

Executive Summary

The divide between the Great Lakes and the Mississippi River Basins extends north-south just to the east of Loomis Lake, located north of the city of Valparaiso, Indiana. However, Loomis Lake drains into both basins through a culverted primary spillway (to the Mississippi River Basin) and through an auxiliary spillway at Proffitts Dam (to the Great Lakes Basin). The auxiliary spillway at Proffitts Dam is used periodically to discharge excessive lake water into the headwaters of Damon Run, which is part of the Salt Creek Watershed draining to the Little Calumet River. The lake's drainage to the Mississippi River Basin is through an underground 900-foot (274 m) long culvert to the adjacent Flint Lake which then empties into Crooked Creek through two 24-inch (61 cm) diameter corrugated metal pipes. Crooked Creek is a tributary of the Kankakee River.

This site was determined capable of conveying water across the basin divide toward the Mississippi River Basin continuously for multiple days from a ten percent annual recurrence interval storm event through the underground culvert from Loomis Lake to the adjacent Flint Lake. However, it is unlikely if not impossible for water to flow in the opposite direction from Flint Lake into Loomis Lake because Loomis Lake is perched approximately 17-feet (5.2 m) higher in elevation than Flint Lake. The probability of a flow connection from the Great Lakes Basin to the Mississippi River Basin was rated as "medium" and the probability of a flow connection from Mississippi River Basin to Great Lakes Basin was rated "low".

As a result of this medium rating for the existence of a pathway at Loomis Lake, the viability of the aquatic pathway for specific ANS of concern was then evaluated by looking at the biological requirements and capabilities of the nine ANS listed in the adjacent table.

That evaluation concluded that any ANS from the Great Lakes that made its way up the headwaters of Damon Run to the base of Proffits Dam would be unable to then scale the auxiliary spillway and enter Loomis Lake during the brief periods when water flows through the auxiliary spillway. Likewise, the evaluation concluded that any ANS attempting to access the Loomis Lake aquatic pathway from the Mississippi River Basin would be unable to

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Aquatic Nuisance Species of Concern

Species	Common Name
Hypophthalmichthys molitrix	Silver Carp
Hypophthalmichthys nobilis	Bighead Carp
Mylopharyngodon piceus	Black Carp
Channa argus	Northern Snakehead
Gasterosteus aculeatus	Threespine Stickleback
Gymnocephalus cernua	Ruffe
Proterorhinus semilunaris	Tubenose Goby
Neoergasilus japonicus	Parasitic Copepod
Novirhabdovirus sp	Viral Hemorrhagic Septicemia Virus (VHSv)

access the Lake because it would have to navigate its way up the headwaters of Crooked Creek to the twin 24inch (61 cm) diameter outfall pipes from Flint Lake, jump the roughly one foot (30 cm) difference in elevation from the creek into one of the discharge pipes, swim up the pipe into Flint Lake, and then swim up a primary spillway conduit from Loomis Lake during a time when it is fully inundated and the water velocity is estimated to be 7.5 feet per second (2.3 meters per second). Also, the ANS would need to pass through primary and secondary trash racks to access Loomis Lake. Consequently, the viability of the Loomis Lake aquatic pathway to facilitate the interbasin spread of ANS was deemed to be low by an interagency team because it was found to be unlikely for any of the species of concern to this location to be able to reach Loomis Lake solely through the aquatic pathway.

However, should an ANS be introduced into Loomis Lake or Spectacle Lake, it would then likely be able to spread into either basin through the primary spillway from Loomis Lake into Flint Lake, or during larger flood events from Loomis Lake through the auxiliary spillway into the headwaters of Damon Run. One way ANS could be introduced to either Spectacle Lake or Loomis Lake is through the release of live bait, which may inadvertently contain ANS. Another is by ANS attachment to recreational boats and other portable marine equipment while in one basin, which are then transported over land and placed in either lake. Direct human release of imported aquaria fish or other exotic species into Loomis or Spectacle Lakes could also result in the spread of ANS into the Mississippi River Basin and perhaps the Great Lakes Basin. So while the viability of the aquatic pathway at Loomis Lake to facilitate the interbasin spread of ANS is low, it is in a unique geographic location where development and implementation of some site specific measures may be appropriate.

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Acronyms

ANS Aquatic Nuisance Species ANSTF.... Aquatic Nuisance Species Task Force CAWS Chicago Area Waterway System CEQ..... Council on Environmental Quality DEM. Digital Elevation Model FEMA.... Federal Emergency Management Agency GIS Geographic Information System GLFC.... Great Lakes Fishery Commission GLMRIS... Great Lakes and Mississippi River Interbasin Study HUC..... Hyrdologic Unit Codes IBI Index of Biological Integrity IDEM Indiana Department of Environmental Management ITSI Indiana Trophic State Index INDNR Indiana Department of Natural Resources NAS..... Nonindigenous Aquatic Species NEPA..... National Environmental Policy Act NOAA.... National Oceanic and Atmospheric Administration NRCS Natural Resources Conservation Service QHEI Qualitative Habitat Evaluation Index TP Total Phosphorus USACE ... U.S. Army Corps of Engineers USFWS . . . U.S. Fish and Wildlife Service USGS U.S. Geological Survey VLACD. . . . Valparaiso Lakes Area Conservation District WRDA Water Resources Development Act

1 Introduction

The Great Lakes and Mississippi River Interbasin Study (GLMRIS) was authorized in Section 3061(d) of the Water Resources Development Act of 2007, and therein, it prescribes the following authority to the Secretary of the Army and the U.S. Army Corps of Engineers (USACE) (WRDA, 2007):

"(d) FEASIBILITY STUDY. - The Secretary, in consultation with appropriate Federal, State, local, and nongovernmental entities, shall conduct, at Federal expense, a feasibility study of the range of options and technologies available to prevent the spread of aquatic nuisance species between the Great Lakes and Mississippi River Basins through the Chicago Sanitary and Ship Canal and other aquatic pathways."

This GLMRIS Focus Area 2 Aquatic Pathway Assessment report addresses the Loomis Lake location in Porter County, Indiana. This location is one of 18 locations identified in the Great Lakes and Mississippi River Interbasin Study Other Pathways Preliminary Risk Characterization as a potential aquatic pathway spanning the watershed divide between the Great Lakes and Mississippi River Basins outside of the Chicago Area Waterway System (CAWS) (USACE, 2010). This report is downloadable from the GLMRIS web site (glmris.anl.gov/).

The dashed line in Figure 1 depicts the nearly 1,500mile (2,414 kilometer) basin divide from the New York - Pennsylvania state line to north eastern Minnesota, and it depicts each of the 18 potential aquatic pathway locations that were previously identified. The Loomis Lake location is shown as site number 7 in northeast Indiana (Figure 1).

The GLMRIS is a very large and complicated task involving multiple USACE Districts and Divisions. Program Management of the study is conducted by the Great Lakes and Ohio River Division. The study considers several ANS of concern, however, the proximity of Asian carp in the Mississippi River Basin to the basin divide near two locations lends a sense of urgency and national significance to completion of the GLMRIS. These two locations are the CAWS in Chicago, Illinois and Eagle Marsh in Fort Wayne, Indiana. To help accelerate completion of the feasibility study, the Great Lakes and Ohio River Division split management of the GLMRIS into two separate focus areas. Focus Area 1 is managed by the USACE, Chicago District and addresses the CAWS that open to Lake Michigan. Focus Area 2 is managed by the USACE, Buffalo District and evaluates all other potential aquatic pathways that exist or are likely to form across the basin divide separating runoff that flows into the Mississippi River and its tributaries from runoff that flows into the Great Lakes and its tributaries.

1.1 Study Purpose

The preliminary report from 2010 and the subsequent analysis contained in this report have been produced for a broad audience ranging from the scientific community to the general public, and are specifically intended to identify any locations where an aquatic pathway exists or may form between the basins from up to a one percent annual recurrence interval flood event, and to evaluate the probability that specific ANS would be able to arrive at that pathway and cross into the new basin. The information in this and the other Focus Area 2 reports are intended to provide a sound scientific basis for helping to prioritize future funding of GLMRIS and/or other actions at these potential aquatic pathway locations.

A recurrence interval relates any given storm, through statistical analysis, to the historical records of rainfall and runoff for a given area. The recurrence interval is based on the statistical probability that a given intensity storm event will be equaled or exceeded in any given year. For instance, a one percent annual recurrence interval storm is a rainfall event that has a one percent probability, one chance in 100, of being equaled or exceeded in any given year. This level of storm event was commonly referred to as a 100-year storm event, but this term has led people to incorrectly conclude that a 100-year storm event is one that only occurs once in any given 100 year period. A ten percent annual return frequency storm (formerly referred to as a ten year event) is a smaller event that has a one in ten chance of being exceed during any given year, and a 0.2 percent

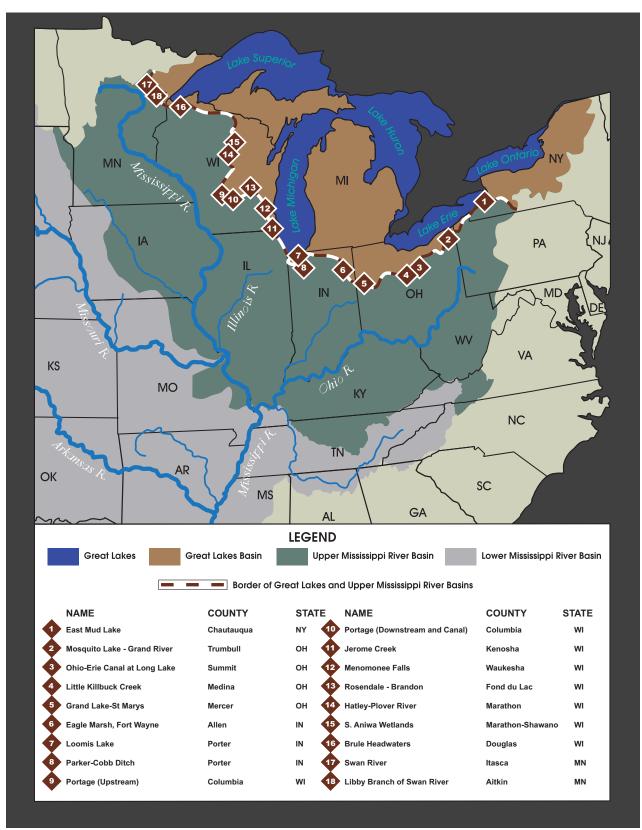
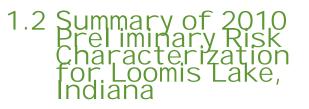


Figure 1. Potential aquatic pathway locations identified in the GLMRIS Preliminary Risk Characterization Study (USACE, 2010).

annual return frequency storm (formerly referred to as a 500-year event) is a larger event that has a one in 500 chance of being exceeded in any given year.

This report is part of a tiered approach to assess the likelihood of ANS spreading between the Great Lakes and Mississippi River Basins via aquatic pathways, and it was prepared in accordance with the detailed procedures and criteria specified in the GLMRIS Focus Area 2 Study Plan (USACE, 2011a). The primary purpose of this report is to present the evidence and explain the procedures used to qualitatively estimate the likelihood that a viable aquatic pathway exists at the Loomis Lake location that will enable the interbasin spread of ANS. It is also intended to contribute to the accomplishment of each of the four objectives identified in the plan by including the following:

- A definitive determination of whether the Loomis Lake, Indiana location should be included in the inventory of locations where a viable surface water connection between headwater streams on both sides of the drainage divide exists or is likely to form between the Great Lakes and the Mississippi River basins;
- A standalone report that characterizes the probability of aquatic pathway formation and the probability that a viable aquatic pathway exists at the Loomis Lake, Indiana location and will enable the interbasin spread of ANS;
- Identification of the means, constraints, and likelihood of the interbasin spread of ANS via the potential aquatic pathway at the Loomis Lake location; and
- Development of clear opportunity statements that illustrate how the collective authorities, resources and capabilities of USACE and other applicable Federal, state, local and nongovernmental stakeholder organizations may best be coordinated and applied to prevent the interbasin spread of ANS through the Loomis Lake location.



The Great Lakes and Mississippi River Interbasin Study Other Pathways Preliminary Risk Characterization was designed as the first step of a tiered approach to rapidly conduct a study intended to accomplish two objectives (USACE, 2010). The first and primary objective was to determine if there were any locations within the GLMRIS, aside from the CAWS, where a near term risk for the interbasin spread of ANS exists. Near term, in this case, indicates that implementation of some measure(s) might be warranted to reduce the potential for ANS transfer at that particular location in the short term versus setting that site aside for further analysis. The second objective was to refine the scope of the other aquatic pathways portion of the GLMRIS by developing a list of potential aguatic pathways that could form anywhere along the divide separating the Great Lakes and Mississippi River Basins, and help provide a basis for prioritizing future feasibility study efforts based upon relative risk.

The USACE solicited the input and collaborated with the U.S. Geological Survey (USGS), Natural Resources Conservation Service (NRCS), U.S. Fish and Wildlife Service (USFWS), National Oceanic and Atmospheric Administration (NOAA), Great Lakes Fishery Commission (GLFC), and the natural resource agencies in the states of Minnesota, Wisconsin, Indiana, Ohio, Pennsylvania, and New York. A total of 36 potential locations were initially identified along the divide where it appeared that interbasin flow could occur. These were locations situated in a mixture of rural, forested, suburban, and urban areas, and included locations where surface water flow patterns have been modified through the building of navigation canals, excavation of ditches, and construction of sewers to facilitate storm water management for agricultural, flood damage reduction, or other water management purposes. Also, many of the potential aquatic pathways identified in 2010 were locations where extensive natural wetlands exist in close proximity to, and in some instances appear to span, the basin divide. The lack of prior hydrologic studies and the level of uncertainty in the

hydrology information led to a conservative approach in assigning the individual qualitative aquatic pathway risk ratings.

At 18 of these locations the interagency group determined that it would likely require an epic storm and flooding event for an aquatic pathway to ever form across the basin divide. These were not recommended for further investigation because this was considered a tolerably low level of risk. However, at the remaining 18 locations the group did recommend that a more detailed assessment be conducted (Figure 1). Only one location, Eagle Marsh in Fort Wayne, Indiana, was determined to pose a near term risk for the potential spread of Asian carp into the Great Lakes Basin, and this led to the installation of a temporary barrier by Indiana Department of Natural Resources (INDNR) until a more complete assessment and remedy could be implemented.

Although the preliminary risk characterization did not identify the Loomis Lake pathway as a location where there is a near term risk for the interbasin spread of ANS, there was some uncertainty with this rating. This was mainly due to the interconnected nature of the Valparaiso Lakes, the presence of a culvert between Loomis and Flint Lakes, and lack of readily available hydrological evidence found during the preliminary study effort to discern the relative frequency and potential magnitude of a potential aquatic pathway at this location. The preliminary effort therefore recommended that a more detailed assessment be conducted at this location. This was subsequently done in collaboration with the County Surveyors, INDNR, USFWS, USGS, and other government agencies. The following actions were taken:

- Federal, State, and local stakeholders (i.e., USGS, INDNR, County Surveyor, and local NRCS representatives) were briefed on the preliminary risk characterization results. Detailed site visits were conducted to observe the location and the available modeling,
- Meeting with stakeholders at Loomis Lake to observe conditions and compile and review available information on the design, relationship, and operations of Loomis and Flint Lake.

- An evaluation of the dams on the connecting streams to the Mississippi River relative to the potential for ANS passage through, around, or over each in-stream structure in both directions.
- An evaluation of habitat and abiotic conditions in proximity to the location relative to the needs and preferences of ANS in proximity to the Loomis Lake, Indiana location.
- Revise ANS transfer ratings for each location based upon a more detailed evaluation of ANS transfer potential via the aquatic pathway in both directions.
- Identify measures that could be implemented at the local or state level to mitigate significant potential associated with the interbasin spread of ANS.

1.3 Aquatic Pathway Team

Due to the large amount of unknowns and natural variability associated with the hydrology and the biology of such a large geographic area, the Study Plan specified formation of a "team of teams," combining the best available local, state, and national hydrologists and biologists to assess conditions at each potential aquatic pathway. The results of this assessment reflect the collective experience, expertise, and focused effort of these biologists and hydrologists from USACE, NRCS, INDNR, and the city of Valparaiso. The results also reflect the guidance, input, review comments, and concurrence of the multi-organizational Agency Technical Review (ATR) of experts from USFWS and Illinois Department of Natural resources. In addition, the Michigan Departments of Natural Resources and Environmental Quality participated on the ATR team and jointly concluded their reviews by stating that "we have reviewed the Loomis Lake pathway report and we don't have any objections to it moving forward."

2 Study Methodol ogy

The GLMRIS risk analysis process is an adaptation of the generic model and process described in the Generic Nonindigenous Aquatic Organisms Risk Analysis Review Process (For Estimating Risk Associated with the Introduction of Nonindigenous Aquatic Organisms and How to Manage for that Risk) (ANSTF, 1996). The Aquatic Nuisance Species Task Force (ANSTF) defines the first step in this process as identification of interested parties and solicitation of input.

