAD)**

  Authority: Federal

  Role: Supports the maritime transportation system and coordinates with marine transportation stakeholders.

- **United States Environmental Protection Agency (USEPA)**

  Jurisdiction: Coordination of federal Great Lakes policy and activities.

  Authority: Federal Great Lakes protection and restoration policy and efforts provided in Clean Water Act (CWA) 118, Executive Order 13340 and other legislation.

  Role: Coordination and funding.

- **United States Fish and Wildlife Service (USFWS)**

  Jurisdiction: Implementation of activities in support and enforcement of the Lacey Act, Endangered Species Act, Fish and Wildlife Coordination Act, Great Lakes Fish and Wildlife Restoration Act, and the Non-indigenous Aquatic Nuisance Prevention and Control Act as amended; and supporting activities to include fish and AIS monitoring, risk assessment, and law enforcement.

  Authority: Federal.

  Role: Coordination with federal, state, tribal, and non-governmental partners on actions to prevent the introduction and establishment of AIS or to mitigate resource impacts from introduced species.

- **United States Geological Survey (USGS)**

  Jurisdiction: Performance of surveys, investigations and research covering topography, geology, hydrology, biology and the mineral and water resources of the United States, its territories and possessions.

  Authority: Federal.

  Role: Provide leadership, technical expertise, and information needed to develop management tools to better predict ranges and effects of AIS; and to contain, reduce, or eradicate their populations.

- **White House Council on Environmental Quality (CEQ)**

  Authority: Federal – CEQ coordinates federal environmental efforts and works closely with agencies and other White House offices in the development of environmental policies and initiatives.

  Role: CEQ is closely monitoring the development and execution of the Asian Carp Control Strategy Framework.

- **International Involvement**

  Canada has followed the Asian carp issue closely, and has offered its assistance to U.S. efforts to keep the species from establishing a presence in the Great Lakes. In October, the Canadian Minister of Fisheries and Oceans launched a bi-national initiative to assess the risk that Asian carp pose to the Great Lakes. The risk assessment will be the first such joint effort. The bi-national GLFC will facilitate the project which should take about eighteen months to complete. The Canadian government announced that it will contribute over $400,000 to the effort.

2.0 Unified Actions for Preventing Continued Asian Carp Migration

Federal actions, funds, and projects identified for 2011 are proposed as part of the FY 2011 President's Budget, and many of these activities will be funded through the Great Lakes Restoration Initiative (GLRI). However, in FY 2012 and beyond, it is expected that much of the ongoing Asian carp activities will shift out of the GLRI and into agencies' base programs and budgets.

The following narratives were developed by the lead agencies for each action and were reviewed by the participating agencies. In some cases, more than one lead agency has been designated.

Methodologies for Fish Testing and Sampling

- **eDNA testing:** Genetic testing is currently conducted using a new technique called the eDNA method to indicate the possible presence of Asian carp in the CAWS. All fish, including Asian carp, release DNA into the environment naturally through bodily secretions. The DNA slowly degrades in the environment, but can be collected in water samples. These water samples are filtered, processed and analyzed to signal the presence or absence of Asian carp DNA. Positive detection means that Asian carp eDNA was detected in a water sample. Negative detection means that no Asian carp eDNA was detected. Positive detections do not mean that live carp are necessarily present in the waterway. At present, we do not know whether a positive sample came from a live or dead fish, how that DNA arrived at the location, or how many fish it might indicate.
- **Application of Rotenone:** Rotenone is an odorless broad-spectrum poison. Rotenone readily disperses in water both laterally and vertically and penetrates below the thermocline in thermally stratified bodies of water. Rotenone enters the bloodstream of the fish through the gills and causes death. In humans, Rotenone is poorly absorbed in the digestive track and is readily excreted from the body, therefore Rotenone is not considered highly toxic to humans if ingested orally.
- **Electrofishing:** Electrofishing uses electricity to stun fish so they can be caught or observed and is a common scientific survey method used to sample fish populations to determine abundance, density, and species composition. When performed correctly, electrofishing results in no permanent harm to the fish.
- **Netting:** Block, trammel, or other types of nets are installed in the waterway to prevent the fish from moving further upstream or downstream where they can be collected and observed.
- **Side-scan sonar:** Side scan sonar is a tool that can be used to distinguish Asian carp from other fish that are in the water. It is a type of sonar system that provides an image of objects in the water. This technique could be used to periodically identify potential or suspected Asian carp. It could also be used to help determine the location of source fish releasing eDNA, to make better determinations on where to apply Rotenone or take other actions.

2.1 Targeted Monitoring Assessment Activities Above and Below the Electric Barrier System

Tasks included in this section pertain to ongoing monitoring for identification/isolation of Asian carp above the electric barrier system in the CAWS and the Great Lakes. Personnel for IL DNR, USACE, and USFWS working under these actions and item 2.6.1 will work together in order to enhance collaborative efforts, avoid duplication of effort, and increase monitoring efficiency.

2.1.1 Enhanced Monitoring Above and Below Electric Barriers in CAWS

Lead Agency: IL DNR

FY 2011 Funding: $800,000 GLRI funds is proposed.

Project Explanation: This task encompasses long-term actions that revolve around monitoring assessment activities conducted above and below the barriers. USFWS, IL DNR, and USACE all have activities under this task and they include rapid response team support, enhanced monitoring, and eDNA monitoring of the CAWS. The enhanced sampling will be used to document the extent of Asian carp population dynamics within the canal system and connecting waterways, provide data for modeling potential population movements (range expansion), and to determine life stages of Asian carp potentially present.

FY 2010 Summary: A comprehensive Monitoring and Rapid Response Plan (MRRP) for the entire CAWS and Upper Illinois River system was created and implemented in May 2010. This was a collaborative effort between IL DNR, USFWS, and USACE that included increased eDNA collection and extensive netting and electroshocking efforts in search of Asian carp above the barriers. Toxicants were employed as a capture method. Sampling locations were dependent on the season but included areas adjacent to warm water discharges, wastewater treatment plant (WWTP) outfalls, tailwaters of locks and dams, marina basins, barge slips, and other backwater areas. From February to September 2010 well over 3,000 hours of labor were deployed for monitoring above the barrier. From June through the end of September 2010, IL DNR and commercial fishermen set out approximately 41,600 yards of net to capture fish in the CAWS above the barrier. These events yielded approximately 1,200 fish and 20 different species. Through these efforts, one bighead carp was caught in June 2010 in Lake Calumet.

FY 2011 Action: Work will include ongoing extensive monitoring efforts to identify the presence of Asian carp and respond to their presence as necessary. “High risk” areas are those previously identified through waterway characterization as preferable Asian carp habitat or where previous eDNA sampling indicated the presence of Asian carp DNA in the area at the time of sample collection. Monitoring of these “high risk” areas will include the following:

- Enhanced eDNA testing.
- Establish contracts with commercial fishing crews to extensively sample.
- Conventional monitoring, such as netting, at designated areas.

Expected Milestones:

- Weekly monitoring reports.
- Removal of Asian carp if collected from CAWS and Upper Illinois Waterway, including high risk areas.

- Crews on the ground sampling the CAWS increase rapid response capability.
- Assessment of fish population over time to document changes.

Potential Hurdles:

- Assessment of fish populations in very low abundances is difficult.
- Sampling in an environment designed for commercial navigation needs cooperation of industry and extra vigilance for safety.
- May require closures of CAWS or navigation stoppage for assessment in channel areas.
- Requires cooperation of local industry for access into fishable areas.
- Traditional fisheries gears are challenged by navigation infra-structure (deep/steep sided flowing canal system).
- Weather may prohibit sampling seasonally (winter air temperatures and ice cover).

2.1.2 USFWS Monitoring (Electrofishing) and Rapid Response Team Support in CAWS

Lead Agency: USFWS

FY 2011 Funding: $1,000,000 GLRI funds is proposed.

Project Explanation: This task encompasses long-term monitoring and rapid response activities for Asian carp throughout the CAWS both above and below the Electric Barrier System. The enhanced sampling will be used to document the extent of Asian carp population dynamics within the canal system and connecting waterways, provide data for modeling potential population movements (range expansion), and to determine life stages of Asian carp potentially present. Rapid response activities may be implemented where specific evidence supports the presence of Asian carp above the electric barriers or other catastrophic event which necessitates the need for immediate actions.

FY 2010 Summary: Following the May 2010 MRRP, IL DNR, USFWS, and USACE increased eDNA collection and extensive netting and electroshocking efforts in search of Asian carp above the barriers. From June through September 2010, USFWS electrofished twice per month and 399 runs were completed for a total of 100 hours. Through this effort, over 25,000 fish were observed or handled of which 46 different species and two hybrid species were noted. No Asian carp were observed through electrofishing.

FY 2011 Action: A USFWS team will be used as necessary for the support of Asian carp monitoring and rapid response activities throughout the region. Conventional monitoring such as electrofishing may be used at designated areas.

Expected Milestones:

- Response actions to be initiated as detections dictate.
- Support Incident Command System (ICS) as needed.
- Provide staff, equipment and ICS team members.

Potential Hurdles:

- Weather conditions.
- Field crew availability.
- Possible negative impacts to commercial vessel traffic movement, recreational uses, and resident aquatic life (other than Asian carp) by activities associated with this action.
- Limited lab analysis capacity.

Operation Pelican: The Asian Carp Rapid Response Operation, May 2010

Following the December 2009 rapid response operation, eDNA sampling, electrofishing, and commercial netting continued throughout the CAWS to look for signs of Asian carp above the electric dispersal barrier on the CSSC. From Fall 2009 to May 2010, several repeated eDNA positive results were obtained in the area near T.J. O'Brien lock on the Little Calumet River. As a result, the decision was made to implement rapid response operations.

The Asian Carp Rapid Response Sampling Operation (Operation Pelican) occurred between May 20 and 27, 2010, on a 2.7-mile stretch of the Little Calumet River of the CAWS. Operation Pelican involved application of Rotenone within this target area to identify all species of fish present—notably for this investigation, Asian carp. Results of these steps to isolate individual Asian carp were to be compared to results of eDNA sampling conducted on this stretch of the Little Calumet River several times previously, including immediately prior to this application of Rotenone. Additional commercial netting operations downstream of the target area were implemented to capture fish and provide a basis for comparison of methods.

Operation Pelican was a multi-agency collaborative effort organized according to the Incident Command System (ICS). It was implemented by IL DNR with the support of other federal, state, and local agencies. To ensure mission success, more than 20 local, state, provincial, and federal agencies participated in the response. Operations included over 200 responders, with additional observers including media, industry, and nongovernmental organizations. Operation Pelican spanned multiple jurisdictions, and the area was split into two geographic subareas defined in relationship to the downstream block net. Components of Operation Pelican included application of chemical toxicant to the target area of the Little Calumet River, detoxification, recovery of fish, commercial netting operations downstream of the target area, and a Hotwash discussion summarizing the response operations and participant feedback. Forty different species were found and in total approximately 67,000 fish were catalogued. The vast majority of fish found were common carp and gizzard shad.

2.2 Commercial Harvesting and Removal Actions Below the Electric Barrier System

In order to address the impact of the Asian carp that already exist within the Illinois River below the electric barrier system, the following projects will be implemented or continued in FY 2011. The overall goal of these projects is to decrease the density of Asian carp in these areas thereby lowering the number of fish that attempt to expand their range to infiltrate the Great Lakes. This process is also referred to as lowering the "propagule pressure" on the system.

2.2.1 Commercial Fishing for Removal Below Lockport Pool

Lead Agency: IL DNR

FY 2011 Funding: $800,000 GLRI funds is proposed.

Project Explanation: In some areas downstream of Lockport Pool, the population density of Asian carp is very high; these fish may be seeking to expand their range. By decreasing the numbers downstream, thereby reducing populations of potential invaders, the pressure to expand may also decrease.

FY 2010 Summary: The ACRCC prioritized this action in June 2010. In 2010 commercial fishing crews removed over 100,000 pounds of Asian carp in the stretch of the Illinois River between Marseilles and

Lockport Pools. Additionally a comprehensive monitoring and rapid response plan for the Upper Illinois River was developed to systematically determine the distribution and abundance of Asian carp in the waterway and to define the leading edge and reproduction locations of those populations.

FY 2011 Action: This action will continue to employ commercial fishermen in the pools below the barrier in a sustained program of catch and removal of Asian carp from the system, while minimizing detrimental effects on native fish species. In both the Lockport and Brandon Road Pools, densities of Asian carp are relatively low therefore at this time no commercial fishing efforts are planned.

Increased funding was requested to reflect ACRCC reprioritization after the May 2010 sampling event near O'Brien Lock.

Expected Milestones:

- Significant reductions from any Asian carp populations in Brandon Road Pool, Dresden Pool, Marseille Pool, and Starved Rock Pool.

Potential Hurdles:

- Negative impacts on commercial vessel traffic movement by fishing operations.

2.2.2 Commercial Market Enhancement/Recruitment Overfishing Near CAWS

Lead Agency: IL DNR

FY 2011 Funding: $3,000,000 GLRI funds is proposed.

Project Explanation: The accepted principle of invasion control is to dramatically suppress Asian carp populations in the Illinois River watershed, including CAWS. Yet with governmental budgets limited, a sustainable mechanism for suppressing carp populations has been difficult to initiate. This project provides several benefits and could provide a "win-win-win": (1) suppression of carp populations, (2) job creation, and (3) if initiated, a possible revenue source for programs designed to restore ecosystems, such as the Great Lakes.

FY 2010 Summary: The State of Illinois signed an agreement with a Chinese meat processing facility for the annual purchase of up to 50 million pounds of Illinois River Asian carp for consumption in China creating 180 direct and indirect jobs. IL DNR began collaborating with the Illinois Department of Commerce and Economic Opportunity (IL DCEO) for the development of an Asian Carp Training, Certification, Incentives, and Market Development Program. The program is intended for commercial fishermen and will begin during the state's FY 2011.