2.1 Coordination

The USACE identified interested parties and solicited input early in the process for Focus Area 2 and has included individual visits and discussions with the state agencies responsible for water resources, and fish and wildlife management in the eight states bordering the Great Lakes. The process used for the Focus Area 2 assessments has also been discussed in meetings with representatives of the Council on Environmental Quality (CEQ), USGS, USFWS, NOAA, NRCS, and GLFC. Development of this plan also included input from the public and interested non-governmental organizations received during formal National Environmental Policy Act (NEPA) public scoping meetings which were held at 12 locations across the region in both basins between December 2010 and March 2011. The USACE requested the support and participation of the best available experts from the State and Federal agencies responsible for water resources, and fish and wildlife management in the states along the Great Lakes and Mississippi River Basin divide to address the critically important issue of preventing interbasin transfer of ANS. The USGS, NRCS, and each state DNR assigned personnel to assist each USACE pathway assessment team. In addition, a technical review team comprised of 16 senior level experts from the USACE and these external partner agencies, including NOAA and GLFC, was assembled to review and guide the work of these teams. Overall, extensive collaboration among partner agencies, the review team, and other subject matter experts has led to detailed Focus Area 2 pathway assessments.

2.2 Identification of Potential Pathways

At 18 of the potential aquatic pathways identified during the 2010 Preliminary Risk Characterization, it was determined it would likely require an epic storm and flooding event (i.e., greater than a one percent annual recurrence interval storm event) for an aquatic pathway to ever form across the basin divide. These locations were not recommended for further investigation because areas that might require a flooding event in excess (greater magnitude, less frequency) of the one percent annual recurrence interval flood are less likely, and therefore present a tolerably low level of risk. This one percent threshold criterion was established through collaboration with the USGS, USFWS, NRCS, GLFC, and the departments of natural resources in the states of MI, MN, WI, IL, IN, OH, PA, and NY. This threshold is also widely used in flood risk management and is typically aligned with most readily available hydrologic information. The one percent annual recurrence interval threshold only indicates at what level event an aquatic connection can begin to form and would indicate a location that should then be subjected to a more labor intensive evaluation of the probability of ANS being able to utilize that pathway. At the remaining 18 locations, it was recommended that a more detailed assessment be conducted (Figure 1). This was subsequently done in 2011-2012 in collaboration with USGS, NRCS, USFWS, state natural resource agencies, and county surveyors (where applicable), and the results for the Loomis Lake location are presented in this report.

Although the focus of this assessment is on aquatic pathways, it should also be mentioned that there are other non-aquatic pathways that may enable ANS to transit across the aquatic pathway or across the basin divide. Although these other pathways do not influence the overall pathway rating outlined in this report, they are included to point out potential other pathways (e.g., anthropogenic) and their potential influence on the same list of ANS as evaluated in Section 4 of this report. Any further analysis of these non-aquatic pathways outside of this study should develop a separate list of ANS that will likely differ from the list of ANS evaluated as part of this aquatic pathway report

2.3 Aquatic Nuisance Species of Concern

This report addresses the problem of ANS invading, via surface-water pathways, the Great Lakes Basin from the Mississippi River Basin and vice versa. ANS is defined by the ANSTF as "... nonindigenous species that threaten the diversity or abundance of native species or the ecological stability of infested waters, or commercial, agricultural, aquacultural or recreational activities dependent on such waters." The USGS Nonindigenous Aquatic Species (NAS) information resource http://nas.er.usgs.gov/about/faq. aspx defines NAS as "...a species that enters a body of water or aquatic ecosystem outside of its historic or native range." (USGS, 2012). Based on discussions between the USACE, USGS, and USFWS the following definitions were established for the purposes of the GLMRIS. All nonindigenous aquatic species (per the USGS definition above), that are present in the Great Lakes but not known to be present in the Mississippi River and its tributaries are defined as ANS of concern for GLMRIS. Likewise, all nonindigenous aquatic species present in the Mississippi River or its tributaries but not known to be present in the Great Lakes are also considered as ANS of concern for the GLMRIS. Therefore, the term ANS is synonymous with the term nonindigenous aquatic species in this report.

2.3.1 Lists of Nonindigenous Species in Great Lakes and Mississippi River Basins

The list of ANS of concern for a particular location was developed by first consulting the USACE white paper titled, Non-Native Species of Concern and Dispersal Risk for the Great Lakes and Mississippi River Interbasin Study released in September 2011 (USACE, 2011b). This technical paper, prepared by a multi-disciplinary USACE natural resources team, took a broad look at the potential range of species that could be of concern to the GLMRIS. The paper is Appendix C of the GLMRIS Focus Area 2 Study Plan and it is an integral component of the plan. This USACE white paper included a review of 254 aquatic species that are either nonindigenous to either basin or native species that occur in one basin or the other. The list of 254 aquatic species were iteratively screened to identify all potential ANS that could be of concern in either basin and to systematically focus the study toward those species judged to pose the highest potential risk of ecological impacts if they became established in the other basin.

In the first screening iteration, 119 of the 254 aquatic species reviewed were determined to pose a potential threat of infiltrating the other basin and were carried into the second iteration of the analysis. The other 135 species were rejected for further analysis for several reasons. Initially, 104 species were dropped from further consideration because they were determined to already be established in both basins. Another 31 species were removed from further analysis because they were not yet located in either basin, could bypass any aquatic control mechanism by terrestrial movement, or had no potential to cause adverse affects to the invaded ecosystem.

2.3.2 List of ANS of Concern for GLMRIS

To determine species of concern that are pertinent for the GLMRIS from the list of 119 species, the USACE natural resources team compiled, reviewed, and analyzed the best available information. Literature reviews, species proximity to aquatic interbasin connections (in particular the CAWS), ecological tolerances and needs, and vagility of the species were all included in the analysis. The team ranked each species as high, medium, or low risk according to these parameters. The result was the establishment of a list of 39 species, each identified as having both a high level of potential risk for both transferring from one basin to another, and potentially a high risk in that if they do disperse, and the invaded ecosystem could be moderately to severely affected by their colonization (Table 1). A fact sheet was developed for each of these species of concern detailing morphological characteristics useful for identification, including color photographs of the species, information on their ecology, habitat, distribution, and current status in the Mississippi River or Great Lakes Basins.

2.3.3 List of ANS of Specific Concern at the Loomis Lake Location

The Loomis Lake aquatic pathway team then subdivided the set of species listed in Table 1 into two groups: ANS threatening the Great Lakes, and ANS threatening the Mississippi River and its tributaries. Each of these two lists was then sorted into subgroups in accordance with taxonomy and common dispersal mechanism. Table 2 and Table 3 reflect these groupings of species that were found to pose a significant risk to the Mississippi River and its tributaries, and to the Great Lakes and its tributaries, respectively (USACE, 2011b).

Additionally, the Loomis Lake aquatic pathway team reviewed the information on the initial 119 species to assess if any were in close enough proximity to the Loomis Lake location to be of concern. In addition, the team reviewed information on the NOAA Watchlist of species threatening the Great Lakes from international waters, and information on other species cited by the Agency Technical Review as high risk potential invaders not yet in either basin (NOAA, 2011). Mapping was produced, using available USGS occurrence data, to show the relative known location of any ANS to Loomis Lake. Any occurrences of ANS within a 25-mile (40 km) radius of Loomis Lake are shown on Figure 2. All of the ANS in close proximity are currently in the Lake Michigan watershed. All locations of ANS occurrences in Lake Michigan are detailed in Figure 3.

Each aquatic pathway team was granted flexibility in determining whether to add additional species to their assessment based on their review of available information, and the actual location of the potential pathway relative to the known location of those ANS being considered. Based on concerns from local agencies in several states about the potential for spread of viral hemorrhagic septicemia virus (VHSv, *Novirhabdovirus* spp), the project team elected to include it on the list of species of concern for this study at Loomis Lake. Although VHSv has been found in both basins (though infrequently and very localized in the Mississippi River Basin), minimizing the spread of VHSv remains a priority for local stakeholders (Great Lakes Commission, 2011; USGS, 2011). It is therefore included

under the grouping of species which could potentially threaten the Mississippi River Basin.

Each of the three subgroups (i.e., fish, virus, copepod) in Table 4 was evaluated based on the dispersal mechanisms and general mobility of the species within each group. Since this location is positioned on the basin divide, well upstream of any know ANS listed here, any organism that moves solely through this aquatic pathway must possess either self-propelled mobility or the ability to "hitchhike" on other organisms to travel upstream. This eliminates organisms that rely on current for dispersal such as plants and algae

Based on the evaluation by subgroups, only fish, or fish pathogens, were considered to have the requisite means of reaching Loomis Lake from either direction, independent of barriers being present. To facilitate determination of the ANS transfer potential via this site, the team of biologists then selected a smaller group of representative species for focused assessment. The species selected may be those most likely to arrive at the divide, pose the greatest possibility of ecological damage, and/or exhibit a broad range of biological characteristics that provides a more thorough and conservative evaluation of potential probability that ANS could spread between the basins at this location. Of all species considered, the Loomis Lake aquatic pathway team determined four of these possible future invaders as ANS of potentially significant threat to the Great Lakes Basin, and five of these ANS of potentially significant threat to the Mississippi River Basin (Table 4).

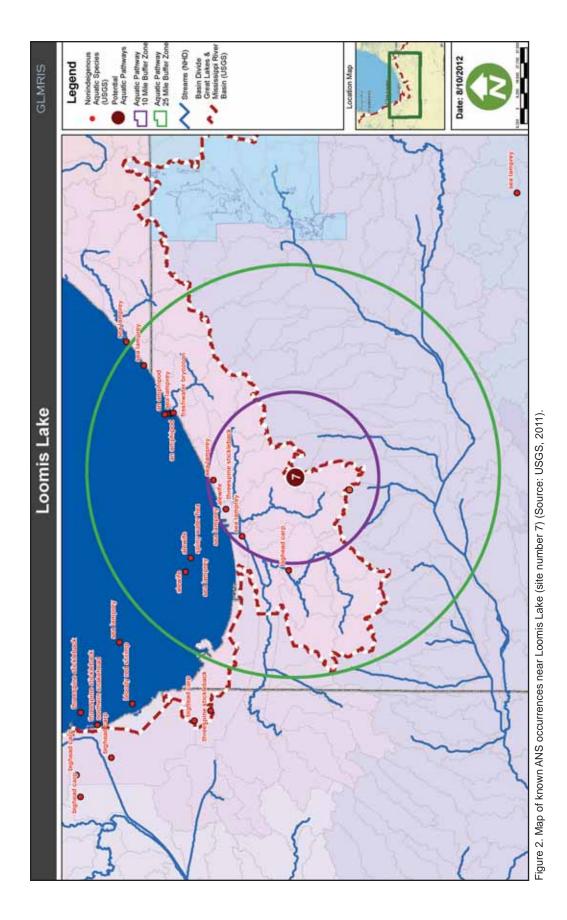
2.3.4 Key Attributes of Selected Organisms

Excluding the information for VHSv, a significant amount of ANS information was obtained from the USACE White Paper listing the non-native species of concern and dispersal risk for GLMRIS and other relevant scientific literature (USACE, 2011b). The VHSv was not identified as a species of concern in this white paper. However, during interagency coordination VHSv was identified as a species of concern for Indiana. Additional information was obtained from the USGS Non-indigenous Aquatic Species (NAS) website (USGS, 2011).

Taxon	Scientific Name	Common Name	Basin	Interbasin Dispersal Mechanisr
fish	Alosa aestivalis	blueback herring	GL	swimmer
fish	Alosa chrysochloris	skipjack herring	MS	swimmer
fish	Alosa psuedoharengus	Alewife	GL	swimmer
crustacean	Apocorophium lacustre	a scud	MS	ballast water
algae	Bangia atropupurea	red macro-algae	GL	ballast / rec. boating
annelid	Branchuris sowerbyi	tubificid worm	GL	sediment transport
crustacean	Bythotrephes longimanus	spiny waterflea	GL	ballast water/sediment transport
plant	Carex acutiformis	swamp sedge	GL	recreational boating & trailers
crustacean	Cercopagis pengoi	fish-hook water flea	GL	ballast / rec. boating
fish	Channa argus	northern snakehead	MS	swimmer
algae	Cyclotella cryptica	cryptic algae	GL	unknown / any water
algae	Cyclotella pseudostelligera	cylindrical algae	GL	unknown / any water
crustacean	Daphnia galeata galeata	water flea	GL	ballast water
crustacean	Echinogammarus ischnus	a European amphipod	GL	ballast water
algae	Enteromorpha flexuosa	grass kelp	GL	ballast / rec. boating
ïsh	Gasterosteus aculeatus	threespine stickleback	GL	swimmer
olant	Glyceria maxima	reed sweetgrass	GL	recreational boating & trailers
ïsh	Gymnocephalus cernua	Ruffe	GL	swimmer
crustacean	Hemimysis anomala	bloody red shrimp	GL	ballast water
fish	Hypophthalmichthys molitrix	silver carp	MS	swimmer
fish	Hypophthalmichthys nobilis	bighead carp	MS	swimmer
plant	Landoltia (Spirodela) punctata	dotted duckweed	MS	recreational boating & trailers
bryozoan	Lophopodella carteri	bryozoans	GL	with aquatic plants
fish	Menidia beryllina	inland silverside	MS	swimmer
plant	Murdannia keisak	marsh dewflower	MS	recreational boating & trailers
ïsh	Mylopharyngodon piceus	black carp	MS	swimmer
crustacean	Neoergasilus japonicus	a parasitic copepod	GL	parasite to fish
olant	Oxycaryum cubense	Cuban bulrush	MS	recreational boating & trailers
ïsh	Petromyzon marinus	sea lamprey	GL	swimmer
mollusk	Pisidium amnicum	greater European pea clam	GL	ballast water
ïsh	Proterorhinus semilunaris	tubenose goby	GL	swimmer
orotozoan	Psammonobiotus communis	testate amoeba	GL	ballast water
orotozoan	Psammonobiotus dziwnowi	testate amoeba	GL	ballast water
orotozoan	Psammonobiotus linearis	testate amoeba	GL	ballast water
crustacean	Schizopera borutzkyi	parasitic copepod	GL	ballast water
mollusk	Sphaerium corneum	European fingernail clam	GL	ballast water
algae	Stephanodiscus binderanus	Diatom	GL	ballast water
plant	Trapa natans	water chestnut	GL	recreational boating & trailers
mollusk	Valvata piscinalis	European stream valvata	GL	ships

Table 2: ANS of Concern Threatening the Mississippi River Basin.						
Таха	Species	Common Name	Interbasin Dispersal Mechanism			
fish	Alosa aestivalis	blueback herring	swimmer			
fish	Alosa psuedoharengus	Alewife	swimmer			
fish	Gasterosteus aculeatus	threespine stickleback	swimmer			
fish	Gymnocephalus cernua	Ruffe	swimmer			
fish	Petromyzon marinus	sea lamprey	swimmer			
fish	Proterorhinus semilunaris	tubenose goby	swimmer			
crustacean	Neoergasilus japonicus	a parasitic copepod	parasite to fish			
crustacean	Bythotrephes longimanus	spiny waterflea	ballast water/sediment			
crustacean	Cercopagis pengoi	fish-hook water flea	ballast / rec. boating			
crustacean	Daphnia galeata galeata	water flea	ballast water			
crustacean	Echinogammarus ischnus	a European amphipod	ballast water			
crustacean	Hemimysis anomala	bloody red shrimp	ballast water			
crustacean	Schizopera borutzkyi	parasitic copepod	ballast water			
mollusk	Pisidium amnicum	greater European pea clam	ballast water			
mollusk	Valvata piscinalis	European stream valvata	ships			
mollusk	Sphaerium corneum	European fingernail clam	ballast water			
protozoan	Psammonobiotus communis	testate amoeba	ballast water			
protozoan	Psammonobiotus dziwnowi	testate amoeba	ballast water			
protozoan	Psammonobiotus linearis	testate amoeba	ballast water			
annelid	Branchuris sowerbyi	tubificid worm	sediment transport			
plant	Carex acutiformis	swamp sedge	recreational boats & trailers			
plant	Glyceria maxima	reed sweetgrass	recreational boats & trailers			
plant	Trapa natans	water chestnut	recreational boats & trailers			
bryozoan	Lophopodella carteri	bryozoans	with aquatic plants			
algae	Bangia atropupurea	red macro-algae	ballast / rec. boating			
algae	Cyclotella cryptica	cryptic algae	unknown / any water			
algae	Cyclotella pseudostelligera	cylindrical algae	unknown / any water			
algae	Enteromorpha flexuosa	grass kelp	ballast / rec. boating			
algae	Stephanodiscus binderanus	Diatom	ballast water			

Table 3: ANS of Concern Threatening the Great Lakes.						
Таха	Species	Common Name	Interbasin Dispersal Mechanism			
fish	Alosa chrysochloris	skipjack herring	swimmer			
fish	Channa argus	northern snakehead	swimmer			
fish	Hypophthalmichthys molitrix	silver carp	swimmer			
fish	Hypophthalmichthys nobilis	bighead carp	swimmer			
fish	Menidia beryllina	inland silverside	swimmer			
fish	Mylopharyngodon piceus	black carp	swimmer			
crustacean	Apocorophium lacustre	a scud	ballast water			
plant	Landoltia (Spirodela) punctata	dotted duckweed	recreational boats and trailers			
plant	Murdannia keisak	marsh dewflower	recreational boats and trailers			
plant	Oxycaryum cubense	Cuban bulrush	recreational boats and trailers			



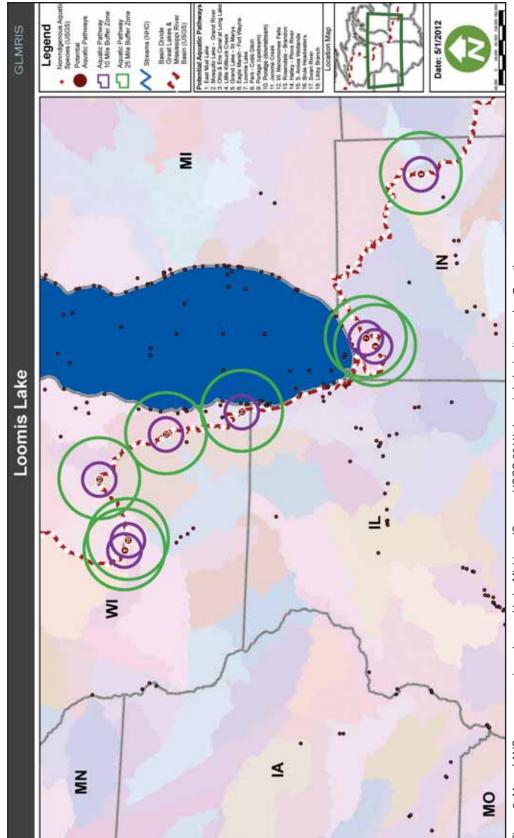


Figure 3: Map of ANS occurrences in and around Lake Michigan (Source: USGS 2011). Loomis Lake is site number 7 on the map.

Table 4: Species of Greatest Concern at Loomis Lake.						
Таха	Species	Common Name	Basin	Interbasin Dispersal Mechanism		
fish	Hypophthalmichthys molitrix	silver carp	MS	swimmer		
fish	Hypophthalmichthys nobilis	bighead carp	MS	swimmer		
fish	Mylopharyngodon piceus	black carp	MS	swimmer		
fish	Channa argus	northern snakehead	MS	swimmer		
fish	Gasterosteus aculeatus	threespine stickleback	GL	swimmer		
fish	Gymnocephalus cernua	ruffe	GL	swimmer		
fish	Proterorhinus semilunaris	tubenose goby	GL	swimmer		
crustacean	Neoergasilus japonicus	parasitic copepod	GL	parasite to fish		
Virus	Novirhabdovirus sp	VHSv	GL	Pathogen to Fish/Water Column		

2.4 Pathway Assessment Process

The GLMRIS risk analysis process is an adaptation of the generic model and process described in the Generic Nonindigenous Aquatic Organisms Risk Analysis Review Process (For Estimating Risk Associated with the Introduction of Nonindigenous Aquatic Organisms and How to Manage for that Risk) (ANSTF, 1996). ANSTF defines the risk associated with an ANS as:

Equation 1

R Establishment = P Establishment X C Establishment

Where:

R *Establishment* = Risk of Establishment

P *Establishment* = Probability of Establishment

C Establishment = Consequence of Establishment

Note the risk is defined as a multiplicative function. That means, if either of these components is zero or low, the overall risk will also be zero or low. In order to work most efficiently given the large number of potential pathways, the GLMRIS Other Aquatic Pathways Team (Focus Area 2) concentrated its effort on characterizing the probability of establishment, while the GLMRIS Focus Area 1 Team for the CAWS is focusing on both components. An estimate of the consequences of any ANS establishment from the Focus Area 2 aquatic pathways will be deferred until possible future study by USACE or others.

ANSTF divides the probability of establishment component shown in Equation 1 into four basic elements

which describe the basic events that must occur for an ANS to establish in the new environment:

Equation 2

 $P_{Establishment} = [P_1 \times P_2 \times P_3 \times P_4]$

Where:

 $P_1 = P_{ANS}$ associated with pathway $P_2 = P_{ANS}$ survives transit $P_3 = P_{ANS}$ colonizes in new environment

 $P_4 = P_{ANS}$ spreads beyond colonized area

Each of the four elements of Equation 2 is qualitatively rated a High (H), Medium (M), or Low (L) based on the available evidence. They are also qualitatively assigned a level of certainty [Very Certain (VC), Reasonably Certain (RC), Moderately Certain (MC), Reasonably Uncertain (RU), Very Uncertain (VU)]. The overall probability rating is the rating of the element with the lowest probability. Thus, in a quartet of HLHH the overall probability rating is "L". The multiplicative nature of the function assures this is actually a somewhat conservative estimate. With actual numbers the overall probability would always be smaller than the smallest of the four factors. These elements have been modified for use in GLMRIS (Equation 3) to describe the basic sequence of events that must occur for an ANS to successfully cross the basin divide through an aquatic pathway and establish in the new basin:

Equation 3 [FA1 Model]

 $P_{Establishment} = [P_0 \times P_1 \times P_2 \times P_3 \times P_4]$

Where:

 $P_0 = P$ Pathway exists $P_1 = P$ ANS has access to pathway $P_2 = P$ ANS transits pathway $P_3 = P$ ANS colonizes in new waterway $P_4 = P$ ANS spreads in new waterway

This model works well in areas where a viable pathway is already known to exist, such as the CAWS. However, for many of the 18 locations identified in GLMRIS Focus Area 2, it was uncertain at the outset whether or not an aquatic pathway does in fact ever form. The team recognized that formation of a pathway at these locations would likely be infrequent, and with a limited duration and magnitude (width, depth, and rate of surface water flow across the basin divide). Consequently, the model in Equation 3 was modified further for Focus Area 2.

Greater efficiency in analysis can be gained by modifying Equation 3 by eliminating evaluation of the last two elements because if a pathway does not exist there is no reason to collect data on colonization (P_3) and spread (P_4) in the new basin. In addition, the third element of Equation 3, ANS transits pathway (P_2), is broken down into its own sequence of necessary events to characterize in greater detail those variables being evaluated to determine whether or not a viable pathway exists. In setting aside the last two elements in Equation 3 (P_3 and P_4) no attempt is therefore made in this report to assess the probability that an ANS will colonize in or spread through the receiving waterway or basin. USACE or others may assess the last two elements of Equation 3 in the future when evaluating specific measures that could be taken to eliminate the probability of transfer at certain aquatic pathways.

Once again, in order to work efficiently in assessing ANS risk for Focus Area 2, the initial assessment focuses narrowly on the question of whether or not a viable aquatic pathway exists. Equation 4 shows how the third element of Equation 3 has been broken down to provide greater resolution for evaluating the pathway itself:

Equation 4 [Modification of Equation 3 – P2 Element] $P_2 = [P_{2a} \times P_{2b} \times P_{2c}]$

Where:

P ₂	= F	ANS	transits pathway
			surviving transit to aquatic pathway
P _{2b}	= F	P ANS	establishing in proximity to the aquatic pathway
P _{2c}	= F	ANS	spreading across aquatic pathway into new basin

Delaying consideration of the last two elements of Equation 3 and substituting the more detailed consideration of the third element as expressed in Equation 4 yields the following model used in the GLMRIS Focus Area 2 assessments:

Equation 5 [FA2 Modified]

 $P_{Viable pathway} = [P_0 \times P_{1'} \times P_{2a} \times P_{2b} \times P_{2c}]$

Where:

Notice the overall probability is now the "probability a viable pathway exists" ($P_{Viable pathway}$) and is no longer the original "probability of establishment" ($P_{Establishment}$) from Equation 3. The probability of establishment for certain aquatic pathways may be assessed in future studies by USACE or others, but likely only for those pathways with an unacceptable rating for the "probability of a viable pathway" existing. Note also that (P_1), ANS has access to pathway from Equation 3 has been renamed (P_1 ?), ANS occurring within either basin". This did not change the element being evaluated but made it clearer to team members what "access to the pathway" actually meant.

This model remains consistent with the overall GLMRIS risk assessment approach and the ANSTF methodology, and the refinements enabled the assessors to focus more appropriately on the relevant evidence. At those locations along the basin divide where the first element in Equation 5 (i.e., likelihood that an aquatic pathway exists at up to a one percent annual recurrence interval event) was estimated to be low, no further assessment of that location was necessary. The low rating of this initial element assures that the overall probability of a viable

pathway existing (Equation 5), the overall probability of establishment (Equation 3), and the ANS risk potential (Equation 1), will all be low because of the multiplicative nature of the model. This approach assured a more prudent use of public resources in data collection and assessment by minimizing the collection of unnecessary data and the conduct of unnecessary analyses. It should also be understood that a low rating for probability of a pathway existing (P_0) is not necessarily the same as there being no probability of a pathway existing. At those locations where the probability of a pathway existing (P_0) was determined to be medium or high which includes the Loomis Lake pathway, the remaining four elements in Equation 5 were evaluated for each ANS of concern specific to that particular location over a 50 year period of analysis ..

2.5 Example Calculation of Overal I Aquatic Pathway Viability

As described in Section 2.2, a list of ANS of concern for the Loomis Lake pathway was developed with input from Federal, State, and local agencies responsible for water resources, and fish and wildlife management in the state of Indiana and neighboring states along the Great Lakes and Mississippi River Basin divide. ANS of concern were grouped according to which basin they were currently established in to determine the viability of the aquatic pathway to transfer species across the divide in either direction. The determination of the likelihood of a viable aquatic pathway for each ANS of concern is the product of five probability elements (Equation 5). Thus, the probability of a viable pathway for a particular ANS of concern is equal to the lowest rating determined for each of the five probability elements (Table 5 and Table 6). The overall pathway viability for transferring ANS of concern from the Mississippi River Basin to the Great Lakes Basin was equal to the highest probability of a viable pathway for each ANS of concern in Table 5. In this example, all were rated low and thus the overall pathway viability for transferring species from the Mississippi River Basin to the Great Lakes Basin is "low". The overall pathway viability for transferring species from the Great Lakes Basin is calculated the same way and is shown in

Table 6. In this example, the overall pathway viability for transferring species from the Great Lakes Basin to the Mississippi River Basin is "medium".

The last calculation is to determine the overall pathway viability for interbasin spread of ANS which is calculated by taking the highest of the overall ANS ratings for unidirectional transfer which were calculated in Tables 5 and 6. Thus, in Table 6, the overall probability that a viable aquatic pathway exists is "medium". The ratings given for each element as well as the overall pathway viability ratings shown in Tables 5 and 6 were coordinated amongst the members of the pathway team regarding the probability rating (H, M, or L) and the level of certainty (VC, RC, MC, RU, or VU). Final agreement was reached on team ratings for each element through collaboration and sharing of applicable information with all team members. The level of certainty in these ratings was modified during these discussions to reflect the range of opinion.

3 Aquatic Pathway Characterization

This section describes and illustrates the topography and features in the vicinity of the potential pathway at Loomis Lake, Indiana, and is intended to help inform the biological evaluations contained later in this report with a compilation of readily available and applicable information for this area as it may influence local hydrology. Maps, photographs, and figures are included to aid understanding of the hydrologic and hydraulic conditions near the drainage divide. Also, this section identifies any significant data gaps and uncertainties related to the topographic and hydrologic information in the area of interest.

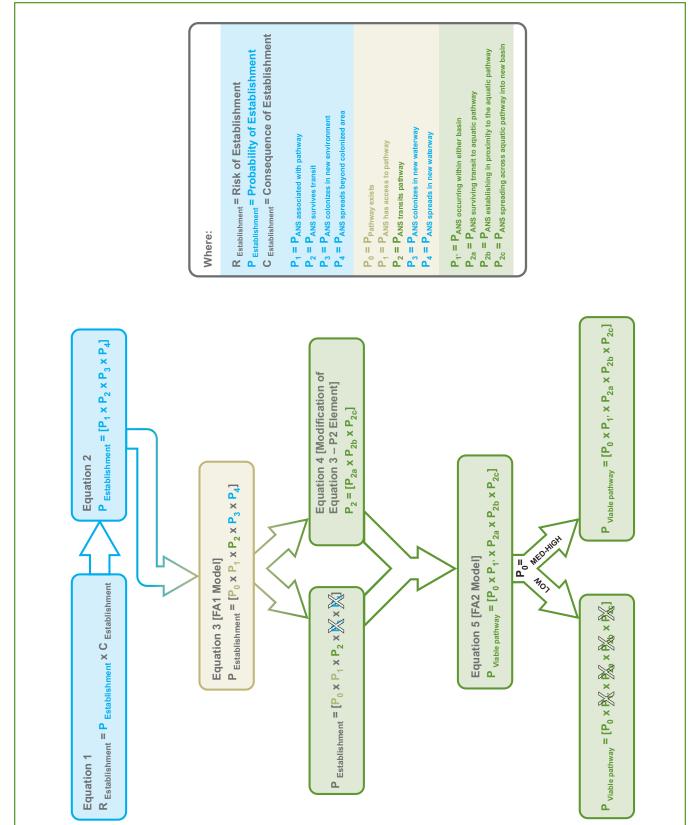


Table 5. Example calculation of Pathway Viability for ANS Spreading from Mississippi River Basin to the Great Lakes Basin.

			Form 1	Form 2	Form 3	Form 4	Form 5	P _{viable}
			P ₀	P ₁	Р 2а	P _{2b}	P _{2c}	pathway
Group	Common Name	Mode of Dispersal	Pathway Exists?	ANS Occuring Within Either Basin?	ANS Surviving Transit to Pathway?	ANS Establishing at Aquatic Pathway?	ANS Spread- ing Across Aquatic Pathway into New Basin?	ANS/Path- way Viability Rating
fish	Asian carp, silver carp, bighead carp, black carp	swimmer	M (RC)	M (RC)	L (RC)	L (MC)	M (RU)	L
fish	inland silverside	swimmer		M (VC)	L (MC)	L (RC)	L (RC)	L
Overall Pathway Viability for Spread of ANS from Mississippi River Basin to Great Lakes Basin							L	

VC=Very Certain (as certain as going to get), RC=Reasonably Certain (reasonably certain), MC=Moderately Certain (more certain than not), RU=Relatively Uncertain (reasonably uncertain), VU=Very Uncertain (a guess)

Table 6. Example calculation of Pathway Viability for ANS Spreading from Great Lakes Basin to the Missis River Basin.								ssissippi
			Form 1	Form 2	Form 3	Form 4	Form 5	P _{viable}
			P ₀	P ₁	P 2a	P 2b	P _{2c}	pathway
Group	Common Name	Mode of Dispersal	Pathway Exists?	ANS Occuring Within Either Basin?	ANS Surviving Transit to Pathway?	ANS Establishing at Aquatic Pathway?	ANS Spread- ing Across Aquatic Pathway into New Basin?	ANS/Path- way Viability Rating
fish	threespine stickleback	swimmer		M (VC)	L (RC)	L (MC)	L (MC)	L
pathogen	VHSv	fish pathogen / water column	M (RC)	H (VC)	H (MC)	H (RC)	H (RU)	М
Overall Pathway Viability for Spread of ANS from Great Lakes Basin to Mississippi River Basin								М

3.1 Location

Loomis Lake and Flint Lake are part of what comprise the Valparaiso Lakes, which are located north of the city of Valparaiso, Indiana. The location of these lakes relative to the city of Valparaiso is illustrated in Figure 5, while Figure 6 presents a slightly larger scale aerial view of the lakes showing the Great Lakes and Mississippi River Basin divide line and general land use in the area. Also presented in this section are the streams and associated subwatersheds for each lake as well as the roadways in the area (Figure 7). The general flow path of these lakes is from Spectacle Lake into Loomis Lake, and then from Loomis Lake primarily into Flint Lake. However, Loomis Lake also has a secondary spillway allowing periodic flows to go north into Damon Run within the Great Lakes Basin. Loomis Lake has no other surface water inputs other than precipitation and inflow from Spectacle Lake, and Flint Lake has no other surface water inputs other than precipitation and inflow from Loomis Lake. The only outflow from Flint Lake is through a pair of culverts located at the southeast corner which empty into Crooked Creek.

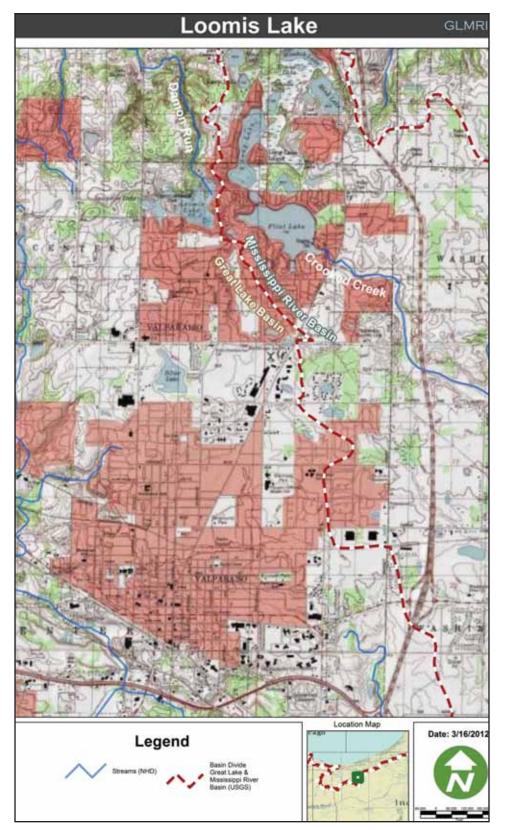
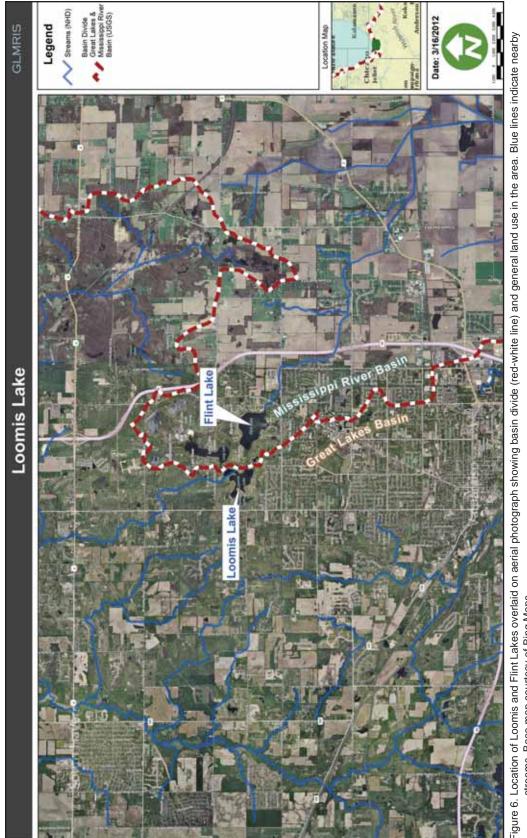


Figure 5. Loomis and Flint Lakes USGS topographic map, north of the City of Valparaiso, Indiana.