FY 2011 Action: The state will expand the commercial market for Asian carp in Illinois and beyond, with a portion of proceeds from carp sales or other similar revenue stream going to fund ecosystem restoration and invasive species prevention. This expansion will be focused on providing fillets for consumption in both domestic and overseas markets, utilizing Omega 3 oils, and using the carcasses as fertilizer. These monies would be utilized to develop a commercial fisheries industry that will overfish the Illinois River and provide Asian carp to commercial processing facilities within the state. IL DNR will explore potential markets for Asian carp in schools, hospitals, and correctional facilities. It is important to note that live Asian carp would not be transported in conjunction with this project to assure compliance with the Lacey Act. IL DNR will also engage other stakeholders in determining what other disincentive programs can be developed (other than existing enforcement activities) to preclude range expansion of Asian carp for commercial gain.

IL DNR will continue its partnership with the IL DCEO to implement the Asian Carp Training and Certification Program as well as assess additional commercial processing capacity at state facilities, and make strategic investments necessary to increase capacity. To evaluate the impact of increased commercial harvesting on Asian carp populations, IL DNR in cooperation with leading scientific experts will be monitoring ecosystem responses to Asian carp removal in the Illinois River.

Expected Milestones:

- IL DNR has received and is evaluating detailed research proposals necessary to support the development of a commercial market for Asian carp. These proposals include:
    - Conducting Asian carp contaminant analysis.
    - Conducting Asian carp component/content analysis.
    - Commercial harvesting program administrative support and data evaluation.
    - Asian Carp marketing summit.

Potential Hurdles:

- Ensuring that market enhancement does not lead to fishery sustenance or substantial detrimental effects to native fishes, but instead meets the desired biological suppression results.

2.2.3 Investigation of Certification Requirements for Asian Carp Usage

Lead Agency: IL DNR/USAID

FY 2011 Funding: No funding necessary.

Project Explanation: There is a potential that Asian carp could be used as a human food source, but certification procedures that document the suitability of Asian carp that are removed from the CAWS, Illinois River, and Mississippi River and used for human consumption have not yet been assessed.

FY 2010 Summary: IL DNR identified requirements necessary for certification. The major requirement is completion of current contaminant studies, which are underway.

FY 2011 Action: IL DNR will continue to work with the Illinois Congressional delegation to identify certification procedures necessary for Asian carp to be declared suitable for use in U.S.-sponsored Humanitarian relief efforts.

Expected Milestones:

- IL DNR is working with the Illinois Congressional delegation to certify Asian carp appropriate for use in the (P.L.) 480 TITLE II Food For Peace Program (US Agency for International Development [USAID]). IL DNR will consult with IL DCEO and Illinois commercial processors to complete the application process.

Potential Hurdles:

- Ensuring that market enhancement does not lead to fishery sustenance, but instead meets the desired biological suppression results, using legal and penal mechanisms.

2.3 Electric Barrier Actions and Waterway Separation Measures

To ensure that Asian carp are not able to bypass the current electric barrier system for migration from the Mississippi River Basin to the Great Lakes Basin, additional measures have begun or will begin in FY 2011. In addition to fortification made to barriers within the CAWS, additional potential diversions between the two systems have been discovered and work is being implemented to ensure separation.

2.3.1 Construction of Des Plaines River and Illinois & Michigan Canal Barriers

Lead Agency: USACE

FY 2011 Funding: $1,190,000 GLRI funds carry-over from FY 2010. No additional funding requested in FY 2011.

Project Explanation: Physically blocking known bypasses around the electric barriers from the Des Plaines River and the Illinois and Michigan (I&M) Canal caused by flooding is necessary to halt possible fish movement through this area. The barriers placed in these locations are intended to stop juvenile and adult Asian carp. Additional and/or more permanent separation measures will be assessed in the Efficacy Study Report.

FY 2010 Summary: On January 12, 2010, the Assistant Secretary of the Army for Civil Works approved the report recommendations that would allow design and construction of these barriers to proceed. The construction of barriers on the Des Plaines River was subsequently completed in October 2010. $6,060,000 was obligated in FY 2010.

Expected Milestones:

- Project was completed in first quarter FY 2011 under budget.

Potential Hurdles: None.

2.3.2 Expedited Construction of Barrier IIB

Lead Agency: USACE

FY 2011 Funding: Base funding and American Recovery and Restoration Act (ARRA) funding

Project Explanation: A second barrier capable of running at voltage levels high enough to repel fish is under construction to further fortify the existing electric barrier. The second barrier will ensure sustained operation during scheduled maintenance and in the event of catastrophic failure.

FY 2010 Summary: Construction of Barrier IIB began in early FY 2010. Included in this project is construction of a power station to provide additional power needed because of increased salinity in the water during winter months. The power station was completed in October 2010, making additional power available on November 1, 2010.

FY 2011 Action: Construction and operational testing is expected to be completed by December 23, 2010. Safety testing is expected to be complete in January 2011 for a fully operational start no later than February 2011.

Expected Milestones:

- November 30, 2010 – Barrier IIB construction and building checks complete.
- December 2010 – System and operational testing to be conducted.
- January 2011 – Safety testing to be conducted.
- February 2011 – Barrier IIB expected to be fully operational.

Potential Hurdles:

- System and safety testing may require additional modifications which may delay Barrier IIB to be fully operational by February 2011.

2.3.3 Modified Structures and Operations

Lead Agency: USACE

FY 2011 Funding: USACE is contributing $60,000 in Base funding.

Project Explanation: To determine whether modified lock and attendant works (sluice gates and pumping stations) operations could impede entry of Asian carp to Lake Michigan. All potential impacts

were considered to ensure public health and safety, and the purposes of these structures must be maintained as authorized by law.

FY 2010 Summary: In 2010, USACE evaluated whether and how to modify the operation of the Chicago and O'Brien locks to deter Asian carp and to ensure that Asian carp are not introduced or allowed to migrate into the Great Lakes. In an interim Efficacy Study, USACE recommended installing screens on the sluice gates at the T.J. O'Brien Lock and Dam (other sluice gates in the CAWS are operated by MWRD). USACE also decided to use the intermittent closure of the Chicago and O'Brien locks, on an as-needed basis, in support of fish control and eradication efforts performed by and upon the request of those agencies and in coordination with USCG. A team of experts led by the USFWS determined that temporary/intermittent lock closures are effective only in support of fish suppression measures. However, the effectiveness of permanent lock closure will be considered in the Great Lakes and Mississippi River Inter-Basin Study.

In July 2010, the Assistant Secretary of the Army for Civil Works approved the installation of the screens and concurred in the recommended method of operation the locks. USACE delivered two screens at the T.J. O'Brien lock and dam in September 2010.

2011 Action: USACE installed one screen at T.J. O'Brien lock and dam in December 2010 and will install the remaining screen in Spring 2011 after the winter season.

Expected Milestones:

- December 2011 – one screen was installed.
- Spring 2012 – Remaining screen will be installed.

Potential Hurdles: None.

2.3.4 Tagged Fish Research to Test Electric Barrier Effectiveness

Lead Agency: USACE

FY 2011 Funding: $200,000 GLRI funds is proposed.

Project Explanation: Monitoring results indicate the presence of Asian carp eDNA upstream of the barrier in several locations. Although no Asian carp have been collected or seen at locations where eDNA has been detected above the barrier, its presence is an indicator that Asian carp may be present. Potential pathways must be identified and evaluated, including the possibility that some fish may be moving through the barrier, although laboratory tests indicate that the barrier is effective. Preliminary work using tagged common carp was conducted by the Illinois Natural History Survey and University of Illinois to determine if the Demonstration Barrier was able to prevent fish from moving across. Follow up work is needed.

2010 Summary: In 2010, as part of the CAWS Workgroup MRRP, the telemetry effort objective was refined to assess the effect and efficacy of the Electric Dispersal Barrier (Barrier) on fish in the upstream and downstream environment of the CSSC. A secondary objective of this effort was to characterize the movement of fish through lock structures in the Upper Illinois Waterway/CAWS. Since this effort characterizes fish movement, tagging focuses on both Asian carp and surrogate species (common carp, grass carp, smallmouth buffalo, and freshwater drum). Fish are released at or near their point of capture. Two hundred tags were procured for this effort: 105 tags were implanted in 2010; the remaining 95 are to be implanted in 2011. Tags are individually coded and the battery life is about 2.5 years.

Fall 2010 totals:

- 105 tags implanted into adult Asian carp and surrogate species (July - November 2010)
- CSSC/Chicago River above Barrier: 20 surrogates
- Lockport Pool above Barrier: 20 surrogates
- Lockport Pool below Barrier: 29 surrogates
- Brandon Road pool: 19 surrogates
- Dresden Island pool: 17 Asian carp

In order to track the movement of the tagged fish, stationary receivers are deployed at fixed locations. These acoustic receivers (32 total) are downloaded monthly to determine if a tagged fish has been in the area of the receiver. Receivers in the vicinity of the Barrier are armored for protection from navigation traffic. Additionally, mobile tracking is used to actively locate the tagged fish for precise locations.

2011 Action: The remaining 95 tags will be implanted into fish below the Barrier in Spring 2011. Smaller fish will also be used to observe fish response to the Barriers. Tracking (stationary receiver supplemented by mobile tracking) will continue to monitor the location of all tagged fish.

- 65 tags into adult surrogate species (Lockport Pool) and Asian carp and surrogate species (Brandon Road Pool)
- 5 tags into Asian carp in Dresden Island pool
- 25 additional tags to be implanted into small fish (species to be determined) in Lockport pool below the Barrier – the shorter battery life of these tags will mean more mobile tracking for these individuals.

A complementary approach would include use of DIDSON sonar equipment at the barrier site to observe fish behavior and to look for any fish penetrating or crossing the barrier. Any Asian carp collected from Lockport pool will not be tagged and released due to the potential of distorting eDNA results from that pool.

Expected Milestones:

- November 2010: Complete all winter tagging efforts and secure acoustic network for winter (ensure no receivers are exposed to iced-over areas); mobile tracking of entire system.
- October 2010 – March 2011: Periodic receiver maintenance and downloads.
- April – May 2011: Spring tag implantation; monthly mobile tracking and receiver downloads.

Potential Hurdles:

- Availability of fish for implantation.
- Weather impacts fish mortality rate.

2.3.5 Wabash-Maumee Interim Watershed Separation

Lead Agency: IN DNR

FY 2011 Funding: No funding necessary.

Project Explanation: Eagle Marsh, a 705-acre restored wetland on the southwest side of Fort Wayne, straddles a natural geographic divide created by the last glacial movement approximately 10,000 years ago. The broad wetland marsh extends across the divide into two key drainage ditches – Graham McCulloch Ditch and Junk Ditch. McCulloch drains west into the Little River and eventually the Wabash River near Huntington, while Junk Ditch drains northeast into the St. Marys River and then the Maumee

River. Under normal conditions, there is no direct link between the Wabash River and the Maumee River. However, tributaries and drainage ditches near Eagle Marsh provide a potential connection under certain flooding situations. Under certain conditions, natural backwash of flooded tributaries, particularly the St. Marys, spreads across this broad, natural area and connects with tributaries of the Wabash. Asian carp have been present in the Wabash River for nearly 15 years and they are currently known to occur in the Wabash River near the mouth of Little River (approximately 20 miles from Eagle Marsh). During flood conditions, there is concern that Asian carp will move upstream through the Little River and McCulloch Ditch and cross over the divide to the Maumee Basin giving them direct access to Lake Erie.

FY 2010 Summary: As an immediate preventive measure based on risk characterization that USACE and its partners conducted, IN DNR installed mesh fencing across a section of Eagle Marsh, creating a barrier against passage of Asian carp between the Wabash and Maumee drainage basins. By the end of October 2010, the fence spanned approximately 1,300 feet across the marsh and is 2 feet above the 100-year flood elevation. Also included in this measure is operation and maintenance including herbicide application, burns, repairs, equipment, and personnel costs. A contract between IN DNR and an academic institution was finalized to perform eDNA sampling through the Little River, McCulloch Ditch, Junk Ditch, St. Marys River, and the Indiana portion of the Maumee River. Sampling began in September 2010.

FY 2011 Action: To finish work on disturbed areas, IN DNR will replace the grass and plants that were removed. In addition, they will perform routine maintenance on barriers including, repairs, herbicide treatments, burns, equipment, and will provide personnel when necessary. eDNA sampling will occur twice a year as per the contract with the University of Notre Dame.

A two-year Asian carp telemetry project is being considered in order to determine the movements of these fish in the upper Wabash River and to see if they move into Little River. This project will only be possible with additional funding. Ideally, the project would start as soon as feasible in order to monitor fish movements during the Spring 2011 spawning season.

IN DNR will also provide Asian carp outreach including wild caught bait movement kiosks at tail waters.

Expected Milestones:

- Radio tag 20 Asian carp in upper Wabash River by December 2010.
- Radio tag 100 Asian carp in the Wabash River by April 2011.
- Perform spawning evaluation in upper Wabash River in May/June 2011.

Potential Hurdles: None.

2.3.6 Wabash-Maumee Permanent Watershed Separation

Lead Agency: USACE

FY 2011 Funding: $4,800,000 GLRI funds (includes $1,000,000 carryover from FY 2010) is proposed. $1,000,000 carryover from FY 2010 will be applied to the production of a detailed project report (DPR) for use in developing contract documents to construct the permanent solution. $3,800,000 is proposed to be applied to the construction of the permanent solution, depending on the cost of recommendations in the DPR as well as existing authorities.

Project Explanation: USACE is conducting a feasibility study to determine what actions could be taken to attain a permanent separation of these two watersheds to preclude the potential range expansion of all invasive species. Analysis will include identification of available authorities for construction activities. Depending on the outcome of the study and assuming available authority, USACE could build a permanent solution in the near term which would replace the temporary remedy.

FY 2010 Summary: USACE and its partner agencies completed a preliminary risk analysis that identified this connection as posing an unacceptable risk based on the determination that a 10 year flood event near Ft. Wayne, Indiana will cause a hydrologic connection between the Wabash and Maumee Rivers that is sufficient for Asian carp to enter into the Maumee River from the Wabash and eventually swim into Lake Erie. The sense of urgency is underscored by sightings of Asian carp 20 miles south of Fort Wayne in the Wabash River. A self-sustaining population of Asian carp exists about 100 miles away at Lafayette, Indiana, in the Wabash River.