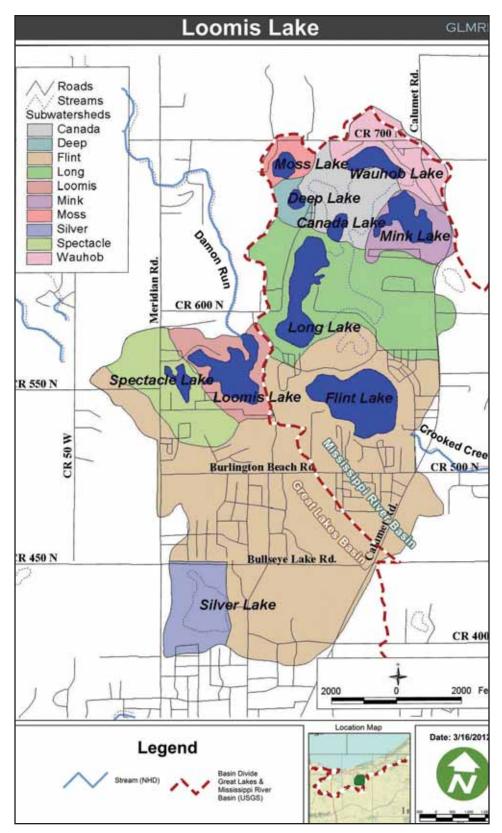


Figure 7. Surface water features and watershed boundaries in proximity of Loomis Lake, Indiana. Spectacle Lake drains to Loomis Lake, which then drains primarily to Flint Lake in the Mississippi River Basin. Base imagery courtesy of Bing Maps.



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3.2 Cl imate

Climate is looked at in this section just in terms of identifying any applicable elements of climate (e.g., temperature, rainfall) and how they may influence the likelihood of an aquatic connection forming at the subject pathway that could be utilized by ANS to spread between basins. This area of northern Indiana is classified as temperate continental with warm summers and cold winters that typically provide enough precipitation, in the form of snow, to supply the soil with sufficient moisture to minimize drought conditions when the hot summers begin (INDNR, 2006). Temperatures in winter average 27°F (-2.7°C), while summers are mild, averaging 71°F (21.6°C). The average temperatures in June, July, and August range from highs in the low 80's (°F) (26-28°C) to lows in the high 50's to low 60's (°F) (14-17°C). Combined with the lack of available shade, surface water temperatures could elevate substantially on hot summer days. Conversely, the average temperature in December, January, and February range from highs in the low to mid 30's (°F) to lows in the teens to low 20's (°F).

The average annual precipitation is approximately 40-inches (101 cm), with the driest times of the year generally occurring between October and March (JFNew, 2006). Precipitation data also indicate that the wettest times of the year occur between April and September (Frankenberger and Carroll, 2011). Area records indicate that especially intense storms are most likely to occur during the spring, and modeling indicates that a one percent annual recurrence interval storm would be expected to produce approximately eight inches (20 cm) of rainfall in a 24 hour period (Frankenberger and Carroll, 2011). The climate of Porter County could therefore limit the quality and quantity of surface water in the small streams leading away from Loomis and Flint Lakes during the hottest summer months (e.g., low levels of dissolved oxygen). Substantial drying of the Damon Creek and Crooked Creek headwaters near these lakes could also occur during summer months and freezing of certain reaches downstream may also occur in the winter.

3.3 Location Specific Surface Water Features

The information contained in this section is meant to present and interpret the readily available information for this location as it pertains to surface water conditions and any aspects that may influence the behavior of surface water. There are three primary areas in the Loomis Lake vicinity that collectively form the Loomis Lake Aquatic Pathway (Figure 8).

The watershed draining Loomis Lake historically drained north to Damon Run and then to Lake Michigan roughly 12 miles (30.5 km) downstream to the north. Loomis Lake was formed in 1924 by the construction of Proffitts Dam, a small earthen dam at the headwater of Damon Run (Figure 8 - Figure 10). The legal lake level of Loomis Lake is set to 813.7 feet (NAVD88), with a surface area of 49.7 acres (20.1 ha), and a normal storage of 317 acre-feet but with a capacity of 485 acrefeet.

As a result of human modification of drainage patterns in the early 1900's, all of the Valparaiso Lakes now drain to Flint Lake as a means of augmenting the former use of Flint Lake as a primary water supply during dry months. However, Flint Lake is no longer used as a primary water supply in the area but still may be used as a back-up water source. All of these lakes are therefore within the Kankakee River Watershed, which is a tributary of the Illinois River, and of the Mississippi River. The legal lake level of Flint Lake is a stage of 17.66 feet, or an approximate elevation of 797.4 feet NAVD88. As of 2002, the maximum water surface recorded was elevation 800.9 feet NAVD88, occurring on July 2, 1983 (USGS, 2003). The topography of the area was also evaluated to see what barrier the slope of the land itself might offer to the formation of an aquatic pathway, as well as possibly the spread of ANS between the basins. Representative surface elevations of the three connection points are shown in Figure 11 - Figure 13 which also depict representative cross-sections through the flow path between Loomis and Flint Lakes (Figure 11), Loomis Lake to Damon Run (Figure 12), and Flint Lake to Crooked Creek (Figure 13), based on the best available Geographic Information System (GIS) data.

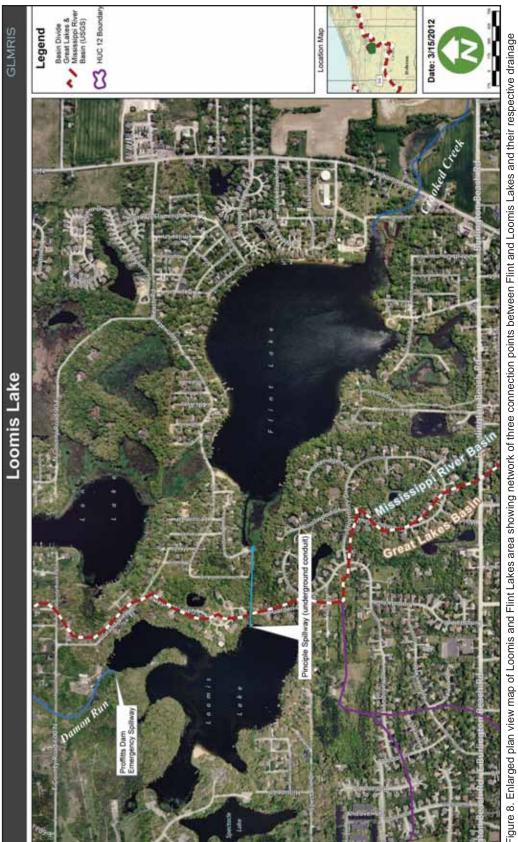


Figure 8. Enlarged plan view map of Loomis and Flint Lakes area showing network of three connection points between Flint and Loomis Lakes and their respective drainage basins: (1) Loomis Lake to Damon Run, (2) Loomis Lake to Flint Lake, and (3) Flint Lake to Crooked Creek at bottom right corner. Base imagery courtesy of Bing Maps.



Figure 9. Proffitts Dam on Loomis Lake, looking west. Photo taken June 20, 2011 by USACE.



Figure 10. Proffitts Dam on Loomis Lake, looking southwest. Photo taken June 20, 2011 by USACE.

Loomis Lake to Flint Lake:

A profile along the basin divide (hydrologic unit code (HUC)-12) depicts the 'saddle point' along the divide and is the location along the basin divide where a hydrologic connection exists between the basins (Figure 11). Also shown is a cross-section through the basin divide to depict the typical ground elevation along the flow path from Loomis Lake to Flint Lake. As can be seen in Figure 11 and Figure 13, flow from Loomis Lake would only occur from the Great Lakes Basin toward the Mississippi River Basin.

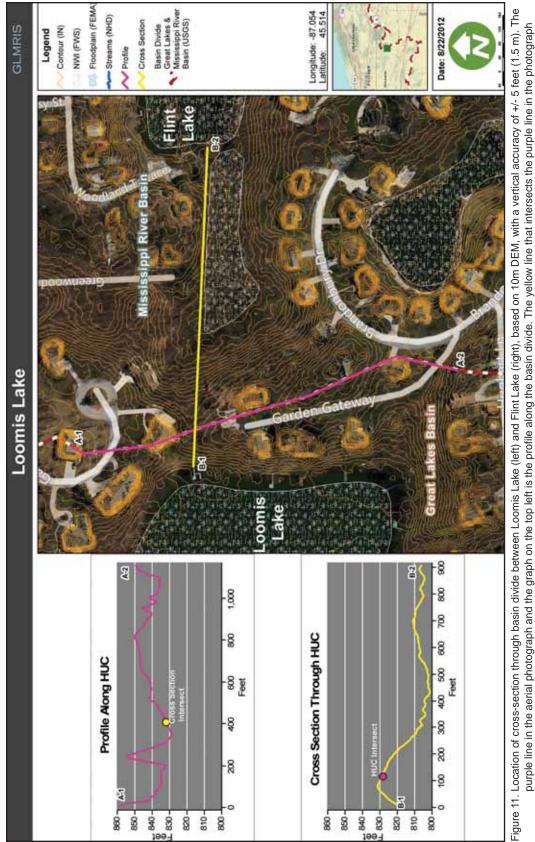
There is also a small wetland area on the west end of Flint Lake that is connected with Flint Lake, and is surrounded by a mixture of thick vegetation and residential development. This wetland does not connect with Loomis Lake. The approximate boundaries of this wetland area are shown as the shaded area on Figure 11. These boundaries are only approximate and a wetland delineation was not performed as part of the site investigation.

For this pathway, the elevations in Figure 11 through Figure 13 are based on the USGS 10m Digital Elevation Model (DEM) with a vertical accuracy of +/- five feet (1.5 m). This level of accuracy may lead one to conclude that there is a high degree of uncertainty regarding the use of this elevation data. However, the absolute vertical accuracy (specific elevation) is not nearly as important as the relative, or point-to-point, vertical accuracy (terrain) when evaluating terrain at the divide location to try and predict hydrology. Point-to-point accuracy has been shown to be much greater than this margin of error regarding absolute elevation would indicate. Although the absolute elevation values may vary from the true value (e.g., 600 feet (183 m) above sea level), they tend to vary a comparable amount at adjacent points so that the terrain of the area is actually depicted relatively well. The grid size used to create the DEM can also affect the accuracy of the DEM. The larger the grid cell size (10 m squares vs. 30 m squares), the more block-like and less detailed the terrain appears and thus the less accurately the DEM depicts the actual terrain. The largest grid size used at any of the pathway locations is 10 m squares with some areas having more detailed information. Even though the 10 m cell size does not depict every hummock or hollow in the terrain, it does

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provide sufficient detail regarding general terrain and relative elevations to provide useful data in evaluating the potential for a hydrologic connection forming across the basin divide.

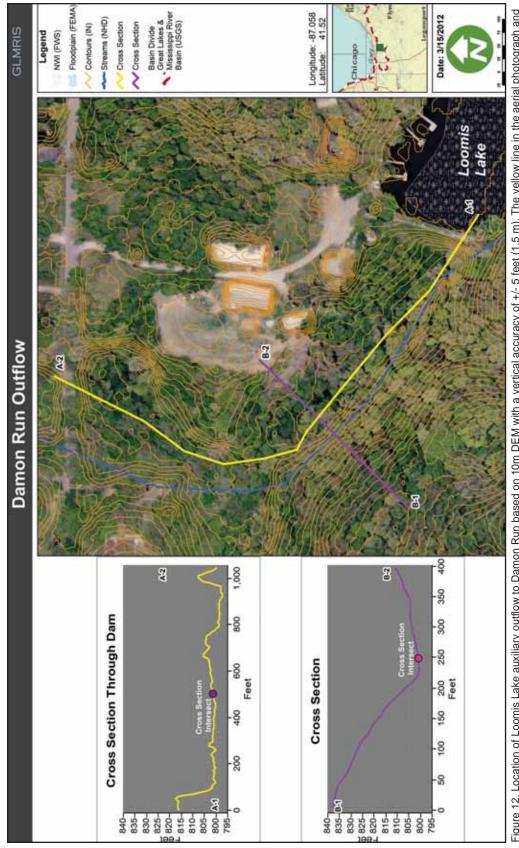
Loomis Lake drains through an underground culvert (called the "principal spillway") out the southeast end of the lake which runs approximately 900 feet (274 m) to the east and then empties into Flint Lake. The cross section in Figure 11 is along the surface profile at this culvert location. This culvert connects Loomis Lake, which is in the Great Lakes Basin, with Flint Lake in the Mississippi River Basin. The inlet to the principal spillway is a drop structure with an outer and secondary trash rack constructed of vertical bars with approximately three inch (7.6 cm) wide openings (Figure 14). As shown in Figure 11, Loomis Lake is approximately 17 feet (5.2 m) higher in elevation than Flint Lake. The grated opening of the culvert inlet is about three feet wide and 2 feet (61 cm) tall. Flow drops vertically several feet into the culvert. The vertical drop inside the inlet structure could not be measured accurately, but is greater than four feet (1.2 m) and is estimated to be eight feet (2.4 m) or greater based on visual inspection. The downstream invert of the pipe is approximately at elevation 796.4 NAVD88 (PTGR, Inc., 1991). The diameter of the culvert is reported in different sources as either a 24 inch (61 cm) pipe or a 48 inch (122 cm) corrugated metal pipe (INDNR, 2006; PTGR, Inc., 1991). According to drawings with the Valparaiso Lakes Area Conservancy District, it is a 24-inch (61 cm) clay tile pipe (Minarich et al., 2011). During the site investigation it was not possible to confirm which of the above diameters is accurate since it was submerged.



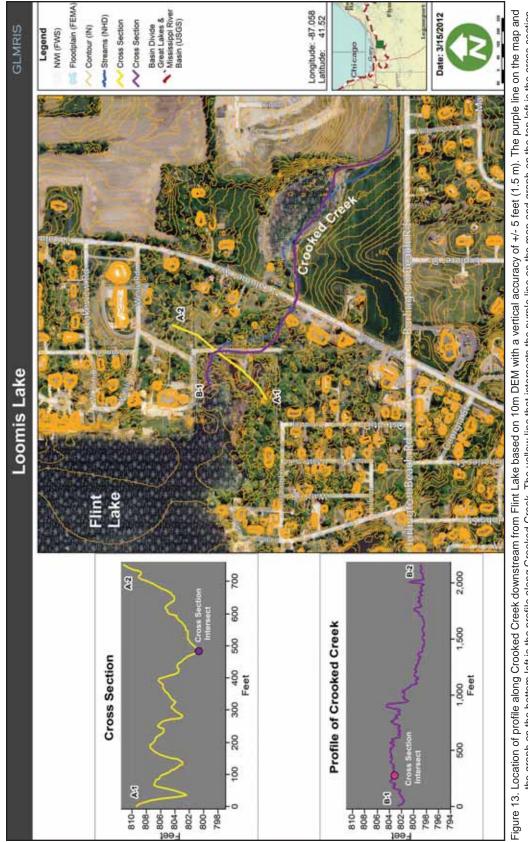
purple line in the aerial photograph and the graph on the top left is the profile along the basin divide. The yellow line that intersects the purple line in the photograph and graph on the bottom left is the cross sections through the basin divide along flow path between the two lakes. Shaded area represents potential wetland area connected with Flint Lake (approximate boundaries). Base imagery courtesy of Bing Maps.