FY 2011 Action: As part of the GLMRIS, USACE will research and prepare a report in full collaboration with IN DNR and other stakeholders. The report will include a feasibility analysis of alternatives and a recommended permanent solution for preventing the migration of all aquatic invasive species between the Mississippi River and Great Lakes Basins at this connection at the drainage divide. The actions will include stakeholder engagement to identify a viable local sponsor, and the report will evaluate potential authorities that can be invoked to accomplish construction. Based on lessons learned from the temporary solution, initial analyses of permanent separation options and potential corresponding costs, the FY 2011 funding level is an estimate of what the construction of the permanent solution may cost.

Expected Milestones:

- September 2011 – Complete Detailed Project Report
- FY 2012 – Construction of permanent measures

Potential Hurdles:

- Specifics related to the construction of a permanent solution and operational plans are to be identified and developed.

2.4 CAWS Barrier System and Great Lake Mississippi River Inter-Basin Study Activities

The following actions will address the connections that exist between the Great Lakes and Mississippi River Basins and also evaluate the risk to the Great Lakes if Asian carp were able to infiltrate the system. The findings will be reported through study reports and available for review.

2.4.1 Efficacy Study

Lead Agency: USACE

FY 2011 Funding: USACE is contributing $1,000,000 in Base funding.

Project Explanation: The study investigates hazards that may reduce the efficacy of the electric dispersal barriers located in Romeoville, Illinois. The project includes an analysis of potential bypasses, optimal operating parameters, deterrent systems, modified structures and operations, and potential for migration via other pathways.

FY 2010 Summary: USACE completed Efficacy Study Interim Reports I (Barrier Bypasses), IIIA (Acoustic-Bubble-Strobe Deterrent System) and III (Modified Structures and Operations), and initiated work on Interim Report II (Optimal Operating Parameters) and the Final Efficacy Study. Construction of measures to address potential barrier bypasses via overland flooding and/or through existing drainage pathways was completed along the Des Plaines River and I&M Canal under emergency authority granted by Congress in Section 126 of the Energy and Water Development Appropriations Act of 2010.

FY 2011 Action: Evaluation of other potential measures to deter the migration of the Asian carp is proceeding via the Final Efficacy Study report. Other electrical barriers, other types of behavioral barriers, and review of the use of existing structures and monitoring technologies are being considered. In addition, this report will address other assisted transits/vectors (bait buckets, ballast water, navigation transiting through the CAWS), and consider measures to control access to Lake Michigan through the Little Calumet and Grand Calumet Rivers. This report also will summarize and update efforts previously completed in the above-referenced interim reports.

Expected Milestones:

- Winter 2011 – Independent external peer review and public review of Final Efficacy Report.
- Summer 2011 – Complete Final Efficacy Report.

Potential Hurdles:

- Future extension of Section 126 emergency authority for recommended actions/measures.
- Determining the relative risk and trade-offs of pursuing which actions.

2.4.2 Great Lakes and Mississippi River Inter-Basin Study (GLMRIS)

Lead Agency: USACE

FY 2011 Funding: $4,880,000 GLRI funds (includes $2,030,000 carryover from FY 2010) is proposed. USACE is also contributing $400,000 in Base funding.

Project Explanation: USACE is conducting a Feasibility Study under GLMRIS authority of the options and technologies that could be applied to prevent or reduce the risk of AIS transfer between Great Lakes and Mississippi River Basins, through aquatic pathways. This is a long-term effort performed in collaboration with federal, state, regional, and local agencies and non-governmental organizations (NGO). The study will provide a thorough identification of potential hydraulic connections between the two basins, identification and exploration of existing and potential aquatic nuisance species, and analysis of aquatic nuisance species control technologies. These control technologies include but are not limited to physical or ecological separation. The study will also evaluate the potential for extended (temporary or permanent) closure of locks and other physical structures to impede continued migration of AIS.

The study is being conducted in two focus areas. Focus Area I consists of the CAWS and Focus Area II consists of all aquatic pathways outside the CAWS, commonly referred to as the Outside Pathways.

FY 2010 Summary: USACE developed a Project Management Plan (PMP) to define the study scope, schedule and budget; conducted a preliminary risk characterization of potential hydraulic connections outside the CAWS; and initiated the National Environmental Protection Act (NEPA) scoping process.

FY 2011 Action: USACE released the PMP and Outside Pathways Risk Characterization Report in November 2010; will conduct NEPA scoping meetings throughout the Great Lakes and Mississippi River Basins; and gather data to establish the baseline study condition.

Expected Milestones:

- November 2011 – Expected completion of Final Risk Characterization Report for Other Pathways.
- Summer 2012 – Expected completion of data collection activities.
- Summer 2014 – Expected completion of Final Feasibility Report and Environmental Impact Statement.
- Summer 2015 – Record of Decision.

Potential Hurdles: None.

2.4.3 Feasibility Assessment of Inter-Basin Transfer of Aquatic Invasive Species Between Des Plaines River and CAWS

Lead Agency: USGS

FY 2011 Funding: $270,000 GLRI funds (includes $120,000 carryover from FY 2010) is proposed. USGS is also contributing $88,100 in in-kind support.

Project Explanation: Transfer of AIS or eDNA via surface and subsurface fractures or solution features may be occurring. These additional hydraulic connections between Des Plaines River and CAWS could provide transfer of AIS and/or eDNA and should be addressed.

FY 2010 Summary: Completed field work except for well drilling. Completed analysis of existing data, characterization of bed sediment on the Des Plaines River, performed bathymetric and water characterization survey of the CSSC and parts of the Des Plaines River, assessed geology in the area of concern, including performance of several surface geophysical surveys. Identified areas where the geology, hydrology, and water quality indicate areas where there is the potential for fractures capable of transmitting Asian carp eggs, fry, or other invasive species as well to be present. Monitoring wells and additional hydrogeologic characterization in these areas is planned. Coordination of efforts with USACE to avoid duplication of efforts has been done.

FY 2011 Action: USGS will install monitoring wells and characterize the hydrogeology and water quality at the monitoring wells using geophysical logging, hydraulic testing, and collection and analysis of water level and water quality data from the wells, the Des Plaines River, and the CSSC. If funds permit, cross-hole testing, including a cross-hole tracer test, as well as potentially the installation of more wells depending on the suitability of the first set, will be performed. There are plans to install wells in November/December pending completion of the drilling contract. A high-flow event along the Des Plaines River will be logged to determine the impact to groundwater. Additional activities with the Upper Midwest Environmental Research Center in LaCrosse could include scale tests of Asian carp eggs moving through scale models for fractures.

Expected Milestones:

- Drilling, well construction and initial data collection on wells between the CSSC and the Des Plaines River will be started in December 2010 or January 2011. The data collection will begin to verify flow directions between the two water bodies and the properties of the fractures in the bedrock, etc., to understand the potential movement of invasive species (small fry, eggs, eDNA, etc.) between the Mississippi River and Great Lakes watersheds.
- Available literature will be synthesized to describe the potential for Asian carp eggs and/or fry to move through rock fissures/fractures. The synthesis will be integrated with data describing the hydraulic connections between the CSSC and the Des Plaines River to assess the potential for Asian carp to move between these water bodies. The analysis will be published either in a USGS series report or submitted to a peer-reviewed journal for publication by June 2011.

Potential Hurdles:

- A high-flow event along the Des Plaines River will be needed after the wells are installed and instrumented to assess the groundwater response to the event. The timing of this event is outside USGS control.
- Access issues for field operations.

2.4.4 Great Lakes Ecological Models for Risk Assessment

Lead Agency: USFWS

FY 2011 Funding: $1,200,000 GLRI funds is proposed.

Project Explanation: Sparse or incomplete modeling exists that describe projected ecological impacts of bighead and silver carp on important components of food webs (Lakes Michigan, Huron, and Erie at this time).

FY 2010 Summary: Project new for 2011.

FY 2011 Action: USFWS will develop biological and/or ecological models for Lake Michigan, Lake Erie, and Lake Huron in order to help predict potential for establishment and impacts of Asian carp on each water body. Results will provide managers with information to help protect and rehabilitate Great Lakes fishery resources.

Each Great Lake is unique in its abiotic and biotic characteristics, so quantitative ecologic models will be developed/modified and validated, and then those models will be used to predict Asian carp impacts on important components of food webs. USFWS will develop quantitative models that predict Asian carp potential for establishment, and impacts on the food web of Lakes Michigan, Erie and Huron. The specific modeling approaches will be determined after consultation with others (e.g., academia, USGS, NOAA) who are beginning to conduct modeling designed to predict Asian carp impact on the Great Lakes. USFWS provisionally plans to use bioenergetics models, and this approach will be complementary to the approach USGS plans to use (which is focused on bioenergetics modeling of bluegreen algae consumption by bighead and silver carp). These modeling approaches will complement each other, and provide outputs that will demonstrate uncertainty in, and precision of, model predictions. Therefore, these complementary modeling approaches will provide decision makers with separate predictions of Asian carp impacts, and uncertainties of those predictions. Predicted impacts of Asian carp will support decisions about what actions to take to: prevent invasions, monitor for new invasions, rapidly respond to incipient invasions, and control established populations of invaders.

Expected Milestones:

- Award by September 30, 2011, a grant to support the proposed modeling to either an academic institution or another agency.

Potential Hurdles:

- The timing of receipt of funds to support the project will determine when the grant agreement will be fully executed.

2.4.5 Forecasting Spread and Bio-economic Impacts of AIS from Multiple Pathways

Lead Agency: NOAA

FY 2011 Funding: $439,000 GLRI funds is proposed. NOAA is also contributing $497,122 in Base funding.

Project Explanation: Without forecasts of the arrival and bio-economic impact of non-indigenous species, natural resource management cannot cost effectively respond to current invasions or prevent future invasions.

FY 2011 Action: Investigators will combine scientific, economic, risk analysis, and management expertise to increase capabilities for forecasting both ecological and economic impact of current and future species invasions, quantify major uncertainties and ways to reduce uncertainty, and identify actions to improve cost effective management of invasive species in the Great Lakes. The following four major goals of the project are:

- Forecast the probability of establishment: Researchers will draw on the literature and on-going studies, to identify which non-indigenous species are likely to be introduced into the Great Lakes via three major pathways: (a) shipping; (b) organisms in trade (pet, horticulture, aquaculture, biological supplies, live food, and live bait industries); and (c) canals, especially the CSSC. For each of these pathways, propagule pressure—the rate of introduction of individuals into the Great Lakes—will be estimated from surveys of the literature and surveys of retail and consumer behavior, and the probability of establishment estimated.
- Forecast the potential habitat of species within the Great Lakes: Investigators will use multiple ecological niche models, based on new geographic information system (GIS) layers of habitat and species distributions for all the Great Lakes.
- Forecast the potential spread of invaders within the Great Lakes: Investigators will compare natural background dispersal (predicted by current models) to that predicted by oceanic ships, lake ships, and recreational boaters. To forecast ecological impacts, researchers will use two general approaches: (a) statistical and computational models based on species; and (b) food web modeling to develop quantitative scenarios of ecological impacts, with uncertainties specified via structured expert judgment.
- Forecast regional economic impact: Researchers will link the food web models to a Great Lakes regional economic model (a computable general equilibrium model) to account for the feedbacks between ecological and economic systems, and quantitatively value ecosystem goods and services affected by invasive species.

Investigators will use the linked ecological and economic models to evaluate alternative management strategies with holistic cost-benefit analyses that focus on preventing species introduction, early detection and rapid response efforts, slow-the-spread strategies, and integrated control options.

Expected Milestones:

- Begin web publication of aquatic environmental data layers for Great Lakes.
- Begin publication of suitability map.
- Forecast natural background dispersal for Lake Erie.
- Begin prediction of ports that are at high risk to invasion due to ship movements.
- Begin to provide forecast of dispersal by recreational boaters and live-bait traded.
- Begin forecast of invasive species impacts.

Potential Hurdles: None.

2.5 Research and Technology Development

The following actions have been developed as a means of long-term control for Asian carp. These actions are aimed at research and development of novel approaches to combat Asian carp or investigating new methods of Asian carp movement through waterway systems.

2.5.1 Investigate Tow Boats and Barges as Potential Vectors

Lead Agencies: USCG/USEPA/IL DNR/USACE

FY 2011 Funding: $413,075 GLRI funds (carryover from FY 2010).

Project Explanation: The presence of eDNA above the electric barriers as a result of transport of Asian carp, carp eggs, or its eDNA, has moved across the electric barrier by means of ballast water or bilge water transport is a potential vector. In September 2009, the industry voluntarily stopped the practice of temporarily taking on and discharging ballast water to transit bridges along the CSSC. USCG issued a rulemaking to prohibit the practice in December 2009. However, there remains a possibility that eDNA or eggs could enter the voids of the towboats or barges through cracked welds or damaged hull plating. Because the majority of the towboats and barges are currently uninspected, their material condition could permit accidental introduction of water and eggs that could be transported and discharged above the barriers.

FY 2010 Summary: In March 2010, USCG established a Cooperative Working Group with towing industry representatives, fishery biologists, scientists, and agency officials to investigate and study the potential vector of towboats and barges for transporting Asian carp across the electric barriers. The workgroup will determine whether vessel ballast/bilge water is a vector in the CSSC. The primary focus

of the workgroup is to investigate and study the potential vector of towboats and barges for transporting Asian carp (eggs, larvae, and juveniles).

The first part of the barge survey took place August 16-25, 2010 and more than 100 local and long distance barges and 10 towboats were inspected. The results from this study will be used to develop plans for further carp studies during FY2011.

FY 2011 Action: Based on 2010 study results, additional work will include (through field experimentation) sampling barge tanks for indications of Asian carp, evaluating the effects that tank leakage has on the potential transport of Asian carp, and evaluating the probability of Asian carp survival in barge tanks.

Expected Milestones:

Part I – Water Transport

- November 2010 – Receive contractor report of findings.
- December 2010 – Brief preliminary findings of water transport.
- January 2011 – Final report regarding water transport and conditions.

Part II Survivability of Asian Carp in Tanks

- January 2011 - Develop objectives, methods, plans, protocols.
- March 2011 – Complete Statement of Work.
- April 2011 – Award contract.
- July 2011 – Complete survival experiments and sampling of Asian carp.
- December 2011 – Preliminary report of findings.
- March 2012 – Final report of findings and determination of risk.
- March 2012 – Implement additional risk mitigation measures if necessary.

Potential Hurdles:

- Finding necessary evidence of species bypass—not just Asian carp eDNA.
- Establishing methodology acceptable to all parties.
- Control of vector pathways during effort to prevent cross-contamination.
- Authority to exceed the IL DNR allocation for discretionary diversion.

2.5.2 Assessment Study of Potential Impacts of Steel-hulled Barges on Fish Movement Across Electric Barrier II

Lead Agency: USACE

FY 2011 Funding: $750,000 GLRI funds is proposed.

Project Explanation: Studies of the Demonstration Barrier (Barrier I), operating at parameters lower than the current operation of Barrier II, indicated that fish swimming alongside barges took about three times as long to become immobilized by the electric barrier than if they were swimming through the electric field without any substantial steel hull present. As the steel hull approaches the barrier the steel warps the electric field toward the hull, thus providing a shielded area for fish where the effects of the

barrier could be reduced or completely eliminated. Therefore, steel-hulled barges may increase the probability that fish are not affected by the electric barrier. The results of the studies at the Demonstration Barrier were used to design Barriers IIA and IIB so that steel hulled effects on the electric field would be eliminated or minimized. However, continued field testing of potential steel-hull effects over Barriers IIA and IIB is needed.

FY 2010 Summary: This testing will be initiated in FY 2011.

Design and conduct experiments to test the effectiveness of the Electric Barriers IIA and IIB in the presence of steel-hulled barges and other vessels.

Expected Milestones:

- March 2011 – Experimental design.
- June 2011 – Completion of study with final report.

Potential Hurdles:

- Interruption of river traffic.

2.5.3 Research on the Impacts of Potential Asian Carp Vectors Being a Source of Fish or eDNA Movement in the CAWS

Lead Agencies: USACE, USGS, USEPA

FY 2011 Funding: $300,000 GLRI funds is proposed.

Project Explanation: Anecdotal evidence exists for potential vectors for Asian carp access to the CAWS. Barge personnel have been observed kicking dead silver carp off decks of barges in the O'Brien Lock. Additionally, live and dead animals, as well as debris, have been observed trapped in the cavities formed between barges lashed together bow to bow or bow to aft. It is unknown if these access routes are viable vectors for the existence of Asian carp eDNA in the CAWS or for the development of self-sustaining populations of Asian carp in the CAWS. In addition, Industry representatives have raised the potential of sloughing of Asian carp remains into the waterway which may also contribute eDNA into the CAWS. Finally, the possibility that eDNA is entering the CAWS through Combined Sewer Outfalls has not been thoroughly evaluated.

FY 2010 Summary: This research will be initiated in FY 2011.

FY 2011 Action: Form interagency/industry task force to validate or disprove the access paths of fish on decks and fish trapped between lashed barges. The task force must establish factual evidence that supports or refutes the viability and effectiveness of these access pathways. The remaining vectors will be assessed through a more rigorous eDNA sampling protocol and procedure.

Expected Milestones: None.

Potential Hurdles: None.

2.5.4 Assessing Risks of Great Lakes Invasion by Understanding Asian Carp and Bluegreen Algae Dynamics

Lead Agency: USGS

FY 2011 Funding: $379,000 GLRI funds (includes $179,000 carryover from FY 2010) is proposed. USGS is also contributing $39,600 in in-kind support.

Project Explanation: Bluegreen algae (primarily *Microcystis sp.*) blooms resulting from the mussel invasion may provide an excellent food source for bighead carp, enhancing their invasion. Noxious bluegreen algal blooms, under some circumstances, can be enhanced by interaction with silver and bighead carp, and presence of these carp may enhance toxin production by noxious algae.

FY 2010 Summary: USGS hired the necessary personnel and obtained permits for laboratory work. Work also began to culture the bluegreen algae and construction of the tank to house and feed Asian carp.

FY 2011 Action: In the second year of this project, the project will be expanded to outdoor water enclosures to accommodate larger fish than those used in the first year of the project. It is not anticipated that the laboratory work with small fish will be completed for both species in the first year; therefore, some work with small silver carp (especially the bioenergetics portion) will be finished in 2012. Purchase and setup of water enclosures

Expected Milestones:

- November 15, 2010: Begin conducting first trials with young bighead and silver carp feeding on bluegreen algae. These are rangefinder tests to determine rate of feeding that will influence design of later studies.
- January 1 2011: Complete validation of total microcystin tissue method. Most work on this has been completed, but some additional validation is required.
- December 2010: Begin trials of bighead and silver carp juveniles fed bluegreen algae/green algae combination. Complete first set of trials by January 30, 2011.
- March 2011: Begin second set of trials on bighead and silver carp fed bluegreen algae; test for effects on toxin production by algae and sequestration by carp.
- May 2011: Complete review of available bluegreen algae spaciotemporal data, and begin modeling of carp use of these resources.
- July 2011 – August 2011: Conduct outdoor water enclosure studies of carp consumption of algae, using larger fishes, but otherwise duplicating earlier work.
- November 2011: Prepare manuscript submission for in-house review.

Potential Hurdles:

- Availability of adequate spaciotemporal data on bluegreen algae.

2.5.5 Risk Assessment of Asian Carp Establishment in the Great Lakes Based on Available Food Sources

Lead Agency: USGS

FY 2011 Funding: $166,000 (includes $49,000 carryover from FY 2010) is proposed. USGS is also contributing $34,800 in in-kind support.

Project Explanation: Asian carp have been observed to diversify their diets beyond preferred pelagic plankton sources and feed on organic matter ("detritus") during certain conditions and on the basis of availability of food resources. Silver carp are also thought to derive substantial nutrition from bacteria, both consumed and cultured in the gut. However, it is not known whether these food sources are adequate for growth and survival of Asian carp. It is unknown if Asian carp can sustain themselves in the Great Lakes.

FY 2010 Summary: USGS hired the necessary personnel and purchased the equipment necessary to test the existing model that assumes Asian carp can't survive in Lake Michigan. Personnel began testing of

the model on bighead carp. In addition, personnel looked at the behavior of Asian carp to seek out and eat alternative food. Cladophora, one of these alternative food sources, is being grown in culture for testing. Data collection began for this project in July 2010.

FY 2011 Action: In FY 2011, the project will be expanded to test the model on silver carp and outdoor mesocosm work with both species. Data collection which began in July 2010 will continue. The current model being tested will be altered as needed throughout the testing phase.

Expected Milestones:

- November 30, 2010: Complete data collection for evaluation of bioenergetics model with young bighead carp.
- January 30, 2011: Complete data collection for evaluation of bioenergetics model with young silver carp.
- March 30, 2011: Completion of data collection phase for bioenergetics model evaluation, all ages and sizes.
- August 2011: Completion of all behavioral work with consumption of alternative foods in aquaria and water enclosures.
- June 2011: Measurement of energetic value of wild collected alternative foods from the Great Lakes, for comparison to lab-generated foods and pseudofeces collected from Missouri sources (study will be performed with Missouri pseudofeces to avoid transfer of VHS – a viral fish disease).
- December 2011: Submission of manuscripts for review.

Potential Hurdles: None.

2.5.6 Use of Seismic Technology to Divert or Eradicate Invasive Asian Carp

Lead Agency: USGS

FY 2011 Funding: $465,000 GLRI funds (includes $15,000 carryover from FY 2010) is proposed. USGS is also contributing $55,000 in Base funding.

Project Explanation: Methods now available to control nuisance and non-native, invasive fishes are inadequate. Some methods are expensive, labor-intensive, and non-selective (e.g., most chemical applications). Others remove fish only in a particular length range (netting, electrofishing, commercial/recreational fishing, and electric barriers), or are in early stages of development and not developed for a variety of species (e.g., use of pheromones with other control methods and sterile male release). Proximity of Asian carp (bighead carp and silver carp) to the Great Lakes Basin highlights the need to make quickly available additional control methods to affect their behavior, thereby impeding their spread into the Great Lakes, or to remove Asian carp through direct mortality. Seismic technology has the potential to affect the behavior or eradicate nuisance and non-native invasive fishes through a range of age classes, making it a viable candidate for integrated suppression efforts.

FY 2010 Summary: FY 2010 Phase I of this project was completed and all milestones met. The seismic cannon was tested in Colorado and work was underway to begin testing the device in Alaska and Illinois. Field tests began in Illinois in September 2010. This project presented several collaborative opportunities with other agencies throughout the year including efforts taken with USFWS, the Bureau of Reclamation, Alaska Fish and Game, and IL DNR. USACE also expressed interest in future work to model how the sound waves travel through the CSSC and its effects on the canal.

FY 2011 Action: Plans for FY 2011 include hiring a postdoctoral fish ecologist, purchase of additional hydro guns, construction of an array for mobilization along with additional testing on behavioral modification in carp and lethality in threatened and endangered species. Additional work will study lethal and sub-lethal effects of seismic technology to divert or eradicate invasive Asian carp as a means to inhibit passage and reduce recruitment. Initial dose response studies will determine the effects of different sound wave frequencies on various age classes of Asian carp at a range of distances from the sound source. The magnitude of the sound wave and particle velocity will be measured in order to quantify fish response to sound impacts. Initial and delayed lethality will be assessed, as well as sub-lethal evading behaviors.

Expected Milestones:

- January 2011: Filling of postdoctoral scientist position.
- May 2011: Preparation and implementation of barrier defense trial.
- October 2011: Conduct dose response and behavioral studies.

Potential Hurdles: None.

2.5.7 Expand Research on the Identification of Asian Carp Attraction/Repulsion Pheromones

Lead Agency: USGS

FY 2011 Funding: $333,000 GLRI funds (includes $173,000 carryover from FY 2010) is proposed. USGS is also contributing $27,074 in Base funding.

Project Explanation: Technologies presently do not exist to specifically target Asian carp for control within aquatic ecosystems. Current applications of non-selective toxicants (e.g., Rotenone) harm native fish species and must be applied to broad expanses of aquatic habitat if they are to have effect. The lack of a species-specific method of attraction (e.g., pheromones) limits the ability to achieve maximal control while minimizing risk to native fishes. Developing attractants with high specificity for Asian carp is necessary to control or eradicate them without further harm to native species and habitat.

FY 2010 Summary: Progress made in 2010 included the identification of over 240 different compounds to screen for pheromone properties. In September work began with the University of Minnesota to screen these compounds by fish response. Six hundred juvenile bighead carp were acquired for the testing phase.

FY 2011 Action: In 2011, completion of physiological olfactory screen is expected of over 100 chemicals from 18 classes of sex pheromone metabolite chemicals, and behavioral studies of about 40 of the most effective of these. Expanded screening will be conducted for the most promising of the attractants to determine consistency and persistence of response with follow up proof of concept pond mesocosm (water enclosure) tests to confirm responsiveness in the field.

Expected Milestones:

- March 2011: Complete behavioral testing of chemical bait lures.

- December 2011: Complete electrophysiological testing of pheromone constituents.
- October 2012: Complete behavioral testing of pheromone constituents.

Potential Hurdles:

- Maintaining source of juvenile carp for behavioral and physiological testing.

2.5.8 Identify Potential Compounds for Inclusion in a Toxicant Screening Program

Lead Agency: USGS

FY 2011 Funding: $480,600 GLRI funds (includes $264,600 carryover from FY 2010) is proposed.

Project Explanation: Current toxicants used to control AIS are general toxicants with limited to no selectivity (e.g., Antimycin and Rotenone). Agrichemical and pesticide laboratories create thousands of new chemical compounds yearly. Although toxicity information is generally not available for these new compounds in aquatic organisms, analysis could identify likely candidates for inclusion in a toxicant screening program.

FY 2010 Summary: Following project initiation, USGS hired the personnel needed to initiate the project. Alternative structures of the selected toxicants were proposed for synthesis in the lab. USGS also began planning the protocols to be used for the remainder of the project.

FY 2011 Action: USGS will develop an inventory of candidate chemicals to include structural and physical characterizations. A database of potential selective fish toxicants will also be developed. Acute toxicity studies will be initiated to evaluate candidate chemicals and identify selective fish toxicants for further development and registration.

Expected Milestones:

- June 2011: Develop a Fish Toxicant Structure-Activity Correlation (FTSAC) database through review of current literature to correlate chemical structures with known modes of toxicity and pathways for elimination in fish.
- July 2011: Initiate review of chemical databases and identify contemporary chemicals using FTSAC.

Potential Hurdles:

- Access to proprietary chemical databases may depend on development of confidentiality agreements with database owners.

2.5.9 Evaluate Physical Methods to Disrupt Asian Carp Spawning Behavior and Decrease Egg Viability

Lead Agency: USGS

FY 2011 Funding: $160,000 GLRI funds is proposed.

Project Explanation: Technologies presently do not exist to specifically target Asian carp for control within aquatic ecosystems. Current physical controls (e.g., electrofishing or netting) are of limited success in altering populations. The development of physical methods to disrupt Asian carp spawning activities in identified tributaries coupled with attractant pheromones has the potential to limit Asian carp reproduction success.

FY 2010 Summary: Much of the work pertaining to this project was not expected to begin until FY 2011. USGS hired the personnel to carry out the activities for the project and initiated the process for collaboration with Purdue to assist with project activities.

FY 2011 Action: Under this task, USGS will conduct the following:

- Refine test system for running electrical current and sonication exposure trials to further evaluate the response of Asian carp eggs.
- Conduct full suite of electrical current and sonication experiments to determine effects on early life history stages of Asian carp.
- Determine whether electrical current and sonication exposures increase sensitivity of carp on early life history stages to chemical control measures.
- Evaluate potential for large-scale implementation of physical disruption.
- Produce a final report and peer-reviewed articles.

The research will enable integrated approaches to prioritize locations of potential physical controls in identified spawning habitat coupled with application of attractant/dispersal pheromones.

Expected Milestones:

- May 2011: Development of egg exposure and incubation systems.
- June to September 2011: Evaluation of egg mortality following electrical exposure from one or more spawning events.

Potential Hurdles:

- Access to sexually-mature bighead and silver carp with viable gametes.

2.5.10 Identify Asian Carp Organs Susceptible to Encapsulated Toxicants

Lead Agency: USGS

FY 2011 Funding: $334,600 GLRI funds (includes $164,600 carryover from FY 2010) is proposed.