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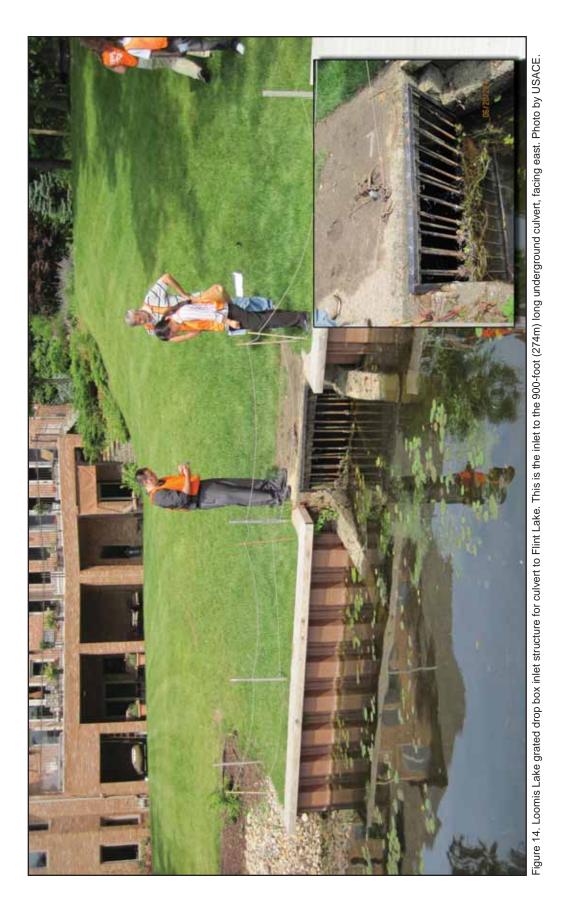






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Loomis Lake to Damon Run:

An approximately three foot (0.9 m) square concrete channel through Proffitts Dam serves as an auxiliary spillway for Loomis Lake, with an invert elevation of 813.6 feet, and top of spillway weir at elevation 814.5 feet (Figure 15). Water level in Loomis Lake must rise 0.8 feet (24 cm) to overtop the low weir. The frequency, depth, or duration of discharge to the Great Lakes Basin through this auxiliary spillway is not known. However, based on input from city officials during the site visit in June 2011, it is believed that overtopping of the low weir (not the dam itself) into the approximate three foot square concrete channel occurs on more than one occasion every year. Proffitts Dam itself has overtopping protection for any excessive flows leaving Loomis Lake that cannot be accommodated by both the principle and auxiliary spillways. City officials believe that overtopping does sometimes occur, but only during what they termed as "rare events." The top of the steel grate of the Proffitts Dam emergency spillway conduit is at 816.6 feet, which is at an elevation approximately equal to top of dam. The dam is approximately 17 feet (5.2 m) high on the downstream side and 200 feet (61 m) wide, resulting in high velocity discharges through the spillway. Downstream of the dam, Damon Run is a heavily vegetated channel contained in a much wider valley (Figure 16). The profile of Damon Run downstream from the dam is shown on Figure 12 The profile line (yellow) on this figure does not match perfectly over the top of the stream line, and some downstream areas on Damon Run are actually shown as being higher in elevation than locations closer to the dam. This phenomenon is attributed to error in the data used for mapping and was not the situation as observed in the field. Accordingly, this figure should be utilized for gaining only a general understanding of the downstream profile trends away from Loomis Lake and not actual elevations.



Figure 15. Loomis Lake 3 foot (0.9 m) square (approx.) concrete channel auxiliary spillway to Damon Run, looking downstream; (Inset) Entrance to concrete channel of this auxiliary spillway at Loomis Lake. Photos by USACE



Figure 16. Damon Run downstream from Proffitts Dam. Photo by USACE.

Flint Lake to Crooked Creek:

Flint Lake drains to Crooked Creek by way of two 24-inch (61 cm) diameter corrugated metal pipes (Figure 17). The downstream end of these pipes is approximately one foot (30 cm) higher than the Crooked Creek channel bottom, thereby likely precluding most if not all aquatic species from being able to swim from Crooked Creek into Flint Lake via these two pipes. In addition, since Flint Lake is the primary source of water for Crooked Creek at this point with no other tributaries nearby, it would be highly unlikely for any backwater flow conditions to develop that could reduce or eliminate this one-foot vertical drop between the pipe and the stream.

Figure 13 presents the approximate ground elevations in the vicinity of the Flint Lake outflow as well as downstream in Crooked Creek. The profile along Crooked Creek in this figure (graph at bottom left) indicates the general downhill path for water exiting from Flint Lake as it descends approximately five feet (1.5 m) over about 2,000 feet (610 m) horizontally. Although some downstream areas appear to be at an equal or slightly higher elevation than the lake itself. This phenomenon was not observed in the field and is attributed to error in the vertical accuracy of the mapping data. What is more important than the actual elevations on this map is the overall trend in the stream profile as it descends away from Flint Lake. This helps to confirm that backflow from the creek into Flint Lake is not possible during high water events.



Figure 17. View of outflow from Flint Lake (left photo) into Crooked Creek (right photo), taken June 20, 2011by USACE during site investigation. Arrows in left photo indicate direction of flow.

3.4 Groundwater

A groundwater section is included in this report since groundwater can sometimes be a source of base flow for streams. Water levels in aquifers normally fluctuate seasonally in response to variations in groundwater recharge and discharge. Groundwater levels commonly rise in spring, when areal recharge is greatest because of snowmelt, spring rain, and minimal evapotranspiration losses. This means that heavier rainfall events, when they coincide with snowmelt and higher groundwater conditions, might result in higher volumes of water discharging from Loomis Lake to Flint Lake, from Flint Lake into Crooked Creek, and possibly from Loomis Lake to Damon Run through the auxiliary spillway.

With the exception of Loomis Lake, the Valparaiso Lakes are glacial features. The lakes are a series of kettle lakes that were formed by ice blocks trapped in the end moraine of retreating glaciers. As these ice blocks melted the resulting meltwater created kettle shaped lakes dotting the landscape. Based on this origin, the lakes are likely fed by both surface runoff and groundwater inputs (JFNew, 2006).

Water levels in Loomis Lake are the key driver in the amount of flow between Loomis Lake and Flint Lake, as well as whether or not the auxiliary spillway is used. These water levels appear to be influenced predominantly by precipitation amounts and inflow from Spectacle Lake to the west. However, groundwater may help to maintain the lake levels and flow duration through the principle spillway during periods of little to no precipitation. As the hydraulic connection between Loomis Lake and Flint Lake is an intermittent surface water connection (i.e., primary spillway to a 900-foot (274m) long culvert), groundwater conditions within the area are not likely to be a significant factor influencing Loomis Lake water levels and were therefore not further evaluated for this site

3.5 Aquatic Pathway Temporal Characteristics

Characterizing the temporal variability of the site's hydrology is potentially an important aspect of understanding the likelihood of an ANS being able to traverse the basin divide as certain flood events may coincide with species dispersal, reproductive patterns, and abilities to survive and establish populations in various areas. For example, given that the area is subjected to freezing temperatures on an annual basis for several months, biological activity and water flow would be somewhat restricted on a temporal basis since water (at least on the surface) would be frozen and the movement of any ANS would be restricted.

At the time of this report, detailed information such as high water marks, gage records, or similar data regarding storm events were not available that could be used to obtain the frequency for flooding events; therefore, quantifying the exact frequency and volume of the hydraulic connection between the basins is not possible at this time. It was communicated that flow is generally perennial from Loomis Lake into Flint Lake except during long periods of hot dry weather (Minarich, 2011).

Flows from Loomis Lake over the Proffitts Dam weir are likely to occur several times per year, but flows overtopping the crest of Proffitts Dam are rare. The most recent event that this occurred was during the September 2008 floods that were caused by the remnants of Hurricane Ike. Approximately 13 inches (33 cm) of rain fell on the Valparaiso area over several hours during this event and it was indicated by city officials that the dam was overtopped by three feet (0.9 m) or more at that time (Minarich et al., 2011). The precipitation for this event was reported as a 327-year event (0.3 percent annual recurrence interval) according to staff for the Valparaiso Lakes Area Conservation District (VLACD). More detailed information is not available, and there are no gages or other sources for such information. The roadways to the dam area were also reported as being impassable during this event. The likelihood of backwater flooding in the opposite direction, from Damon Run across Proffitts Dam into Loomis Lake, is also low. This is based upon findings during the site investigation

and visual inspection of the Damon Run channel which is relatively wide compared to the expected flows, and tailwater depths would be expected to be much less than the 17-foot (5.2 m) dam height under all flood frequencies. Actual elevations and probabilities cannot be calculated with the available data, but it if the dam was not inundated by backwater during the September 2008 flood event then the probability for inundation from this direction is extremely small.

Based upon available information for the primary spillway in Loomis Lake, analysis conducted by the USACE indicates that the connection from Loomis Lake to Flint Lake does appear to receive water from relatively small flows leaving the lake (Bentley Systems Incorporated, 2012). However, in order to provide a complete connection between the lakes it is estimated that the pool of Loomis Lake must increase at least 1.75 feet (53 cm) to initiate a sustained connection. During such a condition, the velocity in the culvert would be moderately high at roughly 7.5 feet per second (2.3 meters per second). Velocity of water in the culvert would increase as the height of water above the top of the pipe at the upstream end increases

3.6 Probabil ity Aquatic Pathway Exists

The rating discussed in this section is only for the likelihood of an aquatic connection existing at this potential pathway (P_0) up to a one percent annual recurrence interval storm. A perennial surface water connection does exist between Loomis Lake within the Great Lakes Basin and Flint Lake in the Mississippi River Basin, based on the following

- Testimony of local area watershed managers and city officials that only small flows occur through the Proffitts Dam on an annual basis, linking Loomis Lake with the rest of the Great Lakes Basin;
- There is a permanent open spillway in Loomis Lake to allow headwater flooding in the Lake to flow toward Flint Lake through a 900-foot (274 m) long underground culvert when water levels in Loomis Lake rise at least 1.75 feet (53 cm).

This flow is only from Great Lakes Basin to the Mississippi River Basin due to approximate 17-foot (5.2 m) elevation difference between the lakes over this 900-foot (274 m) culvert;

- Although small flows will periodically leave Loomis Lake through the Proffitts Dam toward the Great Lakes, flow in the opposite direction is deemed not possible due to the dam's height;
- Analysis of topographic and flow path GIS data shows there to be an obvious flow direction from Loomis Lake toward Damon Run in the Great Lakes Basin, from Loomis Lake toward Flint Lake, and from Flint Lake to Crooked Creek.

Due to the above evidence, the probability of a pathway existing from the Great Lakes to the Mississippi River Basins at Loomis Lake is rated as "medium" since it meets the criteria of an intermittent stream (in this case the 900-foot (274 m) culvert) that is capable of maintaining a surface water connection with both basins continuously for multiple days from a ten percent annual recurrence interval storm (Appendix A). This was not rated as high since there was uncertainty on the exact volume, frequency, and duration of flows going across this pathway. The rating for flow from the Mississippi River Basin toward the Great Lakes Basin was "low" as it is unlikely that water would be able to flow from Flint Lake toward Loomis Lake due to the approximate 17foot (5.2 m) elevation difference between the two lakes, even though they are in fairly close proximity. However, if water from Flint Lake were somehow able to flow into Loomis Lake, there could at that point be an intermittent connection with the rest of the Great Lakes Basin via the outflow through the Proffitts Dam.

This rating for flow into the Mississippi River Basin is considered reasonably certain, and the rating for flow into the Great Lakes Basin is considered very certain because of the following:

- The exact volumes, frequency, and duration of flows through the 900-foot culvert are not known;
- Flint Lake is approximately 17 feet (5.2 m)

lower in elevation than Loomis Lake, with only about 900 feet (274 m) horizontally between the two lakes, making backflow from Flint Lake to Loomis Lake essentially impossible;

- There is some uncertainty related with the ground elevations as shown in the plan and profile figures for the three areas which have vertical accuracies of +/- five feet (1.5 m). This could be a contributing element to part of the Crooked Creek profile downstream of Flint Lake showing a slightly higher elevation than Flint Lake itself; and
- Proffitts Dam is about 17 feet (5.2 m) above the bed elevation of Damon Run, making any backflow from Damon Run (if it ever exists) unlikely to overtop this dam and reach Loomis Lake.

3.7 Aquatic Pathway Habitat

3.7.1 Terrestrial and Riparian Plants and Land Use

Loomis Lake provides 62 acres (25 ha) of various types of fish and wildlife habitat. The lake supports many different species of fish, birds, reptiles, amphibians, and invertebrates. The eastern and southern shores of Loomis Lake are mostly characterized as high to medium-density residential areas. The rest of the land surrounding the lake is mix of forest and open field. In some cases, there is little or no riparian habitat around the lake, especially in the residential areas on eastern shore.

3.7.2 Aquatic Resources

Loomis Lake would likely provide adequate food sources to harbor most of the invasive species of concern for this pathway. A variety of habitat types and a range of depths are also available in Loomis Lake, with most of the lake between five (1.5 m) and 20 feet (6 m) in depth, and a maximum depth of approximately 50 feet (15 m) (Figure 18). Habitat quality throughout the watershed would not likely be a deterrent for most ANS establishment requirements, as nuisance species are generally resilient, aggressive, and adaptable. Water quality in the Salt Creek Watershed within the Great Lakes Basin, of which Damon Run is a part, is considered to be impaired according to the Indiana Department of Environmental Management (IDEM) and is on the 303(d) list for E coli, biotic community impairment, and nutrient loading (e.g., nitrates, phosphorus, and sediment loading) (INDNR, 2011).

Aside from the principle spillway at the east end of Loomis Lake, Damon Run also periodically drains Loomis and Spectacle Lakes. According to the Salt Creek Water Management Plan, in 2000 the IDEM gave Damon Run a Qualitative Habitat Evaluation Index (QHEI) score of 61 (out of a possible score of 100), a ten point drop compared to its 1990 score (Salt Creek Management Plan, 2008). A decrease in substrate quality encompassed the most substantial distinction between the two sampling events. The poor substrate and lack of riffle development limits stream habitat quality in Damon Run. The Salt Creek Water Management Plan stated the following regarding habitat quality in the watershed:

> "During the 2006 biotic community assessment/ intensive survey, QHEI scores ranged from 22 to 69, with a geometric mean of 43. Most of the sites (25 of 43 assessed) rated scores lower than the threshold (51) at which Indiana considers stream habitat to be poor. Common limitations for habitat quality included poor substrate, lack of instream cover, and lack of riffle development."

When assessed in August 2006, physical habitat was good in Damon Run compared to other areas within the Salt Creek Watershed. The site rated a QHEI score of 55. Fish communities were also good compared to other sites, but still did not meet state standards. Eleven fish species were collected at Damon Run. However, tolerant species comprised 57.9 percent of the sample. The site rated an Index of Biological Integrity (IBI) score of 30, which placed the stream in the poor integrity class for the Central Corn Belt Region and was less than the value (36) at which IDEM considers streams to be nonsupporting of its aquatic life use designation.



From Loomis Lake to the Mississippi River

Flint Lake is very similar to Loomis Lake and contains similar flora and fauna. The lake has a mean depth of 20 feet (6.1 m) and covers 86 acres (35 ha). Concentrations of mean total phosphorus in Flint Lake remain high enough to support substantial algal productivity and eutrophic conditions. Data from 2004 suggest that Flint Lake falls within the mesotrophic category according to the Indiana trophic state index (ITSI). However, using 2001 data Flint Lake falls within the hypereutrophic category of Carlson's TSI for total phosphorus (Save the Dunes Conservation Fund, 2008).

Water from Flint Lake empties into the West Branch of Crooked Creek which flows into Crooked Creek. Water then flows through Heinold Ditch before reaching the Kankakee River. These small tributaries of the Kankakee are generally shallow and exhibit poor habitat quality due to channelization and agricultural and urban run-off. The Kankakee River is an approximately 133mile (214 km) long tributary of the Illinois River. Like many Midwestern basins, most of the Kankakee River Basin has been extensively drained. The natural flowpath of the Kankakee has been replaced by a series of canals and ditches. The main branch of the river lacks pools and riffles and is instead a continuous glide. A number of bayous are found along the river. Some remain connected to the river throughout the year while others are connected only during high water or not at all. Fish and wildlife figures indicate that of the 1,200 miles (1,931 km) of stream presently comprising the Kankakee and its minor tributaries, only 16 miles (26 km) remain in the natural state (Robertson, 1972).

The INDNR sampled the Kankakee River for habitat quality in 2001. Qualitative Habitat Evaluation Index scores for 11 stations sampled ranged from a high of 50 to a low of 30.5. Scores between 45 and 60 indicate fair aquatic habitat, and scores below 45 are poor habitat. The scores indicate that habitat is poor at five of 11 Kankakee River stations.

The Illinois River supports a diverse fishery, but is currently threatened by pollution and invasive species like Asian carp. The deposition of sediments into the basin's rivers has resulted in a loss of flow capacity, the filling of adjacent bottomland lakes and associated wetlands which are essential fish production areas, and has caused the smothering of valuable bottom-dwelling organisms and plants thus degrading quality habitat areas. The loss of depth and increased turbidity from the sedimentation threatens the present aquatic habitat and fisheries resources. In addition, the increased production of row crops and the practice of monoculture have resulted in a greater use of herbicides, insecticides and fertilizers. Many of the agricultural chemicals used are toxic to fish. Habitat quality is also diminished by numerous discharges from industrial and manufacturing operations within the basin, some of which have heavy metals, inorganic and organic chemicals, and oxygen demanding organic waste such as wood pulp fibers, canning, and dairy and food processing wastes.

From Loomis Lake to Lake Michigan

Upon exiting Loomis Lake through the Proffitts Dam outflow, an ANS would then enter Damon Run, which is a small tributary of Salt Creek. The water quality of Damon Run is moderately poor when compared to other streams in the Salt Creek Watershed. However, temperature, dissolved oxygen, pH, and conductivity measurements do not exceed Indiana water quality standards (Save the Dunes Conservation Fund, 2008).