Project Explanation: Current toxicants used to control AIS are non-selective and applied throughout the entire water column, resulting in equal exposures of native and invasive species to the toxicant. Development of a delivery system that is selectively consumed by or active in an invasive species could reduce non-target species exposure to the toxicant and may enhance selectivity and reduce effects to non-target species. Development of such delivery methodologies will require full understanding of native and invasive species gill and gut enzyme activity and physiology, because a targeted delivery system will likely use an oral or gill adhesion delivery route

FY 2010 Summary: Tasks completed in 2010 included the literature review, native planktivore selection to study their gastroinintestinal system, creating the Real Time – Polymerase Chain Reaction (RT-PCR) protocol for gene sequence, creating field testing protocols, and sampling of planktivore digestive track.

FY 2011 Action: Research will be conducted to identify and characterize potential bioactive agent delivery sites within native fishes, especially those with potential dietary or other life history overlap with bighead and silver carp, including the gill, skin, and gastrointestinal tract. Research will focus on acquisition of data on important characteristics of native species (e.g., enzyme, protein, lipid, carbohydrate components, pH, and enteric microbial community). This data is critical to the understanding of factors that might affect delivery of a bioactive agent. Microbial libraries of the gastrointestinal tract and digestive systems of native plankton-eating fish will be established and bioinformatic analysis completed. Unique characteristics (e.g., digestive system pH, enzyme profile, and

microbial community) that can be used in the development of species-specific management chemicals will be identified.

Expected Milestones:

- Complete the description of digestive enzymes of gizzard shad and bigmouth buffalo.
- Using bacterial sequencing, describe the bacterial flora of the digestive tracts of gizzard shad and bigmouth buffalo.
- Synthesize the differences in digestive physiology (enzymatic and symbiotic flora) of planktivorous fishes.

Potential Hurdles:

- Establishment of contracts to sequence samples of native planktivore digestive tract bacterial flora.

2.5.11 Great Lakes' Tributary Assessment for Asian Carp Habitat Suitability

Lead Agency: USGS

FY 2011 Funding: $341,000 GLRI funds (includes $175,000 carryover from FY 2010) is proposed.

Project Explanation: Tributaries that would be suitable for Asian carp spawning need to be identified to focus management efforts, as well as locate sites to implement control actions.

FY 2010 Summary: Following project initiation in 2010, USGS identified two Lake Michigan River tributaries to asses for habitat suitability. The Milwaukee River in Wisconsin had hydraulic and water-quality data collected at 1 mile transects. The St. Joseph River in Michigan and Indiana was not sampled due to unusually dry weather conditions. The Asian carp egg development timeline was delineated to free swimming fish stage and the density of the eggs was characterized. This egg data, along with the hydraulic and water quality data will be used in FY 2011 to create models for spawning suitability.

FY 2011 Action: One additional tributary is planned to be assessed in FY 2011. The hydraulic and water-quality data collected in FY 2010 will be analyzed and documented to finish the Milwaukee River in Wisconsin. The St. Joseph River in Michigan and Indiana will have data collected either before the river freezes this winter or when the weather warms in the spring, depending on when the next significant rain event occurs. Additional testing of the other Asian carp species in the Columbia Environmental Research Center for verifying the development series and density data collected in the summer of 2010 will be completed. Spawning suitability models will be developed with the University of Illinois utilizing data collected in 2010 and 2011.

Expected Milestones:

- December 2010: A meeting will be held with the University of Illinois to discuss the flume experiments and model development.
- January-February 2011: The data from the Milwaukee River will be processed by January 2011 and analyzed by February 2011.
- March 2011: The field crew for the new tributary to be assessed will be assembled and given data collection instructions.
- August 2011: The new tributary will have hydraulic and water-quality data collected.
- Late May –June 2011: Second round of spawning for developmental series.
- January 2011: Submit manuscript for in-house review and eventual journal publication on survival of bighead and silver carp eggs on a variety of substrates, based on 2010 data collection.

- January 2011: Submit for Fundamental Science Practices review a data series report on preliminary results of developmental series work, with pictures of each developmental stage, both live and preserved, to compare with Li et al. 2006 drawings, and Celsius temperature units required for each developmental stage.

Potential Hurdles:

- Tributary assessment involves the collection of field data during a high-flow event, which sometimes involves a false-start of mobilization if the event flows are not high enough.
- The collection of field data depends on rain events of sufficient size to cause a rise in the hydrograph.
- Asian carp egg analysis depends on getting sufficient number of eggs during the spawning season.

2.5.12 Technologies Using Oral Delivery Platforms for Species-Specific Control

Lead Agency: USGS

FY 2011 Funding: $2,126,000 GLRI funds (includes $1,096,000 carryover from FY 2010) is proposed. USGS is also contributing $168,535 in Base funding.

Project Explanation: The technology does not currently exist to specifically target bighead and silver carp for control within aquatic ecosystems. Methods with high specificity for bighead and silver carp are necessary to control or eradicate the carp without harm to native species and habitat.

FY 2010 Summary: Progress made in 2010 involved hiring personnel, setting up protocols for gene sequencing and field testing. Bighead and silver carp digestive tract sampling was initiated in August 2010. In collaboration with the USGS Science Support Program, samples were collected and analyzed from unionid and zebra mussel digestive glands in the Mississippi River to compare to Asian carp enzymes. Bighead and silver carp were exposed to Rotenone to determine circulating plasma Rotenone concentrations during lethal immersion exposure. Concurrent with plasma collection, liver samples were collected to determine biochemical responses to Rotenone exposure.

FY 2011 Action: Work initiated in FY 2010 will continue in the following areas:

- Compare and contrast Asian carp gill structures relative to native fish with a focus on the identification of optimal particle size and geometry that may enhance selective filtration by Asian carp.
- Characterize Asian carp gastrointestinal pH and digestive enzyme profiles.
- Determine the response of Asian carp to oral dosing with Rotenone or Antimycin will be used to calculate required bioactive agent levels in targeted delivery systems.

Additionally, work will be initiated and or implemented in the following areas:

- Prepare incorporated registered piscicides into one or more targeted delivery platform formulations.
- Evaluation of non-target species toxicity will be initiated to support an experimental use permit application in FY 2011.
- An annual chemical registration meeting will be coordinated and hosted to bring together stakeholder agencies/entities that have a vested interest in developing management tools to control aquatic invasive species.
- Determine appropriate locations to conduct experimental field applications of incorporated piscicides to control Asian carp.

Expected Milestones:

- Complete the description of digestive enzymes of bighead and silver carp.
- Using bacterial sequencing, describe the bacterial flora of the digestive tracts of bighead and silver carp.
- Compare gill raker structure between bighead and silver carp to that of gizzard shad and bigmouth buffalo.
- Synthesize the differences in digestive physiology (enzymatic and symbiotic flora) and gill structure of bighead and silver carp with that of gizzard shad and bigmouth buffalo.
- Evaluate the efficiency of bighead and silver carp to selectively retain and digest targeted delivery system formulations to select targeted delivery system formulations for evaluation with an incorporated piscicide (e.g. Rotenone.)
- Sequence the transcriptomes of Asian carps and native planktivores for genomic analysis.
- Use transcriptome sequence information to identify the modes of detoxification of piscicides (e.g. Rotenone) in bighead and silver carps and native planktivores.
- Apply for Experimental Use Permit to conduct field application of Rotenone-incorporated targeted delivery system formulation in limited application sites.

Potential Hurdles: None.

2.5.13 Study Efficacy of Reducing Asian Carp Food Source Through Nutrient Removal

Lead Agency: USEPA/IEPA

FY 2011 Funding: $300,000 GLRI funds is proposed.

Project Explanation: Asian carp are filter feeders and therefore grow the fastest and reproduce prolifically in systems where an ample food supply supported by nutrient-rich conditions exists. In the CAWS, the WWTP effluent makes up the majority of the flow and, thus, the nutrients fuel phytoplankton growth, which (along with suspended organic matter present in effluent) serves as the primary food source of the carp.

FY 2011 Action: One potentially effective tool to control Asian carp in the CAWS/Lower Des Plaines River/Illinois River system is to reduce the food source of the carp by addressing the base of its food chain. A viable long-term strategy to reduce the nutrients, fine particulate matter, and phytoplankton concentrations would likely reduce the abundance of carp. Nutrient reductions could be accomplished by removing phosphorus and nitrogen from WWTPs that discharge into the CAWS/Upper Illinois Watershed. In this critical area, point source discharges are a primary source of nutrients and particulate matter. Over time, nutrient reductions by point sources could reduce Asian carp populations, could potentially enhance native fish communities, and would support the goal of USEPA to reduce nutrient discharges to the Mississippi River and Gulf of Mexico.

Expected Milestones:

- 2011 – Review existing and new information on Asian carp food, energetics, growth, and reproduction as related to nutrient and phytoplankton abundance.
- 2011 – Determine expected nutrient reductions and costs associated with widespread and/or targeted implementation of both short-term and long-term actions of this proposal.
- 2011 – Complete preliminary modeling of the effects associated with the implementation of a range of nutrient reduction strategies on Asian carp population and native fish communities in the Illinois River.

- 2011 – Work with stakeholders to assess model uncertainties, if present, and perform data collection, if necessary, such that the model can be used to implement actions, as determined to be most effective, in National Pollutant Discharge Elimination System (NPDES) permits over time.

Potential Hurdles:

- Cost of implementing nutrient controls at treatment plants depending on which treatment technologies are selected.

2.5.14 Efficacy Study for Toxic Zones Using Wastewater Treatment Plant Effluent

Lead Agency: MWRD

FY 2011 Funding: No funding necessary.

Project Explanation: This project is analyzing the creation of a toxic zone through the bypass of ammonia-laden primary effluent to the CSSC at the Stickney WWTP and the Little Calumet River at the Calumet WWTP. This would create toxic zones to kill fish migrating upstream. These two zones would block passage to the lakefront control structures and serve to assist in the plan for controlled lock operations.

FY 2011 Action: The length of the toxic zone, as well as other operating parameters, would have to be determined through study, including the method to remove the ammonia toxicity at the downstream end of the toxic zone. Full-scale testing would be included in the study and would be necessary to verify that the toxicity would be present across the entire channel cross-section throughout the zone. Instream mixing may be necessary to accomplish complete dispersal. MWRD envisions collaboration with other institutions on this applied research.

Expected Milestones:

- 2011 – Complete literature research.

Potential Hurdles:

- Creation of a toxic zone would require emergency waivers from regulatory agencies and/or departments to exceed the NPDES permit limits for various pollutants.
- Proposal would discharge not only toxic concentrations of ammonia, but also total suspended solids, toxic metals, and organics, and impact biological oxygen demand, which could have adverse aquatic life and human health consequences in the vicinity of the discharges and in downstream waters.
- By bypassing ammonia laden primary effluent and the resultant decrease in dissolved oxygen, there is the potential liberation of toxics-laden sediments that can occur when an anoxic environment is created.

2.5.15 Develop Alternate Traps and Net Designs to Enhance Asian Carp Capture Rates

Lead Agency: IL DNR

FY 2011 Funding: No funding necessary.

Project Explanation: Successful control or eradication of Asian carp requires that the rate of removal exceeds the rate of increase and that there is an ability to target all individuals in a population. The most reliable method to target low densities of Asian carp that are likely present at the leading edge of an

invasion front are two nonspecific fish toxins: Rotenone and Antimycin. However issues such as costs, poison availability, regulatory requirements and non-target impacts limit their use to occasional applications over short sections of the CAWs. There is a need to evaluate the potential for new methods that can capture Asian carp at low densities in canals and river habitats for deployment in CAWs, Upper Des Plaines and Illinois Rivers, and possible Great Lakes spawning rivers. These new methods would be additional tools to be used in combination with existing intensive methods of fishing.

FY 2010 Summary: New 2011 project.

FY 2011 Action: A working group of net makers, fisheries biologists, Great Lakes, and riverine commercial fishers, and hydroacoustic and pheromone experts will be established to design a set of alternative nets and trap designs, and identify available chemical and sound attractants and/or repellants that could be used in combination to increase Asian carp capture rates that would lead to the design and construction of systems that would more effectively drive or herd Asian carp into net or trap designs. These systems would be built and refined for optimum performance combinations in the Dresden Island and Brandon Road pools downstream of USACE's electric barriers, where low densities of carp are known to occur. The best designs and methods would then be deployed upstream of the electric barriers in the CAWs and/or Great Lakes rivers where eDNA technology indicates the possible presence of Asian carp.

Expected Milestones:

- Initial gear deployed and reported on Winter 2010.
- Additional gear and refinement to methods into 2011.
- Report and efficacy of alternative gear compared to gear already deployed.

Potential Hurdles:

- Some gear may require either long soak times or channel areas where commercial navigation operations might be disrupted. This will require cooperation with navigation industry.
- Building nets to specifications that can be deployed in the CAWS may take time.
- Developing attractants/repellants is not yet completed. This product may require laboratory work to refine.

2.5.16 Development of a Rapid and Quantitative Genetic-Based Asian Carp Detection Method

Lead Agency: USGS

FY 2011 Funding: $205,000 GLRI funds is proposed.

Project Explanation: USGS proposes to develop a genetic-based method to determine the relative abundance of Asian carp through the quantification of key microbial populations uniquely present in the fecal materials discharged from bighead and silver carp. This approach is based on the same assumption used in microbial source tracking that host-specific microbial populations are present in the fecal materials from Asian carp , and can be identified based on the use of a common genetic biomarker (i.e., ribosomal ribonucleic acid [rRNA] gene) found in all life. This approach has been successfully applied to identify sources (human, cow, swine, and water fowl) of fecal contamination in rivers, lakes, and drinking water distribution systems. To identify Asian carp-specific biomarkers, fecal materials from different Asian carp and indigenous fishes will be obtained. The DNA materials will be extracted and used in the construction of the rRNA biomarker library using the "next-generation" DNA sequencing technology. Based on the rRNA gene sequence results, Asian carp-specific biomarker(s) will be identified. Quantitative polymerase chain reaction (qPCR) will be applied to detect the abundance of AC-specific biomarkers from a few copies to millions copies within 3-4 hours after obtaining water samples

and transporting the samples to a typical molecular biology laboratory. On-site detection is possible with proper equipment provided. As the amount of fecal materials discharged from Asian carp is significantly high, the detection sensitivity can be greatly enhanced compared with the current "eDNA" method. The use of genetic biomarkers can further ensure the specificity of detection for Asian carp, and differentiate the detection signal from other non-Asian carp in the river. These features have advantages over the current eDNA test that takes days to 1 week to detect only the presence and absence of Asian carp DNA.