After traversing Damon Run, an ANS would then enter Salt Creek. Land uses within the Salt Creek Watershed include agricultural, forest, grassland, residential, commercial, industrial, and recreational. The section of Salt Creek between Damon Run and the East Arm of the Calumet River has no listed impairments (Save the Dunes Conservation Fund, 2008). The section of Salt Creek upstream of the junction of Damon Run and Salt Creek is listed by the state of Indiana as having impaired biotic communities. Habitat in the reach of Salt Creek downstream of Damon Run is generally poor with low quality biological communities (IDEM, 2011). However this stretch of Salt Creek contains some of the highest quality habitat in the Salt Creek Watershed, and the Salt Creek mainstream is considered a cold water fishery (Save the Dunes Conservation Fund, 2008).

Salt Creek drains into the East Arm of the Little Calumet River. This river is largely protected as part of the Indiana Dunes National Lakeshore. Despite this designation, the East Arm of the Little Calumet River has several

advisories, including: Mercury Fish Consumption Advisory, PCB Fish Consumption Advisory, and Pathogens (USEPA, 2012). Some sections of the river contain habitat suitable for salmonids and the INDNR stocks the river with several species of salmonids (INDNR, 2012). Beaver have been detected in the river which may lead to improvements in habitat for a variety of aquatic organisms via the construction of beaver dams and the creation of ponds behind the dams (Whitaker, 1999; Pollock et al., 2003). The section of the East Arm of the Little Calumet River between Salt Creek and the Burns Ditch is approximately 1.5 miles (2.4 km) in length.

Upon exiting the East Arm of the Little Calumet River, an ANS would then need to travel through Burns Ditch which is a constructed diversion of the Little Calumet River into Lake Michigan near Portage, Indiana. Construction of the ditch drained most of the wetlands in the area leading to extensive development (Chicago Historical Society, 2005). Burns Ditch has poor water quality with unsafe levels of E. coli. The Indiana Geological Survey conducted an E. coli forecasting and modeling study at Burns Ditch and stated that "the Burns Ditch location was chosen because it is the outfall point for the largest watershed (Little Calumet drainage) contributing contaminated streamflow to Indiana's southern Lake Michigan" (Harper and Olyphant, 2010). Burns Ditch also has several impairments including Mercury Fish Consumption Advisory, PCB Fish Consumption Advisory, and Pathogens (IDEM, 2011). The distance between Burns Ditch and Lake Michigan is approximately 1.5 miles (2.4 km).

3.7.3 Water Quality

According to the Valparaiso Lakes Watershed Management Plan, there has been a general increase in the lake's total phosphorus (TP) concentrations since baseline measurements were first taken in 1972 (JFNew, 2006). The data show a consistent pattern of lower TP concentrations in the surface, or epilimnetic waters, and higher concentrations in the bottom, or hypolimnetic waters. This suggests that phosphorus may be released from the sediments. Plankton density did not reflect the increases in TP concentrations, suggesting that the phosphorus entering the lake is mainly in the insoluble

form rather than soluble forms which can be utilized by the phytoplankton. Though the ITSI score for 2001 places Loomis Lake in a mesotrophic category, the Carlson Trophic State Index for total phosphorus concentration in the same year places the lake in a hypereutrophic category. Hypereutrophic lakes are very nutrient-rich lakes that can be characterized by frequent and severe algal blooms and low transparency. These algal blooms can significantly reduce oxygen levels and prevent life from functioning at lower depths creating dead zones beneath the surface. Hypereutrophic lakes can be the most biologically productive lakes, and support large amounts of biodiversity (JFNew, 2006).

Lakeshore and stream bank erosion was identified as a problem in Loomis Lake by the *Valparaiso Lakes Watershed Management Plan.* Soil erosion is known to cause sediment and nutrient pollution and increase TP concentrations. Other types of non-point source pollution impacts indentified by the plan include septic systems, which can lead to toxic and bacterial pollution, in addition to nutrient loading.

The IDEM sampled Damon Run in 1990, twice in 2000, 2003, and again in 2006. Concentrations of *E. coli* were consistently high, exceeding the Indiana state standard (i.e., 235 CFU/100 ml) during each sampling event, and conductivity measurements were similarly high (IDEM, 2012). Flint Lake suffers from many of the same water quality issues like run-off and erosion that affect Loomis Lake. Both lakes suffer from anoxia in the hypolimnion (bottom layer of water), and since the lakes are connected, water quality parameters are also similar. Degraded water quality alone will likely not deter the establishment of ANS. One reason most invasive species are successful is the fact that they are able to tolerate a wider range of environmental parameters than native species occupying the same niche.

3.7.4 Aquatic Organisms

Loomis Lake supports a diverse plant community structure with thriving emergent, floating, and submerged zones. In portions of the lake, shoreline development has impaired the lake's emergent communities, limiting the emergent zone's size. While Loomis Lake does not suffer from severe algal blooms as many ultra-fertile lakes, the abundant vegetation in the lake has been known to cause problems. Loomis Lake supports a warm water fishery that has been historically dominated by bluegill (*Lepomis macrochirus*). This skewing of the fish community structure toward bluegill (especially small bluegill) may be caused by the copious aquatic vegetation that persists in the lake. Abundant vegetation can make it difficult for predators, like the largemouth bass (*Micropterus salmoides*), to feed on the bluegill, and consequently cause overpopulation issues such as the stunted growth witnessed in Loomis Lake. It can also result in an unconsolidated lake bottom where only invertebrate and plant species that are very tolerant near anoxic conditions area able to survive.

Invasive plant species already established within and around Loomis Lake are partly to blame for the vegetation issues. Problematic exotic species found around and in the lake include purple loosestrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), Eurasian water milfoil (*Myriophyllum spicatum*), and curly leaf pondweed (*Potamogeton crispus*), which is likely the most prolific exotic aquatic species in Loomis Lake. As in Loomis Lake, Flint Lake supports large beds of Eurasian water milfoil and curly leaf pondweed.

The Indiana Natural Heritage Data Center database lists five state endangered animal species as occurring in Porter County, Indiana. These include the least bittern (*Ixobrychus exilis*), black-crowned night heron (*Nycticorax nycticorax*), king rail (*Rallus elegans*), spotted turtle (*Clemmys guttata*), and Blanding's turtle (*Emydoidea blandingii*). There are also two plant species listed as state endangered: the forget-me-not (*Myosotis laxa*) and Vasey's pondweed (*Potamogeton vaseyi*). The database also lists Richardson's pondweed (*Potamogeton richardsonii*), a state threatened plant species, and pale duckweed (*Lemna valdiviana*), a state extirpated species, as occurring in the watershed.

The establishment of ANS within or around Loomis Lake may affect some listed species, even though some listed species in the area are terrestrial. Aquatic nuisance species are known to upset the balance of an ecosystem's food web dynamics, and sensitive species are usually the first to be affected. Aquatic nuisance species can ultimately negatively affect higher trophic levels in the food chain, by preying on lower level

Loomis Lake Report May, 2013 species or by outcompeting them for food or habitat.



The connecting streams and/or water bodies downstream in both directions from Loomis Lake are as follows:

From Loomis Lake to Great Lakes: Damon Run ► Salt Creek ► East Arm Little Calumet River ► Little Calumet River ► Lake Michigan.

From Loomis Lake to Mississippi River: Flint Lake ► Crooked Creek ► Heinold Ditch ► Kankakee River ► Illinois River ► Mississippi River.

The Preliminary Risk Characterization included a compilation of the known potential obstacles to ANS movement via streams connected to the pathway at Loomis Lake (Table 7). From left to right, the table summarizes the impediments along the connecting streams from Lake Michigan up to the basin divide and down to the Mississippi River, then back up the connecting streams from the Mississippi River to the Basin Divide and back to Lake Michigan. In addition to the probable barriers listed below, the outlet structures for both Flint Lake and Loomis Lake likely serve as a barrier to the spread of ANS. Both Flint Lake and Loomis Lake drain into their receiving streams through culverts, or similar structures, through which it would be difficult for ANS to spread.

Table 7: Obstacles in	n connecting streams	to ANS movement (N	IID, 2010; USACE, 20 ⁻	10).
	Dispersal Difficulty from Great Lakes to Location	Dispersal Difficulty from Location to Mississippi or Ohio River	Dispersal Difficulty from Mississippi or Ohio River to Location	Dispersal Difficulty from Location to Great Lake s
Loomis Lake	Partially obstructed. NID show no dams, but completion of water column into Lake Loomis appears unlikely.	Minimally obstructed by 2 multi-purpose dams on Kankakee River and 7 locks and dams on the Illinois River w/max dam height of 30 feet.	Partially obstructed by 2 multi-purpose dams on Kankakee River and 7 locks and dams on the Illinois River w/max dam height of 30 feet.	Unobstructed. NID show no dams, but completion of water column out of Lake Loomis is likely very rare.

4 Aquatic Pathway Viabil ity for ANS of Concern

The likelihood that a viable aquatic pathway exists at Loomis Lake, Indiana that would allow transfer of aquatic nuisance species (ANS) between the Great Lakes and Mississippi Rivers Basins was evaluated in accordance with the procedures outlined in the Methodology Section of this report. This potential was characterized as high, medium or low for the following categories:

- Probability that pathway exists (Section 3)
- Probability of the target ANS occurring within either basin
- Probability target ANS survive transit to reach aquatic pathway
- Probability of ANS establishment in proximity to the aquatic pathway
- Probability of ANS spreading across aquatic pathway into new basin

The criteria for designating probabilities of high, medium or low are provided under each category. In addition, a certainty rating is also assigned with each probability assessment. Certainty ratings associated with any given probability ratings include:

- Very Certain (As certain as we will get with this effort)
- Reasonably Certain

- Moderately Certain (More certain than not)
- · Reasonably Uncertain
- Very Uncertain (An educated guess)
- A team rating is provided based on the professional collaboration of the interagency team of biologists

A team probability and certainty rating is provided for each species for each category, as appropriate, and the rating represents the most conservative probability assessment for each category considered. Just as important as the subjective estimates of probability are the remarks that summarize the key data that supports the estimates, which were made by an interagency team of biologists for each ANS of concern to the Loomis Lake location. The completed forms, which include the probability and certainty ratings and the remarks from all agency professionals participating in this assessment, are included in Appendix A.

4.1 Probability of the ANS being within either basin

General Considerations for Assigning Probability Ratings:

High - Target ANS exists on connected waterways in close enough proximity to be capable of moving to the aquatic pathway within 20 years.

Medium - Target ANS exists on connected

waterways, but based on current proximity and mobility, is considered incapable of moving to the aquatic pathway within 20 years.

Low - Target ANS is not known to exist on a connected waterway.

Certainty ratings were applied as outlined above.

Asian Carp

Silver carp and bighead carp are established throughout the middle and lower Mississippi River Basin. Both silver carp and bighead carp have been recorded in significant numbers in the Illinois River. In the spring of 2011, an adult bighead carp was taken from the Kankakee River near Channahon, Illinois (CBS Chicago, 2011). Black carp may be established in portions of the lower Mississippi River Basin. The known distribution of black carp is not as extensive as that of the silver and bighead carp.

Team Rating: **High** Certainty rating: Very Certain

Northern Snakehead

The northern snakehead was found in 2008 in Arkansas, and has since established a reproducing population in the area. This population is within the Mississippi River Basin and represents a population that could spread throughout the basin. Although in a different basin, this species is also established in the Potomac River in Maryland and Virginia (USGS, 2011). While this species is within the Mississippi River watershed, its population does not seem to be spreading at a high rate at this time and it is unlikely that it would reach the Loomis Lake divide location within the next 20 years without the assistance of some non-aquatic vector.

Team Rating: **Medium** Certainty rating: Very Certain

Parasitic Copepod

The parasitic copepod has a life cycle in which the female adopts a parasitic phase on several fish species, including members of the minnow, sunfish, and catfish

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families, and potentially other fish species. The common carp (Cyprinus carpio) is a frequent host of this parasite (Hudson and Bowen, 2002). The females can detach and re-attach to host species. The invasive copepod has been detected in Lake Huron and Lake Erie, and is likely found throughout the Great Lakes. The common carp is established in Lake Michigan as well as the rivers and streams leading to Loomis Lake from Lake Michigan. While other host fish species are known to exist in the pathway system, the common carp was selected as the most likely host species because of the life cycle capabilities of the common carp and the likelihood it would use, and survive within, the pathway habitats. The parasitic copepod and a necessary host species are in the Great Lakes Basin. The males are free living but do not have the capability of dispersal upstream. The parasitic copepod is small and relatively easy to miss in field surveys, even by trained biologists. Therefore, the parasitic copepod may be much more prevalent than the distribution maps depict.

Team Rating: **Medium** Certainty rating: Reasonably Certain

Viral Hemorrhagic Septicemia Virus

Viral hemorrhagic septicemia virus can infect a wide range of host fish species causing a variety of external and internal pathology, including death of the host fish. Variables such as the species of host fish and water temperature can impact the pathology of the virus. Seemingly healthy individuals that have been previously infected with VHSv can have chronic infections and be carriers of the disease (Skall et al., 2005). This virus has been reported from throughout the Great Lakes Basin (USGS, 2011).

Viral hemorrhagic septicemia has been found in many species of fish including common carp. The common carp is established in Lake Michigan, as well as the rivers and streams leading to Loomis Lake from Lake Michigan. While other host fish species are known to exist in the pathway system, the common carp was selected as the most likely host species because of the life cycle capabilities of the common carp and the likelihood the common carp would use and survive in the pathway habitats. Viral hemorrhagic septicemia and a necessary host species are both within the Great Lakes Basin. It should also be noted that VHSv has been found in 28 different host fish species in the Great Lakes Basin and that it can survive without a host in the water column (WDNR, 2012).

Team Rating: **High** Certainty rating: Very Certain

Ruffe and Tubenose Goby

The ruffe and tubenose goby are located within the Great Lakes and are associated with river mouths and estuaries of large river systems entering the Great Lakes. The ruffe exists in northern Lake Michigan in Green Bay, but is not widespread and there are no high density populations in Lake Michigan (Bowen and Goehle, 2011). The ruffe prefers deep waters of lakes and pools of rivers, usually over sand and gravels but has a tolerance for different habitats and environmental conditions (Gray and Best, 1989). The ruffe has a high reproductive rate and spawns in clean water. Females produce up to 200,000 eggs in the first batch, and up to 6,000 eggs per subsequent batch (Global Invasive Species Database, 2012). The ruffe is an aggressive species that possesses the ability to feed in darkness, cold temperatures and turbid conditions. The ruffe has extended its range rapidly and modeling predicts it will find suitable habitat in all five Great Lakes (USGS, 2012). Literature reviews and actual fish survey data have not documented the collection of the ruffe in smaller upstream tributaries. The tubenose goby's introduced range includes Lake St. Clair, Erie, Huron, Superior, and Ontario and is a benthic species that consumes a wide variety of invertebrates (USGS, 2011). They are found in the open waters and estuaries of slow flowing rivers and are often guite abundant in backwaters and lakes and seem to prefer dense vegetation. It has been collected in the lower reaches of larger Great Lakes rivers and estuaries, but no tubenose goby have been collected locally in upper Great Lakes river tributaries to date. Tubenose gobies have exhibited a much slower rate of expansion in the Great Lakes than the round goby (Neogobius melanostomus), also an invasive species in the Great Lakes and now located within both the Great Lakes Basin and the Mississippi River Basin. The tubenose goby's nearest locations are in Lake Superior and Lake Huron (USGS, 2011).

Team Rating: **High** Certainty rating: Very Certain

Threespine Stickleback

The threespine stickleback is found in each of the Great Lakes (Lake Ontario HUC 8 records are within native range) and has been collected in some inland river systems (USGS, 2011). This species prefers to live in smaller streams but may occur in a variety of habitat including lakes and large rivers. The threespine stickleback was first encountered in lower Green Bay about 25 years ago, but has never been seen upstream from this area. Great Lakes populations of this species tend to be potamodromous (truly migratory but within fresh water only) and only enter the lower reaches of streams briefly during spring spawning.

Team Rating: High

Certainty rating: Very Certain

4.2 Probabil ity ANS surviving transit to aquatic pathway

4.2.1 Probabil ity of ANS Surviving Transit to Aquatic Pathway through Connecting Streams.

High - Target ANS are established in relatively close proximity to location and have ample opportunity, capability and motivation to successfully navigate through the connecting streams to arrive at the subject pathway within 10 to 20 years.

Medium - Target ANS are established at locations in close enough proximity to location and have limited capability to survive passage through the connecting streams to arrive at the subject pathway within 20 to 50 years.

Low - Target ANS are not in proximity to the

pathway, and/or it is highly unlikely that they could survive transit from current locations through the connectin streams to arrive at the subject pathway within next 50 years.