This project is a collaboration between the USGS Columbia Environmental Research Center, the USGS Illinois Water Science Center, and the University of Illinois at Urbana-Champaign.

FY 2010 Summary: New 2011 project.

FY 2011 Action: In the next three months, USGS will collect fecal materials from different Asian carp and indigenous carp, extract DNA and construct rRNA libraries for different carp, identify Asian carp-specific microbial populations and design specific qPCR primers for Asian carp-specific microbial populations, and calibrate, optimize and validate qPCR test for Asian carp detection.

Expected Milestones:

- Identify Asian carp-specific microbial populations.
- Develop Asian carp-specific qPCR test.
- Test Asian carp-specific qPCR test with blind samples.

Potential Hurdles:

- Obtaining representative fecal materials from Asian carp and other indigenous carp.
- Identification of Asian carp-specific microbial populations.

2.6 eDNA Analysis and Refinement

2.6.1 eDNA Monitoring of the CAWS

Lead Agency: USACE

FY 2011 Funding: $600,000 GLRI funds is proposed.

Project Explanation: This task encompasses long-term activities that revolve around monitoring assessment activities conducted above the barriers. USFWS, IL DNR, and USACE all have activities under this task that include rapid response team support, enhanced monitoring, and eDNA monitoring of the CAWS. The enhanced sampling will be used to document the extent of Asian carp population dynamics within the canal system and connecting waterways, provide data for modeling potential population movements (range expansion), and determine life stages of Asian carp potentially present.

2010 Summary: The ACRCC CAWS Workgroup implemented the MRRP for the entire CAWS and Upper Illinois River system. This was a collaborative effort between IL DNR, USFWS, and USACE. USACE efforts included increased eDNA collection above the barriers. Sampling locations were dependent on the season but included areas adjacent to warm water discharges, WWTP outfalls, tailwaters of locks and dams, marina basins, barge slips, and other backwater areas.

2011 Actions: The USACE proposal for eDNA sampling within the CAWS includes the collection of water samples at locations designated by the CAWS Workgroup, filtering the samples at a local USEPA laboratory, and processing the samples at the USACE Engineering Research and Development Center (ERDC). Several positive eDNA samples were found in early FY 2011. USFWS and IL DNR support this effort by collecting the samples. Results are posted to the Chicago District website: http://www.lrc.usace.army.mil/AsianCarp/eDNA.htm.

Expected Milestones:

- End of 2012 – fully transition to USFWS.

Potential Hurdles:

- Rainfall impacts the quality of samples.
- Weather may impact sampling.
- Quantity of sampling required/desired versus funding available.

2.6.2 USFWS Capacity for eDNA Sampling for Early Detection

Lead Agency: USFWS

FY 2011 Funding: $300,000 GLRI funds is proposed.

Project Explanation: USFWS Great Lakes Fish and Wildlife Conservation Offices have the expertise and capability to perform eDNA sampling in support of analysis work planned for the La Crosse Fish Health Center. However, no comprehensive, effective, and efficient program is currently being conducted in the Great Lakes to detect incipient invasions. This task will provide USFWS Fish and Wildlife Conservation Office facilities with the resources and expertise to conduct integrated long-term early detection activities with a particular focus on locations in southern Lake Michigan, western Lake Erie and other investigational hotspots.

FY 2011 Action: An academic institution will receive support under a three-year grant through USFWS to develop and refine eDNA technology for use in a Great Lakes-wide early detection program. USFWS will be investigating the transition of this technology to its La Crosse Fish Health Center. As this occurs, USFWS Fish and Wildlife Conservation offices will test and refine capabilities to begin monitoring for eDNA outside the CAWS once the technology transition to USFWS is complete. USFWS will also begin work on development of an eDNA sampling protocol to be incorporated into long term monitoring strategy in collaboration with participating agencies.

Expected Milestones:

- Fully develop the capacity for implementing an eDNA sampling program at USFWS Great Lakes Fish and Wildlife Conservation Offices.
- Support the establishment of a biologically based statistically tenable eDNA sampling protocol for use basin wide.
- Implement an eDNA draft sampling protocol at other areas of concern with particular focus on southern Lake Michigan, western Lake Erie and other potential hotspots.

Potential Hurdles:

- Weather and access to sites.
- Quality Assurance/Quality Control (QAQC) process for sample contamination.
- The degradation rate of eDNA is uncertain.

2.6.3 eDNA Calibration and Increased Efficiency

Lead Agency: USACE, USGS, USEPA

FY 2011 Funding: $1,970,000 GLRI funds is proposed.

Project Explanation: eDNA analysis is an emerging and cutting edge science for predicting the presence and tracking the movement of Asian carp through a waterway. To further validate its use as an effective tool, its methodology must be further refined and its analysis capacity increased. eDNA analysis will also be used as part of a diversified detection portfolio. The purpose of a calibration scope of work is to quantify the correlation between the number and distribution of positive detections with the density of Asian carp.

FY 2011 Action: A series of experiments will be done to refine the sensitivity and intensity of eDNA detections in manipulated pond and artificial stream experiments to better inform the management actions needed to help prevent Asian carp establishment in the Great Lakes. These experiments include the following:

- Whole pond experiments to monitor the time to detection of Asian carp at low density.
- The length and patchiness of the DNA plume produced from fish in variable flow artificial streams and flumes.
- The degradation rate of DNA released into the environment.
- Seasonal (temperature) variation in DNA detection rates in CAWS from an area of known fish density.

Using experimental manipulations and field trials to estimate detection and degradation rates, the outcome of this research will be the calibration of the positive detections in the CAWS to known fish densities and abundances across a range of environmental conditions.

USGS is contributing Asian carp expertise and is directing and organizing the acquisition of pond and artificial streams at the USGS experimental research station in Columbia, Missouri.

Additional necessary components for the project:

1. Development of a conceptual model to explore all possible ways eDNA could appear in waterbodies.
2. Time until an eDNA detection (ponds): Given a known density of fish, eDNA samples will be collected over time to determine the frequency and distribution of eDNA positive detections. The information gained from this experiment is critical for assessing low flow waterways such as the Calumet.
3. Time until an eDNA detection (flumes/artificial streams): Given a known density of fish and water flow, eDNA samples will be collected to delimitate the length of the eDNA plume and evaluate the DNA signal. The information gained from this experiment is critical for assessing the distribution of positive DNA detection in higher flow systems.
4. Juvenile pond and flume studies: It is expected there is positive relationship between body size, fish density, and probability of positive DNA detection. The studies in components one and two focus on adult bighead and silver carp. Given flume and mesocosm facilities at ERDC, this study will be used to evaluate the eDNA detection tool for juvenile Asian carp. The information gained from these experiments is critical because detection of juvenile fish could provide an indication of population establishment. Additionally, inference regarding temperature effect on the DNA signal may be experimentally evaluated.
5. Degradation studies: DNA from any organism degrades in the environment. As such an eDNA signal will also degrade. Using seasonal sampling from the LaGrange Pool (where there is a known density of silver carp), mesocosm experiments, and whole pond experiments, we will evaluate the degradation of the eDNA signal. This information will be critical for evaluating the

seasonal usefulness of eDNA as a surveillance tool, and the coverage needed to insure adequate sampling is being conducted throughout the CAWS.

6. Hydrodynamic eDNA transport predictive model to characterize temporal-spatial risk and uncertainties of a population.

Expected Milestones:

- Spring 2011 – Initiate Calibration tasks.

Potential Hurdles: None.

2.6.4 USFWS Region 3 Fisheries Capacity for eDNA Processing

Lead Agency: USFWS

FY 2011 Funding: $750,000 GLRI funds is proposed.

Project Explanation: The USFWS Fish Health Center in La Crosse, WI has the expertise and capability to perform eDNA PCR and analysis. However, adequate staffing, equipment, and laboratory space is not available to process a high volume of additional samples.

FY 2011 Action: USFWS will develop capacity for the systematic collection and analysis of eDNA samples in the support of species management plans (e.g., AIS prevention and control and native species recovery and restoration). Samples from the CAWS and the Great Lakes can be sent to the USFWS Fish Health Center for analysis to assist collaborating agencies in sample processing while increasing efficiency and decreasing turn-around time for results. Locations within the Great Lakes could be selected using a risk-based and statistically-based sampling design that USFWS and partners would develop. Asian carp would be given the highest priority for sample processing following by other AIS that are concluded to be at a high risk to invade and/or impact the Great Lakes.

Expected Milestones:

- Meet with USACE ERDC personnel in December 2010 to establish timeline and feasibility of eDNA technology transfer.
- Develop guidelines and process for eDNA technology transfer.
- Establish new lease agreement with GSA allowing for remodel and expansion of the La Crosse FHC facility by January 1, 2011.
- Remodel and expand La Crosse FHC facility, purchase needed equipment and supplies by September 30, 2011.
- Hire appropriate personnel by September 30, 2011.

Potential Hurdles:

- The timeline for transfer to USFWS may not be adequate for addressing technical issues with eDNA technology.
- The proprietary nature of eDNA technology may preclude realization of planned timeline specifically as it relates to the genetic markers needed for evaluating eDNA samples.
- The weather may affect construction timelines.

2.6.5 eDNA Genetic Marker Development

Lead Agency: USACE

FY 2011 Funding: $350,000 GLRI funds is proposed.

Project Explanation: Develop a new set of eDNA markers for silver and bighead carp. The goal is to develop high-fidelity; sensitive genetic markers for detecting the presence of Asian carp DNA in filtered water samples based on RT PCR or qPCR. Specifically, the goal is to develop optimized fluorescent oligonucleotide probes for use in qPCR assays for eDNA silver carp and bighead carp. Development of new qPCR-based eDNA markers for Asian carp will allow more direct control over eDNA processing schedules, should provide for greater efficiency of eDNA processing, and may provide for a greater degree of sensitivity to eDNA at low concentrations. This work will serve as a basis for advancing future potential studies on eDNA calibration.

FY 2011 Action: USACE will design and test potential qPCR markers for each species. After testing the markers, a determination will be made on the best marker per species. A final report on the study and findings will be provided.

Expected Milestones:

- March 2011 - Design 10 potential qPCR markers for each species
- July 2011 - Test Markers
- August 2011 – Determine best marker per species
- September 2011 – Final Report

Potential Hurdles: None.

2.7 Enforcement and Outreach Activities

Silver, largescale silver, and black carps are currently listed as injurious under the Lacey Act, and USFWS is currently evaluating the need for listing bighead carp as injurious. In addition, Congress has recently passed legislation that would add bighead carp to the list of injurious wildlife under the Lacey Act. USFWS and IL DNR have proposed: (1) increased enforcement of Federal and State regulations, and (2) expanded public outreach to increase awareness to further decrease the potential to spread Asian carps into the Great Lakes and other waters where those species are not established.

2.7.1 Outreach to Northeast Illinois' Bait Shops

Lead Agency: IL DNR

FY 2011 Funding: $30,000 GLRI funds is proposed.

Project Explanation: Juvenile Asian carp have been included in the live bait trade in the past, and are cryptically similar to species used as bait (e.g., gizzard shad and threadfin shad), which may be inadvertently transported along with more typical bait fish species (i.e. fathead minnows, golden shiners, and white suckers). Given that the sources of many bait stocks are from regions of the United States where bighead and silver carp have established populations, the possibility exists that fisherman are unintentionally redistributing Asian carp throughout the Great Lakes region through contaminated bait stocks. Screening of bait shop fish stocks is the most direct approach to evaluating the threat of this alternative introduction pathway. However, census screening of fish stocks requires keen taxonomic expertise and considerable effort.

FY 2010 Summary: eDNA technology was used on water collected from area bait shops and minnow stock tanks and test for the presence of Asian carp minnows. This monitoring helped ensure fishermen were not inadvertently redistributing Asian carp. In 2010, 52 wholesale and retail establishments with valid permits to sell live minnows were identified in Lake, McHenry, Kane, Cook, DuPage, Kendall, Kankakee, Will and Grundy counties. IL DNR contacted these bait shops to identify whether Asian carp were potentially collected and sold as bait in the Chicago area. Water samples were taken onsite at the

bait shops to screen for the presence of Asian carp using eDNA. With the advancement of other eDNA testing procedures, analytical results could be obtained within a 24-hour period of time.

FY 2011 Action: IL DNR will continue to collect one or more water samples from bait shops to ensure that fishermen are not distributing Asian carp throughout the CAWS. However, before larger scale application, a number of steps are needed: (1) development of key molecular markers for the bait trade, (2) testing of collection and detection protocols for application to the bait trade, (3) experimental manipulations to evaluate detection efficacy, and (4) pilot testing of a small number of bait shops.

Expected Milestones:

- Report of results from 52 retail bait establishments sampled in 2010 forthcoming, which include site inspection and results from eDNA samples.
- Repeat visits to retail bait establishments in 2011 to maintain surveillance.
- Education and outreach during surveillance increases awareness to reduce future contamination.

Potential Hurdles:

- Time to develop key molecular markers and efficacy testing for bait trade.
- Testing of collection and detection protocols, which include effects of filtering, flow through design, water sources, and chemicals used in bait holding systems.
- Annual surveys may miss periodic presence of Asian carps in bait trade.

2.7.2 Increased Lacey Act Enforcement of Illegal Transport of Injurious Wildlife

Lead Agency: USFWS

FY 2011 Funding: $400,000 GLRI funds is proposed.

Project Explanation: Although transfer of AIS is currently illegal, stricter enforcement is necessary to mitigate the risk of transfer.

FY 2010 Summary: Expanded surveillance and enforcement of illegal transportation of Asian carp activities were implemented in 2010. Support for Federal law enforcement activities to enforce the Lacey Act, and to work in coordination with State law enforcement partners to enforce State statutes and regulations related to AIS prevention and control were initiated. Additional law enforcement activities were initiated to interdict the illegal movement of other injurious species in the Great Lakes region.

Congress has recently passed a bill (S. 1421) to list bighead carp as injurious under the Lacey Act, and that bill is currently awaiting signature by the President. The addition of bighead carp to the list would result in the prohibition of importation and interstate transport of live bighead carp. Concurrent with this legislative action, FWS has been continuing a process to evaluate the possible listing of bighead carp as injurious via the rulemaking process.