Asian Carp

While silver and bighead carp are highly opportunistic on their diet, bighead carp are primarily zooplanktivorous, whereas silver carp primarily consume smaller phytoplankton and fine particulate organic matter (Dong and Li, 1994; Jirasek et al., 1981; Williamson and Garvey, 2005). Adult black carp are primarily molluscivores. However, they will opportunistically consume a wide variety of food items (USFWS, 2002). Juvenile black carp have a diet more similar to silver and bighead carp, consisting primarily of zooplankton (USACE, 2011b). The diet of juvenile black carp may allow them to survive in areas unsuitable for adults. The habitat of black carp is very similar to the grass carp (Ctenopharyngodon idella) (Nico et al., 2005). It is believed that black carp should be able to colonize the same areas of the United States where the grass carp have established (USFWS, 2002).

However, the exact dispersal capability of these species remains unknown. Juvenile, sexually immature Asian carp have been observed in the upmost reaches of small tributaries to large rivers attempting to pass over barriers, such as dams, to continue their upstream movement (D. Chapman, personal communication, September 12, 2011; N. Caswell, U.S. Fish and Wildlife Service, September 12, 2011). The gradient needed to prevent juvenile fish from moving upstream is unknown. It is important to note that young Asian carp tend to move laterally away from the river in which they were spawned and not back upstream (D. Chapman, personal communication, September 12, 2011). It has also been observed that Asian carp, as small as advanced fingerlings, have traveled up to 37 miles (60 km) though tributaries of the lower Missouri River. These tributaries were located laterally to the Missouri river segment in which these fish hatched (D. Chapman-USGS, personal communication, September 12, 2011). Adult, sexually mature Asian carp have occasionally been found in very small streams, which appear scarcely large enough to support the fishes at low water (D. Chapman, personal communication, September 12, 2011). The age of these

Loomis Lake Report May, 2013 fish when they arrived at these locations is unknown. While ongoing research by Indiana Department of Natural Resources and Purdue University may suggest that tagged Asian carp have no interest in ascending some of the smaller rivers, more long term studies are needed, and even these may not help explain the seemingly random movements of juveniles that have been witnessed in Midwestern rivers and their tributaries (Coulter and Goforth, 2012; D. Chapman, personal communication, September 12, 2011).

If Asian carp were able to arrive close to Flint Lake, the hydrologic connection at Loomis Lake is only from the Great Lakes Basin toward the Mississippi River Basin. Due to the obstructions of the Flint and Loomis Lake control structures, even the strongest swimmers could not spread into either lake on their own. There are also several in-stream dispersal obstructions within the Mississippi River Basin that provide a range of potential ANS dispersal obstructions. Therefore, there is a low probability that Asian carp would be able to find their way into Flint Lake or Loomis Lake solely through the aquatic pathway.

Team Rating: **Low** Certainty rating: Very Certain

Northern Snakehead

The northern snakehead utilizes specialized structures (suprabranchial organ and a bifurcate ventral aorta) that permits aquatic and aerial respiration (Ishimatsu and Itazaw 1981, Graham 1997). This species thrives in stagnant, oxygen depleted back-waters and marshes (Courtenay, Jr. and Williams, 2004). The northern snakehead's preferred habitat is not flowing water, which may slow its spread up the Mississippi River and larger streams leading to the tributaries and eventually to Loomis Lake. Despite this information, the northern snakehead has been consistently caught by anglers in the Potomac River near Great Falls Virginia during spring high flow events (J. Newhard-USFWS, personal communication, December 22, 2011). Based on data from external tags recaptured by anglers, in rare instances northern snakehead have been found to move as far as 50 river miles (80 km) upstream at a rate of approximately one mile (1.5 km) per day. This extensive movement typically occurs in the spring with the fish returning back downstream to slower moving water in the summer (J. Newhard-USFWS, personal communication, December 22, 2011). If the Arkansas population does begin to expand into and up the Mississippi River, the locks and dams within the Mississippi River Basin and the control structures in Flint and Loomis Lakes would prevent even the strongest swimmers from reaching the pathway. Therefore, there is a low probability that northern snakehead would be able to find their way into the pathway from the Mississippi River Basin.

Team Rating: **Low** Certainty rating: Very Certain

Parasitic Copepod

The parasitic copepod has been found on the common carp, and the common carp was therefore used as the surrogate species potential host for the parasitic copepod for the evaluation of the likelihood of the copepod to reach the Mississippi River Basin through the Loomis Lake aquatic pathway. During spring run-off events typically in April and May, common carp move into the shallow waters of bays and river systems to spawn. Within the rivers, common carp move upstream to spawn in suitable habitat such as marshes and even drainage ditches with as little as a one foot or less of water depth. Common carp are strong swimmers and though they cannot jump like members of the salmon family, they can move upstream during moderate flow events. The only obstruction for a potential host fish to reach Loomis Lake is the Proffitts Dam at the head of Damon Run. As there is an approximate 17-foot (5.2 m) elevation difference between the bed of Damon Run and the top of the dam, back flooding and subsequent overtopping of the dam into Loomis Lake would be highly unlikely. Accordingly, a rating of low was assigned.

Team Rating: **Low** Certainty rating: Very Certain

Viral Hemorrhagic Septicemia Virus

In addition to the parasitic copepod, common carp is also a potential host for viral hemorrhagic septicemia (USGS, 2011). The common carp was therefore used as a surrogate potential host to estimate the probability of VHSv moving from its current location in the Great Lakes Basin to the Loomis Lake aquatic pathway. During spring run-off events in April and May, common carp move into the shallow waters of bays and river systems to spawn. Within the rivers, common carp move upstream to spawn in suitable habitat such as marshes and even drainage ditches with as little as one foot or less of water depth. Common carp are strong swimmers and though they cannot jump like members of the salmon family, they can move upstream during moderate flow events. The only obstruction for a potential host fish to reach Loomis Lake is the Proffitts Dam at the head of Damon Run. As there is an approximate 17-foot (5.2 m) elevation difference between the bed of Damon Run and the top of the dam, back flooding and subsequent overtopping of the dam into Loomis Lake would be highly unlikely. Accordingly, a rating of low was assigned.

Team Rating: **Low** Certainty rating: Very Certain

Ruffe and Tubenose Goby

The ruffe prefers deep waters of lakes and pools of rivers, usually over sand and gravel, but has a tolerance for different habitats and environmental conditions (Gray and Best, 1989). Ballast water transport has been the key means for the spread of ruffe in the Great Lakes (USFWS, 1996). The ruffe has a high fecundity rate and spawns in clean water. Natural rates of dispersion are not well known and ruffe have not spread beyond Green Bay in the nine years since its detection in that area, and populations have been trending down (Bowen and Goehle, 2011). The ruffe's ability to swim upstream during high flow events and move over dams is questionable, especially since it prefers still or slow moving water (Fishbase, 2011). The tubenose is found in the open waters and estuaries of slow flowing rivers. The tubenose goby appears to be more capable of living in more diverse types of riverine habitat than the ruffe (Dopazo et al., 2008; Jude and DeBoe, 1996). Sufficient forage ranging from zooplankton to fish may be available throughout the Great Lakes side of the connection. However, suitable habitat for the ruffe and tubenose goby in Salt Creek may be limited or even nonexistent.

The only obstruction for either of these species to reach Loomis Lake is the Proffitts Dam at the head of Damon Run. As there is an approximate 17-foot (5.2 m) elevation difference between the bed of Damon Run and the top of the dam, back flooding and subsequent overtopping of the dam into Loomis Lake would be highly unlikely. Accordingly, a rating of low was assigned.

Team Rating: **Low** Certainty rating: Very Certain

Threespine Stickleback

The only obstruction for this species to reach Loomis Lake is the Proffitts Dam at the head of Damon Run. As there is an approximate 17-foot (5.2 m) elevation difference between the bed of Damon Run and the top of the dam, back flooding and subsequent overtopping of the dam into Loomis Lake would be highly unlikely. Accordingly, a rating of low was assigned.

Team Rating: **Low** Certainty rating: Very Certain

4.2.2 Probabil ity of ANS Surviving Transit to Aquatic Pathway through Other Means

This section does not influence the overall pathway rating outlined in this report and is only included to point out other potential pathways (e.g., anthropogenic) that may be important to different audiences. Any further analysis of non-aquatic pathways outside of this study should develop a separate list of ANS that will likely differ from those which may exploit the aquatic pathway.

General considerations for assigning probability ratings:

High - Target ANS are established in relatively close proximity to location and have ample opportunity, capability and motivation to successfully navigate through a non-aquatic pathway to arrive at the subject pathway within 10 to 20 years.

Medium - Target ANS are established at locations in close enough proximity to the location and have limited capability to survive passage

through a non-aquatic pathway to arrive at the subject pathway within 20 to 50 years.

Low - Target ANS are not in proximity to the pathway, and/or it is highly unlikely that they could survive transit from current locations through a non-aquatic pathway to arrive at the subject pathway within next 50 years.

Asian Carp, Northern Snakehead, Parasitic Copepod, VHSv, Threespine Stickleback, and Ruffe/ Tubenose Goby

It is likely that most of the ANS of concern could become established in, and spread from Loomis Lake if they were introduced from sources such as aquaculture operations or exotic pet trade, bait bucket transfer, bilge releases, contaminated tackle, wading birds, and other natural and anthropogenic vectors. Loomis and Flint Lakes provide a variety of habitat types that are suitable for most of the ANS considered in this evaluation. One reason most invasive species are successful is the fact that they are able to survive and reproduce in a wide range of environmental conditions. The motivation for anthropogenic introductions range from accidental to intentional and malicious. Public education regarding the detrimental impacts of ANS and how to prevent their spread are likely the best tools to prevent anthropogenic transfer from occurring. Because of the recreational use of the Valparaiso Lakes, including Loomis and Flint Lakes, there is some residual probability associated with the interbasin transfer of ANS due to it their location along the basin divide.

Team Rating: **Medium** Certainty rating: Reasonably Certain



General Considerations for Assigning Probability Ratings:

High - Sources of food and habitat suitable

to the ANS are plentiful in close proximity to support all life stages from birth to adult, abiotic conditions align with native range, and there are no known predators or conditions that would significantly impede survivability or reproduction.

Medium - Limited and disconnected areas and sources of food and habitat suitable to the ANS are available in proximity, abiotic conditions are within latitude limits of native range, but only a portion of the healthy individuals arriving at location can be expected to effectively compete and survive.

Low - Habitat and abiotic conditions in proximity are outside the range where the target ANS has been known to survive; there is very limited availability habitat area suitable for ANS cover, sustainable food supply and reproduction; or native predators or competition with native species would likely prevent establishment of a sustainable population.

Team Rating: Species-specific ratings for this section were not completed because the ratings for the likelihood that any of the ANS of concern for Loomis Lake would be able to survive transit from their current locations in either basin to the pathway were all low.

4.4 Probabil ity of ANS Spreading Across Aquatic Pathway into the New Basin

General Considerations for Assigning Probability Ratings:

High - Sources of food and habitat suitable to the ANS are available, and the species has demonstrated capabilities to significantly expand range from locations where initially introduced.

Medium - There are limited sources of food and suitable habitat, and/or the species has

demonstrated limited ability to spread significant distances beyond areas where it has been introduced.

Low - There are severely limited sources of food and suitable habitat, and/or the species has demonstrated very limited ability to spread beyond areas where it has been introduced.

Team Rating: Species-specific ratings for this section were not completed because the ratings for the likelihood that any of the ANS of concern for Loomis Lake would be able to survive transit from their current locations in either basin to the pathway were all low.

5 Overal I Aquatic Pathway Viability

As discussed in Sections 2.4 and 2.5, the determination of the likelihood of a viable aquatic pathway occurring at the Loomis Lake location for each ANS of concern is the product of five probability elements (Equation 5). Thus, the probability of a viable pathway for a particular ANS of concern is equal to the lowest rating determined for each of the five probability elements (Table 8 and Table 9). The overall pathway viability for transferring ANS of concern from the Mississippi River Basin to the Great Lakes Basin was equal to the highest probability of a viable pathway for each ANS of concern in Table 8. At the Loomis location, all four species were rated "low"

			Form 1	Form 2	Form 3a	Form 4	Form 5 (P _{2c})	D
			(P ₀)	(P ₁)	(P _{2a})	(P _{2b})		P _{Viable} pathway
Group	Common Name	Mode of Dispersal	Pathway Exists? (Sect. 3.6)	ANS Occurring Within Either Basin? (Sect. 4.2.1)	ANS Surviv- ing Transit to Pathway? (Sect. 4.2.1)	ANS Establishing in Proximity to Pathway? (Sect. 4.3)	ANS Spread- ing Across Aquatic Pathway into New Basin? (Sect. 4.4)	Aquatic Pathway Viability Rating
	Asian Carp							
fish	silver carp, bighead carp, black carp	swimmer	L (VC)	L (VC)	L (VC)	NN ¹	NN	L
fish	northern snakehead	swimmer		M (VC)	L (VC)	NN	NN	L

			· · · · · · · · · · · · · · · · · · ·		all pathway v ement are in	· · · · · · · · · · · · · · · · · · ·		s Basin to
			Form 1 (P ₀)	Form 2 (P ₁)	Form 3a (P _{2a})	Form 4 (P _{2b})	Form 5 (P _{2c})	P _{Viable pathway}
Group	Common Name	Mode of Dispersal	Pathway Exists? (Sect. 3.6)	ANS Occur- ring Within Either Basin? (Sect. 4.1)	ANS Surviv- ing Transit to Pathway? (Sect. 4.2.1)	ANS Establishing in Proximity to Pathway? (Sect. 4.3)	ANS Spread- ing Across Aquatic Pathway into New Basin? (Sect. 4.4)	Aquatic Pathway Viability Rating
fish	threespine stickleback	swimmer		H (VC)	L (VC)	NN	NN	L
	Benthic fish							
fish	ruffe and tubenose goby	swimmer	M (RC)	H (VC)	L (VC)	NN	NN	L
copepod	parasitic copepod	parasite	M (RC)	M (RC)	L (VC)	NN	NN	L
virus	VHSv	fish pathogen/ water column		H (VC)	L (VC)	NN	NN	L
	Overall Pa	athway Viabil	ity for Spread	of ANS from Gr	eat Lakes Basi	n to Mississipp	i River Basin:	L

and thus the overall pathway viability for transferring species from the Mississippi River Basin to the Great Lakes Basin is "low". The overall pathway viability for transferring species from the Great Lakes Basin is calculated the same way and is shown in Table 9. At the Loomis Lake location, the overall pathway viability for transferring species from the Great Lakes Basin to the Mississippi River Basin is "low". The last calculation is to determine the overall pathway viability for interbasin spread of ANS which is calculated by taking the highest of the overall ANS ratings for unidirectional transfer which were calculated in Tables 8 and 9. Thus, the overall probability that a viable aquatic pathway exists at the Loomis Lake Pathway is "low"

6 Conclusions

The overall viability of the Loomis Lake aquatic pathway to facilitate the interbasin spread of ANS was determined to be low by an interagency team because no species was found capable of being able to reach Loomis Lake solely through the aquatic pathway. However, should an ANS be introduced into Loomis Lake or Spectacle Lake, it would likely then be able to spread into the Mississippi River Basin through the primary spillway from Loomis Lake into Flint Lake. Once in Loomis Lake, it may also be possible for ANS to then spread into the Great Lakes Basin through the auxiliary spillway (Proffits Dam) to the headwaters of Damon Run, but only during more significant flooding events when the spillway might be used. One way ANS could be introduced to either Spectacle Lake or Loomis Lake is through the release of live bait, which may inadvertently contain ANS. Another is by ANS attachment to recreational boats and other portable marine equipment while in one basin, which are then transported over land and placed into either lake. Direct human release of imported aquaria fish or other exotic species into Loomis or Spectacle Lakes could also likely result in the spread of ANS into the Mississippi River Basin and perhaps the Great Lakes Basin. So while the viability of the aquatic pathway at Loomis Lake to facilitate the interbasin spread of ANS is low, it is at a unique geographic location where development and implementation of some site specific measures may be appropriate.

6.1 Loomis Lake Opportunity Statements

While it is not the purpose of this assessment to produce and evaluate an exhaustive list of potential actions to prevent ANS transfer at this location, some opportunities were still identified that, if implemented, could prevent or reduce the probability of ANS spreading between the basins at the Loomis Lake site. The opportunities listed below are not necessarily specific to the Loomis Lake location and they are also not specific to the USACE authorities, but incorporate a wide range of possible applicable authorities, capabilities, and jurisdictions at the Federal, State, and local levels and include some more regional opportunities:

- Prevent introductions of additional ANS by exploring legislative prevention measures, and for prohibiting the establishment of drainage ways that would connect the Mississippi River tributaries with Great Lakes tributaries.
- There are broad categories of technology for potential active measures to prevent ANS transfer at this locations, such as:
 - Chemical deterrents in order to reduce habitat suitability at or near the pathway
 - Biological control measures that prevent ANS reproduction or prevent the ability of ANS to establish a sustainable population in the vicinity
 - Physical removal of ANS at their current locations
 - Increase commercial and recreational harvest, specifically of bighead and silver carp
- Public education to:
 - Prevent bait bucket transfers of ANS

- Prevent transfer via boating and recreational equipment
- Prevent transfer due to religious or cultural ceremonies
- Improve identification and reporting of ANS to the appropriate authorities
- Support research on the biology of ANS so transfer potential can be better understood:
 - · Life history
 - Habitat requirements and tolerances
 - · History of invasiveness
- Take ANS transfer potential into account for proposed water resource projects (e.g., ecosystem restoration, dam removal, stream restoration, water management).
- Improve and increase field sampling and monitoring for the presence of ANS to support better informed water resource management decisions within the state and region:
 - Develop integrated ANS sampling and analysis plan utilizing eDNA and conventional biological sampling events at times when ANS would be expected to be present in an area, such as during flood events
 - Target, encourage, and train recreational fishermen, boaters and other direct users of the surface waters of the state of Indiana to identify, report, collect, and deliver ANS to the appropriate agencies
- Prevent introductions of additional ANS by exploring prevention measures:
 - · Improve or new regulations for bilge releases
 - Improve or new regulations on the pet industry

- Improve or new regulations on the live bait industry
- Improve or new regulations on the aquaculture industry

None of the opportunities identified above are exclusive of the others. In fact, any single measure to prevent ANS transfer through the Loomis Lake location would likely benefit from corresponding development and implementation of one or more of the other types of opportunities identified. The results of this assessment may also aid in the implementation of, and future updates to, the Indiana Aquatic Nuisance Species (ANS) Management Plan.