Under the Lacey Act, wildlife can be listed as injurious because the species has been found to be harmful to: health and welfare of humans; interests of forestry, agriculture, or horticulture; or the welfare and survival of wildlife or the resources that wildlife depends upon. To control the spread of an injurious species, the importation and interstate transport of the listed species are prohibited without a permit issued by the USFWS. Permits may be granted for the importation or transportation of injurious wildlife for scientific, medical, educational, or zoological purposes. The Lacey Act does not address intrastate transport. The effect of listing a species is the same, regardless of whether USFWS lists a species administratively, or whether Congress passes a bill to list it.

FY 2011 Action: USFWS will continue: 1) surveillance and enforcement of illegal transportation of injurious wildlife, 2) to respond to requirements of potential legislative changes to U.S. Code pertaining to listing bighead carp as injurious, and 3) the process of evaluating whether to list the bighead carp as injurious, if the legislation to list bighead carp is not enacted.

Expected Milestones:

- Coordination between USFWS and State law enforcement personnel to support implementation of authorities to preclude illegal activities related to aquatic nuisance species, with an emphasis on all species of Asian carps listed as injurious under the Lacey Act.

Potential Hurdles:

- Enforcement personnel staffing levels.
- Short timeframe for publication of rulemaking documents.

2.7.3 Increased Public Outreach and Enforcement

Lead Agency: IL DNR

FY 2011 Funding: $500,000 GLRI funds is proposed.

Project Explanation: This project builds on IL DNR efforts associated with Northeast Illinois' Bait Shops and creates a more robust and effective enforcement component for IL DNR's invasive species programs.

FY 2011 Action: IL DNR proposes to increase officer presence and enforcement activities related to Asian carp. In addition to continuing coordinating with bait shops, IL DNR staff and Conservation Police Officers will perform education and enforcement activities at fish processors, fish markets, and retail food establishments. These activities will focus on ethnic markets known for having a preference for live fish for release or food preparation. In addition, import and export audits and inspections will be performed to ensure compliance with both the federal Lacey Act and Illinois Injurious Species Rule. Conservation Police officers (CPOs) will also be tasked with ensuring adherence to other laws and regulations by commercial fisherman and other personnel working on various aspects of the GLRI programmed funding.

Expected Milestones:

- Perform administrative audit of import, export, and transport permits statewide by program staff. Potential violations discovered will be targeted for field inspections by CPOs.
- Continue bait shop inspections for inadvertent use of Asian carp as bait; expand to truck inspections for minnow haulers.
- Perform visual inspection of live fish sales / brokers in Northwest Illinois (Chicago/Chinatown).
- Conduct field inspection of commercial fisherman catch and reporting to ensure compliance with contracting and administrative rules.
- Review administrative rules associated with Asian carp import, transport, and use within Illinois by a collaborative process.

Potential Hurdles:

- Program manager and assistant are new and therefore this could be a long process while learning the intricacies of the permitting process.

- Current personnel responsible for permitting and authorizing shipments are retiring and/or transitioning out of the program.
- Enforcement duties above will be demanding in light of a reduced force of CPOs and limited training budget.

2.8 Funding Opportunities and Agency Preparation Activities for AIS

In order to increase state participation and further collaborative efforts, the following actions serve to provide state and local agencies a means and funding source to prepare plans for combating Asian carp and AIS should they be introduced into their jurisdictions. Additional actions under this section seek to further the capabilities federal or state agency have in dealing with Asian carp or enhanced monitoring programs.

2.8.1 State and Interstate AIS Management Plans

Lead Agency: USFWS

FY 2011 Funding: No monies are being allocated in the Framework for this activity. (NOTE: $11,000,000 in GLRI funding was provided in the May 2010 Framework.)

Project Explanation: Currently, there is a lack of development of state programs specific to AIS Management Plans

FY 2010 Summary: 2010 funding included State and Interstate Pest Management Plans and Asian carp activities for eight Great Lakes states. It is anticipated that similar opportunities will also be provided in requests for proposals (RFP) in FY 2011.

FY 2011 Action: USFWS will continue to provide funds allocated through the GLRI in 2010 to Great Lakes States, Tribes, and others to enhance activities that prevent introduction of AIS into the Great Lakes. This would include development of state-led rapid response actions conducted under new rapid response plans developed by the eight Great Lakes states and approved by the AIS Task Force.

Expected Milestones:

- Develop and implement an effective, efficient, and environmentally sound program of integrated pest management for invasive species including program functions of containment, eradication, control and mitigation.
- Establish or revise the eight Great Lakes states AIS management plans to include rapid response capabilities. Implement mock exercises to practice rapid response specified under these plans and/or perform actual rapid response.
- Promote actions, including coordinated education and outreach which will prevent the introduction and spread of invasive species through recreational uses such as hunting, fishing, and boating.
- Support the development and on-the-ground implementation of AIS management plans for each of the Great Lakes states.

Potential Hurdles:

- States may have difficulty providing the 25 percent cost-share requirement (non-federal funds) as a requirement for receiving annual funding allocation for support of activities identified in approved State AIS Management Plans.

2.8.2 Competitive Funding Opportunities

Lead Agency: USEPA

FY 2011 Funding: Not applicable.

Project Explanation: Invasive species disrupt fragile ecosystems causing economic and ecological damage. This task supports research to develop sound techniques for dealing with Asian carp.

FY 2010 Summary: In FY 2010, USEPA awarded a $1,000,000 grant to University of Notre Dame for the assessment of eDNA presence within Lake Michigan tributaries.

FY 2011 Action: This is a placeholder in the event the Great Lakes National Program Office receives grant applications after the RFPs are released in FY 2011.

Expected Milestones: None.

Potential Hurdles:

- Agencies have little control over what is submitted; Asian carp proposals may be lacking.

2.8.3 Incident Command System Training and Communication

Lead Agency: IL DNR

FY 2011 Funding: $100,000 GLRI funds is proposed.

Project Explanation: Rapid response activities require personnel trained in Incident Command System (ICS) protocols. This project will support the training of IL DNR personnel and other interested stakeholder partners as well

FY 2011 Action: IL DNR personnel will complete ICS training so that the agency will have two complete teams of trained staff.

Expected Milestones:

- All division heads will complete basic training.
- First class completes training in Winter of 2011.
- Second class completes training in Spring of 2011.

Potential Hurdles:

- Limited opportunities for training given existing workloads.

2.8.4 USFWS National Asian Carp Plan/Activities – Great Lakes Basin

Lead Agency: USFWS

FY 2011 Funding: $1,500,000 GLRI funds is proposed.

Project Explanation: Develop and implement an early detection surveillance program for bighead and silver carps in and near the Great Lakes. This program would complement the eDNA sampling and analysis programs being implemented by academia, USACE (via Task 2.6.3), and USFWS (via Tasks 2.6.2 and 2.6.4). If either bighead or silver carp are collected in the Great Lakes, then USFWS would implement a rapid assessment sampling program to describe distribution and relative abundance. Initial sampling is proposed targeting rivers being monitored for eDNA, western Lake Erie, the Wabash-

Maumee separation site, and several other Great Lakes-Mississippi River Inter-Basin flood connection points.

FY 2011 Action: USFWS staff/teams will be prepared, and may be mobilized, to sample any of the above mentioned locations. Feasibility of physical structures or other Asian carp barriers at inter-basin transfer points may also be explored.

Expected Milestones:

- Provisional sampling program, which will include sampling locations, and standard operating procedures using nets, sonar, and other "traditional" gears. FWS will work with partners to develop and implement sampling plan, including collaboration with State, Tribal, NGO, and Canadian/Provincial agencies and organizational.
- FWS will convene a workshop to develop sampling program criteria and strategy to be implemented basin-wide.

Potential Hurdles:

- Sampling site logistics (e.g. permits, access, and working in Canada) and getting the appropriate sampling gear (e.g. large trawls) available and mobilized in a timely manner.
- Timely eDNA results.
- Inefficiency of traditional sampling gears, particularly in large voluminous water bodies. Timely selection and integration of any appropriate additional staff.

2.9 Other Asian Carp Support Activities

Lead Agency: USEPA

FY 2011 Funding: $1,150,000 GLRI funds is proposed.

Project Explanation: The threat of Asian carp introduction into the Great Lakes directly affects the Great Lakes ecosystem, the eight Great Lakes states, and the economics of several associated industries. A variety of actions and activities are contained in this Framework item. These include funding to support barrier defense, which includes separating newly discovered potential pathways of migration and fish suppression activities during maintenance of the electric barriers; contractor support to the agencies in developing reports, tracking activities, and providing field support as necessary; providing response agencies' travel costs for relocation of personnel and equipment during response events; continued support of the Asian carp director and deputy to enhance collaborations among the federal, state, local, tribal agency partners, as well as with other industry and private stakeholders; and provide senior executives and the ACRCC with continued communication and outreach support activities.

FY 2011 Action: Funding will be used for Asian carp efforts and will include support for the following areas:

- Federal Executive Committee and ACRCC support ($100,000)
- Contractor support ($300,000)
- Multi-agency barrier defense activities ($300,000)
- Rapid response support including costs for travel and relocation of equipment by other agencies ($400,000)
- Communication and outreach activities ($50,000)

Expected Milestones: None.

Potential Hurdles: None.

3.0 Great Lakes States' Involvement

In 2010, all Great Lakes states were invited to join the ACRCC. This 2011 Framework and its proposed actions should unite the Great Lakes states and allow them to achieve the common goal of protecting the Great Lakes against Asian carp. As a result of these proposed actions, the Great Lakes states are in a unique position to enhance the unified front throughout each state's individual jurisdiction.

Several proposed actions in the Framework specifically aim at increasing Great Lakes states' programmatic capacity against AIS to promote sharing of technologies and expertise. This would allow the states an opportunity to leverage their resources and expertise for implementing short-term and long-term actions to prevent Asian carp from establishing a self-sustaining population in the basin. The inclusion of all Great Lakes states will provide for:

- **Coordination and participation in the ACRCC**. Full engagement by all of the Great Lakes states and close coordination and cooperation with the Federal Government in joint response, preparedness, research, operational implementation, and analysis of ecological separation potentialities for all Asian carp activities is now feasible.
- **Funding opportunities for AIS and prevention program development.** Through existing funds such as the Wildlife and Sport Fish Restoration Grants Program, states can apply for grants for AIS, specifically Asian carp program development within the respective states or through multi-state collaborations and grants.
- **Competitive funding for state response operations and response plan implementation.** Additional competitive funding opportunities for 2011 are available for implementation of AIS- and Asian carp-specific control activities.
- **Increased pest management program implementation using a combination of physical, chemical, and biological methods.** Importantly, this program addresses one of the nine priorities of the Council of Great Lakes Governors and directly supports state and interstate management of AIS plans approved by the AIS Task Force.
- **Preparation of AIS Management Plans.** Additional funds have already been allocated for 2010 through GLRI due to the significance of Asian carp control. States are strongly encouraged to utilize these funds to prepare and implement AIS-specific plans and other supporting activities.

The USFWS will work closely with the Great Lakes states to provide assistance where applicable in program development and plan preparation through the Nonindigenous Aquatic Nuisance Prevention and Control Act (NANPACA). As amended, it has authorized federal support, via USFWS, for state and interstate AIS management plans. Draft plans are approved by the AIS Task Force. All Great Lakes states are implementing, with USFWS grants, either or both state and interstate AIS management plans. Great Lakes states are the primary recipients of the grants, but others can be invited by states to share in grant allocations.

Additional examples of measures states could adopt to protect their waters from Asian carp establishment include:

- **Holding consensus-building forums with other state and federal agencies.** For example, a series of Governor's Policy Summits could be held across the basin to provide solid scientific information to decision makers and the general public on the nature and scope of the issue, and accomplishments and plans to deal with problems, including alternative approaches and impacts. The objective is to begin dialogue that may lead to collaborative regional approaches.

- **Considering multi-state coordinated actions to prevent establishment of Asian carp in the Great Lakes.** This would allow actions on a larger scale, with potentially pooled resources to increase the effects and reach of these potential actions.
- **Along with provinces, tribes, and local municipalities, investigating the passage of ordinances/laws prohibiting sale and import/export of live Asian carp (similar to the law already in place in Chicago).**

4.0 Stakeholders' Participation

The efficacy of the actions described above and summarized in the Framework can be significantly enhanced through increased participation by other agencies and stakeholders. For example, recreational water sports groups can play a direct role in educating their members and the general public about how they can participate in ways to prevent transport of invasive species through the Great Lakes watershed. Additionally, NGO volunteers can report any potential sightings of Asian carp to appropriate resource agencies. Many precedents for effective natural resource education programs in the United States could be adopted by agencies participating in this Framework.

Outreach actions being implemented concurrently with the programs in the Framework include:

- Implementation of a Strategic Communication Plan as part of this Framework. The plan outlines communication tools, methods, and protocols that will provide timely and transparent information to multiple target audience groups including elected officials, states, tribes, key constituents, and the media.
- Maintenance of the primary online communication tool www.asiancarp.org to disseminate announcements and provide information on ACRCC activities.
- Coordination of on-site or telephonic media events, including press announcements regarding new Asian carp control efforts, such as release of sampling and eDNA results.
- Outreach to state resource agency heads, municipal leaders, and tribal leaders.
- Development of opportunities for public comment.
- Establishment of a "How to Help" section on the www.asiancarp.org website.
- The Communication and Outreach Workgroup will continue to use www.asiancarp.org and media advisories to disseminate validated information.

The ACRCC invited stakeholders and user groups to provide input and comments on the Strategy Framework via public meetings and via a centralized e-mail account. Ongoing stakeholder input is necessary in both individual actions within this Framework and in further development of the Framework itself.

5.0 Asian Carp Regional Coordinating Committee Coordination

The intent of the ACRCC is to plan for and execute efforts to prevent the unintentional transfer of AIS between the Mississippi River and Great Lakes watersheds. The ACRCC provides strategic oversight of each of the actions outlined in the Asian Carp Control Strategy Framework.

Figures 3, 4, and 5 below depict the relationship of the primary agencies or governmental groups involved in the implementation of the Framework. The relationship is non-linear because of the need for harmonized input from each group in all facets of the Framework. The Executive Committee consists of senior managers from key federal agencies. The ACRCC is made up of agencies with operational and coordinating authority for work relevant to the CAWS. The two workgroups surrounding the ACRCC are tasked with the specific responsibilities laid out in the Framework. The third group – Non-Technical and Policy Group is a stand-alone entity, guided by State and private personnel, providing advice to all the workgroups based on topics of interest to the Group. Each of the workgroups will be led by representatives from the agencies identified, although the workgroups themselves are comprised of several staff members from each agency.

Figure 3. Asian Carp Regional Coordinating Committee Organization Chart

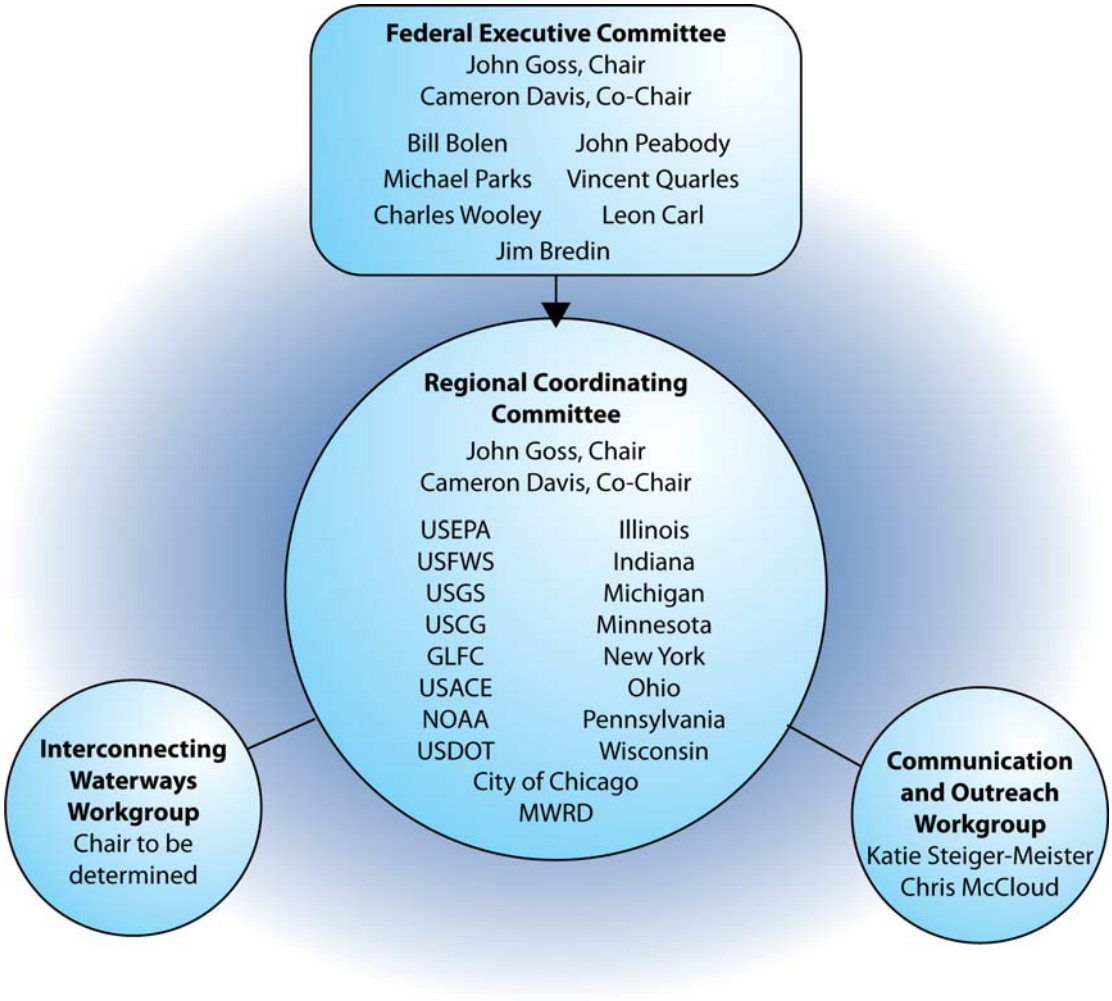


Figure 4. Interconnecting Waterways Workgroup

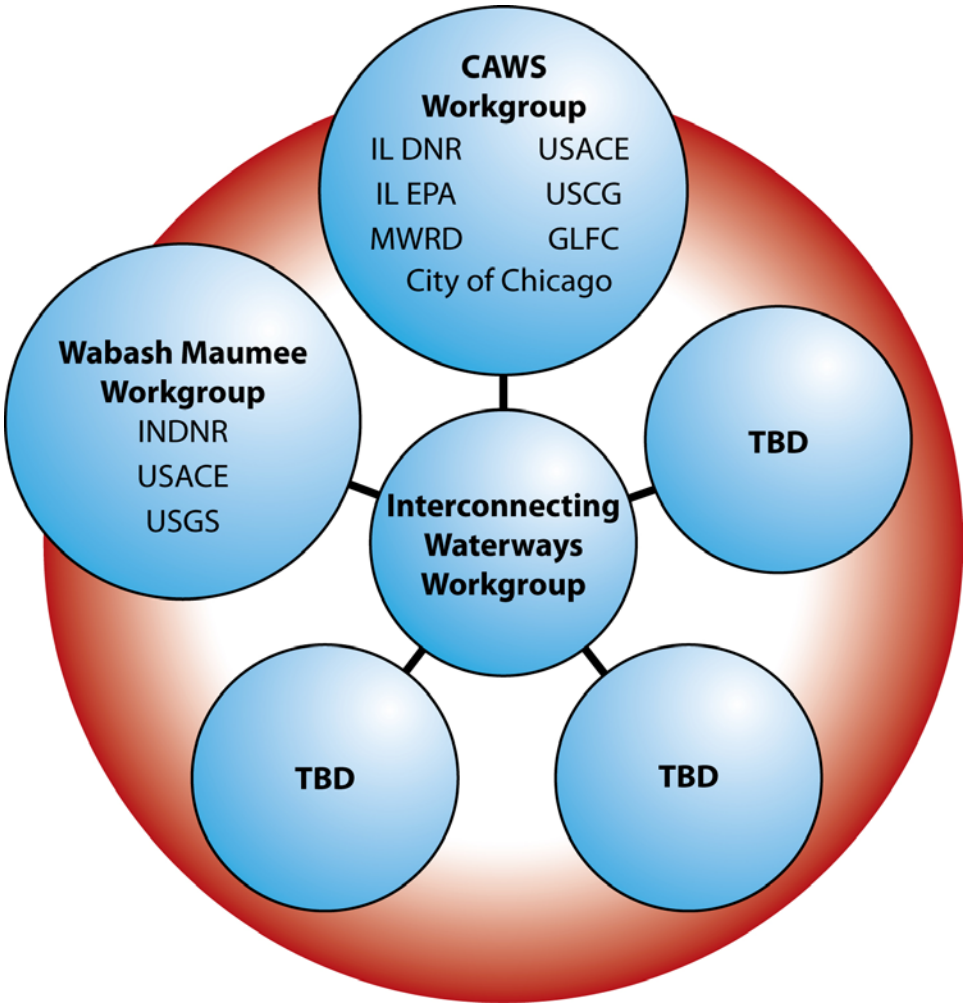
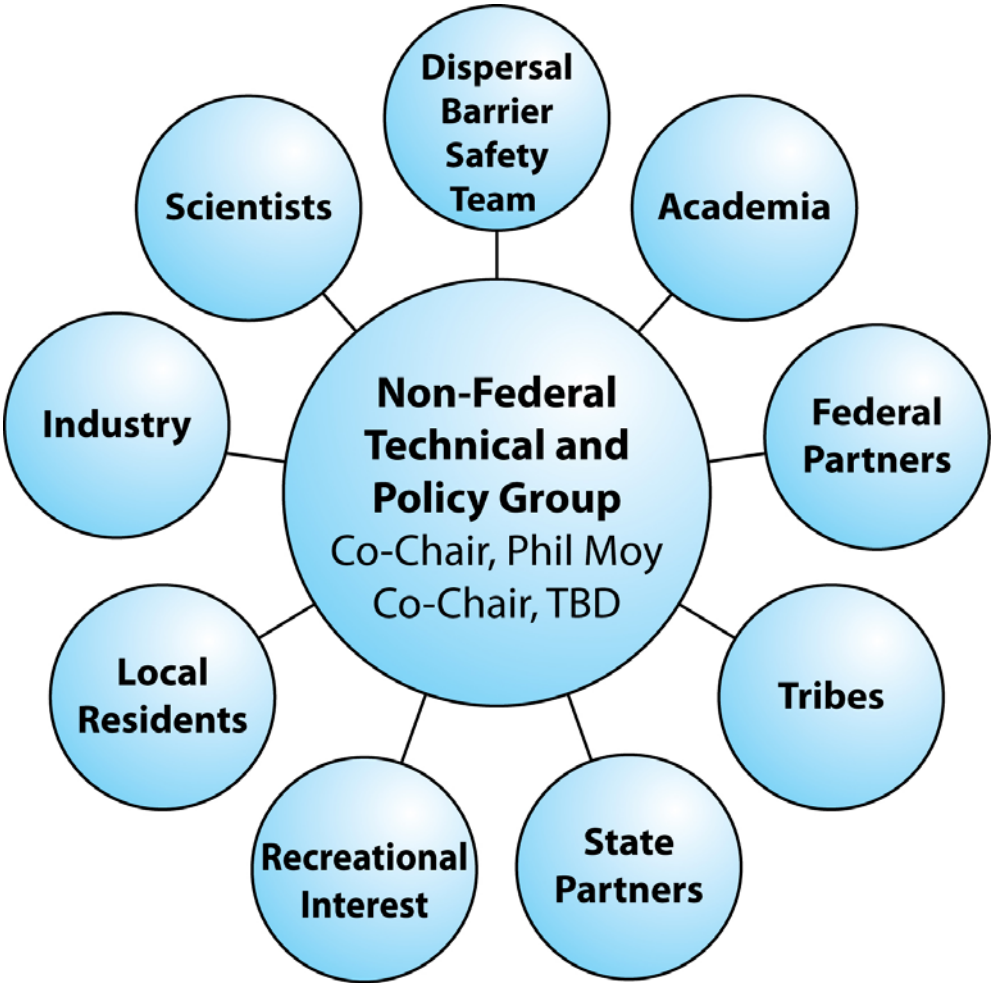


Figure 5. Non-Federal Technical and Policy Group



6.0 Acronyms

ACRCC	Asian Carp Regional Coordinating Committee
AIS	Aquatic Invasive Species
ANS	Aquatic Nuisance Species
ASA CW	Assistant Secretary of the Army for Civil Works
Barrier	Electric Dispersal Barrier
BOD	Biological oxygen demand
CAWS	Chicago Area Waterway System
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
CPO	Conservation police officers
CSSC	Chicago Sanitary and Ship Canal
CWA	Clean Water Act
DIDSON	Dual-frequency identification sonar
DO	Dissolved oxygen
eDNA	Environmental deoxyribonucleic acid
ERDC	USACE Engineering Research and Development Center
Framework	2011 Asian Carp Control Strategy Framework
FTSAC	Fish Toxicant Structure Activity Correlation
FY	Fiscal Year
GIS	Geographic information system
GLFC	Great Lakes Fishery Commission
GLMRIS	Great Lakes and Mississippi River Inter-Basin Study
GLRI	Great Lakes Restoration Initiative
IEPA	Illinois Environmental Protection Agency
IL DCEO	Illinois Department of Commerce and Economic Opportunity
IL DNR	Illinois Department of Natural Resources
IN DNR	Indiana Department of Natural Resources
I&M	Illinois and Michigan
km	Kilometer
MI DNRE	Michigan Department of Natural Resources and Environment
MN DNR	Minnesota Department of Natural Resources

MWRD	Metropolitan Water Reclamation District of Greater Chicago
MRRP	Monitoring and Rapid Response Plan
NANPACA	Nonindigenous Aquatic Nuisance Prevention and Control Act
NEPA	National Environmental Policy Act
NY DEC	New York Department of Environment and Conservation
NGO	Non-governmental organization
NPDES	National Pollutant Discharge Elimination System
OH DNR	Ohio Department of Natural Resources
PA DEP	Pennsylvania Department of Environmental Protection
PA FBC	Pennsylvania Fish and Boat Commission
PMP	Project Management Plan
PCR	Polymerase chain reaction
POTW	Publicly owned treatment works
qPCR	Quantitative polymerase chain reaction
RCC	Regional Coordinating Committee
rRNA	Ribosomal ribonucleic acid
RT	Real time
USACE	United States Army Corps of Engineers
USAID	United States Agency for International Development
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WI DNR	Wisconsin Department of Natural Resources
WWTP	Wastewater treatment plant

7.0 Websites

Asian Carp Regional Coordinating Committee – Asian Carp Control Website
http://www.asiancarp.org/

Great Lakes and Mississippi River Inter-Basin Study (GLMRIS)
http://glmris.anl.gov/

GLMRIS Summary (GLMRIS)
http://www.lrc.usace.army.mil/pao/GLMRIS-StudySummary-08Nov10.pdf

Efficacy Studies
http://www.lrc.usace.army.mil/AsianCarp/efficacy.htm

Dispersal Barrier Efficacy Study – Interim I
http://www.lrc.usace.army.mil/pao/ANS_DispersalBarrierEfficacyStudy_Interim_I_FINAL.pdf

Dispersal Barrier Efficacy Study – Interim IIIA
http://www.lrc.usace.army.mil/pao/02June2010_InterimIIIA.pdf

Management and Control Plan for Bighead, Black, Grass, and Silver Carps in the United States
http://www.asiancarp.org/Documents/Carps Management Plan.pdf

Great Lakes Regional Collaboration Strategy
hthttp://www.glrc.us/about.html

Great Lakes Restoration Initiative Action Plan
http://www.glrc.us/initiatives/index.html

2010 Asian Carp Control Strategy Framework
www.asiancarp.org

eDNA Background Information
www.lrc.usace.army.mil/pao/eDNA_FactSheet_08-11-09.doc

eDNA Current Results
www.asiancarp.org