7 References:

ANSTF. (1996). Aquatic Nuisance Species Task Force. Generic Nonindigineous Aquatic Organisms Risk Analysis Review Process for Estimating Risk Associated with the Introduction of Nonindigineous Aquatic Organisms and How to Manage for that Risk. Report to the Aquatic Nuisance Species Task Force. Risk Assessment and Management Committee, Aquatic Nuissance Species Task Force.

Bentley Systems Incorporated. (2012). CulvertMaster® (v.3.1) (computer software). Exton: Pennsylvania.

- Bowen, A.K. and M.A. Goehle. (2011). Surveillance for ruffe in the Great Lakes, 2011. http://www.fws.gov/ midwest/alpena/documents/2011-GL-Ruffe-Report.pdf
- CBS Chicago. (2011). Fifty Pound Asian Carp Caught Near Joliet Considered Moderate in Size. Retrieved from http://chicago.cbslocal.com/2011/04/15/50-pound-asian-carp-caught-near-joliet-considered-moderate-insize/
- Chicago Historical Society. (2005). Electronic Encyclopedia of Chicago. Retrieved from http://www.encyclopedia. chicagohistory.org/pages/300076.html
- Coulter, A. and R.R. Goforth. (2012). An assessment of silver and bighead carp (*Hypopthalmichthys spp.*) movements and spawning activities in the Wabash River Watershed, Indiana Phase I Annual Report. Department of Forestry and Natural Resources, Purdue University, Indiana.
- Courtenay, W.R. and J.D. Williams. (2004). Snakeheads (*Pisces, Channidae*)— A Biological Synopsis and Risk Assessment. USGS Circular 1251.
- Dong, S., and D. Li. (1994). Comparative studies of the feeding selectivity of silver carp, *Hypophthalmichthys molitrix*, and bighead carp, *Aristichthys nobilis*. Journal of Fish Biology 44:621-626.
- Dopazo, S.N., L.D. Corkum, and N.E. Mandrak. (2008). Fish Assemblages and Environmental variables associated with Gobiids in Nearshore Areas of the Lower Great Lakes. Journal of Great Lakes Research, 34(3): 450-460.
- Fishbase. (2011). Froese, R. and D. Pauly. (2012). Editors. World Wide Web electronic publication: www.fishbase.org.
- Frankenberger, J.R. and N. Carroll. (2011). Water Resources of Porter County, Indiana. Retrieved from https://engineering.purdue.edu/SafeWater/watershed/porter.pdf
- Global Invasive Species Database. Accessed May 24, 2012: http://www.issg.org/database/species/ecology.asp?si =544&fr=1&sts=sss&lang=EN.
- Graham, J.B. (1997). Air-breathing fishes: evolution, diversity, and adaptation. Academic Press. San Diego, California. xi +. 299 pp.
- Gray, J.A.B., and A.C.G. Best. (1989). Patterns of excitation of the lateral line of the ruffe. Journal of the Marine Biological Association of the United Kingdom 69:289-306.

- Great Lakes Commission. (2011). Retrieved from http://www.great-lakes.net/envt/flora-fauna/invasive/pdf/vhs_glc_factsheet_2011.pdf
- Harper, D. and G. Olyphant. (2010). Monitoring and Forecasting Outfalls of Streamflow Contaminated by *E. Coli* at Burns Ditch, Lake Michigan, Indiana. Indiana Geological Survey (IGS). Retrieved from http://igs. indiana.edu/WatershedHydrology/BurnsDitch.cfm?sublogo=CGDA.shoreline.http://igs.indiana.edu/WatershedHydrology/BurnsDitch.cfm?sublogo=CGDA
- Hudson, P.L. and C.A. Bowen II. (2002). First record of *Neoergasilus japonicus* (*Poecilostomatoida: Ergasilidae*), a parasitic copepod new to the Laurentian Great Lakes. Journal of Parasitology 88(4):657-663.
- IDEM. (2011). Indiana Department of Environmental Management. Total Maximum Daily Loads. Retrieved from http://www.in.gov/idem/nps/2853.htm
- IDEM. (2012). Indiana Department of Environmental Management. Total Maximum Daily Load for *Escherichia coli* (*E. coli*) and Impaired Biotic Communities (IBC) in the Salt Creek Watershed in Porter County. Office of Water Quality Total Maximum Daily Load Program.
- INDNR. (2006). Indiana Department of Natural Resources. Salt Creek Watershed Management Plan (DRAFT)
- INDNR. (2011). Indiana Department of Natural Resources. Salt Creek Watershed Fact Sheet. Retrieved from http://www.in.gov/dnr/lakemich/files/Im-Satl_Creek.pdf
- INDNR. (2012). Indiana Department of Natural Resources. Stocking Schedule. Retrieved from http://www.in.gov/ dnr/fishwild/3626.htm
- Ishimatsu, A. and Y. Itazaw. (1981). Ventilation of the air-breathing organ in the snakehead *Channa argus*. Japanese Journal of Ichthyology 28(3): 276–282.
- JFNew. (2006). Valparaiso Lakes Watershed Management Plan. Walkerton, IN.
- Jirasek, J., A. Hampl and D. Sirotek. (1981). Growth morphology of the filtering apparatus of silver carp (*Hypophthalmichthys molitrix*). Gross anatomy state. Aquaculture 26:41-48.
- Jude, D.J. and S.F. DeBoe. (1996). Possible impact of gobies and other introduced species on habitat restoration efforts. Canadian Journal Fisheries and Aquatic Sciences. 53:136-141.
- Minarich, R., M. Zhou and D. McGuire. (2011). Valparaiso Lakes Area Conservancy District. Personal Communication. June 20, 2011.
- Minarich, R. (2011). Valparaiso Lakes Area Conservancy District. Personal Communucation. August 3-4, 2011.
- Nico, L.G., J.D. Williams and H.L. Jelks. (2005). Black Carp: biological synopsis and risk assessment of an introduced fish. American Fisheries Society, Special Publication 32. Bethesda, Maryland.
- NID. (2010). U.S. Army Corps of Engineers, 2010 National Inventory of Dams: http://nid.usace.army.mil.

- NOAA. (2011). National Oceanic and Atmospheric Administration. Great Lakes Nonindiginous Aquatic Species Information System (GLANSIS). Retrieved from http://www.glerl.noaa.gov/res/Programs/glansis/watchlist. html.
- PTGR, Inc. (1991). Feasibility Study on Water Quality and Sedimentation in Flint Lake, Porter County, Indiana. Produced for Valparaiso Lakes Area Conservancy District.
- Pollock, M.M., M. Heim and D. Werner. (2003). Hydrologic and Geomorphic Effects of Beaver Dams and Their Influence on Fishes. American Fisheries Society Symposium 37.
- Robertson, R.N. (1972). Kankakee River Basin Stream Survey Report. Indiana Division of Fish and Wildlife. Indianapolis, Indiana.
- Save the Dunes Conservation Fund. (2008). Salt Creek Water Management Plan Porter County, Indiana. Retrieved from http://www.savedunes.org/water_program/salt_creek/SCWMP.pdf
- Skall, H.F, N.J. Oleson and S. Mellergaard. (2005). Viral hemorrhagic septicemia virus in marine fish and its implications for fish farming a review. Journal of Fish Diseases 28:509-529.
- USACE. (2010). United States Army Corps of Engineers. Great Lakes and Mississippi River Interbasin Study Other Pathways Preliminary Risk Characterization. Great Lakes and Ohio River Division. November 9, 2010. United States Army Corps of Engineers.
- USACE. (2011a). United States Army Corps of Engineers. GLMRIS Focus Area 2 Study Plan. Great Lakes and Ohio River Division. United States Army Corps of Engineers.
- USACE. (2011b). United States Army Corps of Engineers. Non-Native Species of Concern and Dispersal Risk for the Great Lakes and Mississippi River Interbasin Study.
- USEPA. (2012). United States Environmental Protection Agency. USEPA Watershed Assessment, Tracking & Environmental Results for Indiana, Little Calumet-Galien Watershed. Retrieved from http://iaspub.epa.gov/tmdl_waters10/attains_watershed.control?p_huc=04040001&p_state=IN&p_cycle=&p_report_type=T
- USFWS. (1996). Ruffe control plan. Submitted to the Aquatic Nuisance Species Task Force by the Ruffe Control Committee. Available at: http://www.fws.gov/midwest/ashland/ruf_cont.html
- USFWS. (2002). Black Carp Invasive Species Program Fact sheet. United States Fish and Wildlife Service. Retrieved from: http://www.fws.gov/southeast/hotissues/Black_Carp_FS.pdf
- USGS. (2003). United States Geological Survey. U.S. Geological Survey Water Resources Data, Indiana. Water Year 2002. Retrieved from (http://pubs.usgs.gov/wdr/wdr-in-02/pg474-518.pdf).
- USGS. (2011). United States Geological Survey. Nonindigenous Aquatic Species (NAS) website. Retrieved from http://nas.er.usgs.gov.
- USGS. (2012). Nonindigenous Aquatic Species (NAS) website, ruffe. http://nas.er.usgs.gov/queries/factsheet. aspx?SpeciesID=7 Accessed 13 June 2012.

- WDNR. (2012). VHS 101 Fact Sheet. Wisconsin Department of Natural Resources. Website accessed April 10, 2012: http://dnr.wi.gov/fish/vhs/vhsfacts.html#3a
- WRDA. (2007). Water Resources Development Act of 2007 [Section 3061(d): P.L. 110-114; amends Section 345: P.L. 108-335; 118 Stat. 1352].
- Whitaker, J.O. (1999). Mammals of the Grand Calumet River Region. Proceedings of the Indiana Academy of Science: 122–143.
- Williamson, C.J. and J.E. Garvey. (2005). Growth, fecundity, and diets of newly established silver carp in the middle Mississippi River. Transactions of the American Fisheries Society, 134: 1423–1430.

Appendix A

Evaluation Forms for each ANS of Concern Selected for Loomis Lake

1. Probability of aquatic pathway existence Aquatic Pathway Team P Aguatic Pathway Team USAC USAC USAC 1. How do you rate the likelihood of the existence of a location where untreated surface water flow across the storm up to the 1% annual return frequency storm.	atic pathwa	ay existence				
Aquatic Pathway 1. How do you rate the lik location where untreated is storm up to the 1% annual	_					
 How do you rate the like location where untreated is storm up to the 1% annual 	Team	Expertise Position title or team role	Rating Flow into GLB	Certainty	Rating Flow into MRB	Certainty
 How do you rate the like location where untreated: storm up to the 1% annual 		USACE, Detroit - Hydraulic Engineer	Medium	RC	Low	RC
 How do you rate the like location where untreated: storm up to the 1% annual 		USACE, Louisville - Hydraulic Engineer	Low	VC	Low	RC
 How do you rate the like location where untreated s storm up to the 1% annual 	_	USGS - Hydrologist	Low	RC	Low	RC
 How do you rate the like location where untreated s storm up to the 1% annual 	_	Indiana DNR - Engineering Geologist	Medium	RC	Low	VC
 How do you rate the like location where untreated s storm up to the 1% annual 		Team Ratings	Medium	RC	Low	VC
storm up to the 1% annual	elihood of the	1. How do you rate the likelihood of the existence of a viable aquatic pathway at the subject location? Assume a viable aquatic pathway is any	location? Assu	ime a viable a	iquatic pathw:	ay is any
	surrace water return freque	now across the divide is deented likely to occur and c ency storm.		ater streams		
Qualitative Rating	Qualitative	Qualitative Rating Category Criteria				
High	Perennial str across the ha	Perennial streams and wetlands or intermittent stream known/documented to convey significant volumes of water across the basin divide for daws to weeks multiple times per war	umented to cor	rvey significan	it volumes of v	vater
	Intermittent	Intermittent stream capable of maintaining a surface water connection to streams on both sides of the basin divide	tion to streams	on both sides	of the basin d	ivide
Medium	continuously which maints	continuously for multiple days from a 10% annual return frequency storm; or, location of wetland spanning basin which minitains significant ponds that are likely to become inter connected and connect with streams on both sides of	storm; or, loca	tion of wetlar.	id spanning ba reams on both	isin divide sides of
	the basin div	the basin divide from a 10% annual return frequency storm.				
Low	Intermittent from larger th	Intermittent stream or marsh forming a surface water connection between streams on either side of the basin divide from larger than a 1.0% annual return frequency storm.	etween stream	s on either sic	le of the basin	divide
	Symbol	-				
Very Certain	VC	As certain as I am going to get.				
Reasonably Certain	RC	Reasonably certain.				
Moderately Certain	MC	More certain than not.				
Reasonably Uncertain	RU	Reasonably uncertain				
Very Uncertain	٧U	A guess				
very oncertaint the sequently connected to both watersheds, but it is probability of backwater inundation to permit transfer of species conduit into Flint Lake will infrequently create a connection, and 1% frequency) connected from Loomis Lake to Damon Run tribut spillway would impede transfer of ANS upstream from the GLB at Flint Lake. The observed drop at the outlet structure from Loomi Lake into Loomis Lake, making it a low probability connection fropermit transfer of ANS upstream from the GLB at end to conditions necessary to achieve that flow could happen only unditingeuent to establish an occasional connection during spring moradition. If the Basin boundary were appropriately drawn, the ransfer into the MRB. and 2.3 of the attached report. Loomis Lake is a man-made lake the Profitting the perennial drainage and therefore been based on knowledge of the actual flow characteristics as do Lake to the Great Lakes Basin vie the edam and spillway (VC). I Dam is intermittent and therefore the H& H rating will be Mediur structure and pipe for the perennial discharge from Loomis Lake.	connected to the undation to per infrequently or orm Loomis La sifer of ANS up op at the outlik ing it a low protect Loomis Lake a lieve that flow inter except for la rexcept for la ort. Loomis La dary were ap at the perennia ort. Loomis La invie the darm unlikely, there erennial disch erennial disch	We procertain the first regularly connected to both watersheds, but it is professional judgment that flow is likely in downstream direction only. The probability of backwater inundation to permit transfer of species into Loomis Lake appears highly unlikely from the Great Lakes. Surcharge of the conduit into Flint Lake will infrequently connected for mome Run transfer of species into Loomis Lake appears highly unlikely from the Great Lakes. Surcharge of the conduit into Flint Lake will infrequently create a connection, and velocities in the conduit are expected to be high. Flow is very occasionally (less than 1% frequency connected from Loomis Lake to Plant Run transfer of ANS upstream from the ULB and up the spillway across the dan. The slope and shallow depth of the narrow spillway would impede transfer of ANS upstream from the MB to the CLB. The possibility of backwater inundation from Flint Lake. The observed drop at the outlet structure from Loomis Lake to Flint Lake. The observed drop at the outlet structure from the MB to the CLB. The possibility of backwater introduction from Flint Lake into Loomis Lake in Loomis Lake in Domis Lake in the Ruttion the MB. This rating has the contrading pringentian of the Ratarder Equition to ELB mundary connection during spring months. (evelved B <i>S</i>):11, based on curvet flow computations by K. Lamkin). Agree. In addition. * If the Basin boundary were appropriately drawn, the risk would be based on only the northern outet structure with a low rating for transfer into the MB. The Basin Doundary were appropriately drawn, the risk would be based on only the northern outet structure with a low rating for transfer into the MRB. The Basin Doundary stiffing the p	L consisting the pro- by unlikely from occel to be hit in the dam. The: ke. Flow is regult riment to adult or back subsitivent flow conduct and the lace or the Mississippi the Mississippi the STOW from the STOW from th	with the Great Lah The Great Lah The Flow is vera slope and sha allarly connect NNS swimming water inunda mis during co the Kankakee F mputations b et structure wi et structure wi et structure wi the GLB into L the GLB into L the GLB into L	rection only. rection only. (es. Surcharge y occasionality ed from Loom a pustream fro a pustream fro nditions of pig nditions of pig nditions of pig ach rask is nol ver would be y K. Lamkin). A tha low rating sea go technica sea go technica io the connection o to comis Lake (W	y. The arge of the ally (less than of the narrow omis Lake to i from Flint Flint Lake to f pipe full flow f not an tung for See Section 1.3 nically shifted his rating has on of Loomis ce (MRB) over y at Profifits necting drop

		Loomis Lake, Porter County, IN - Asian Carp		
2. Probability of ANS occurring within either basin	occurring	within either basin		
Aquatic Pathway Team	Team	Expertise Position title or team role Rating		Certainty
		USACE, Louisville - Biologist High	4	VC
		USACE, Louisville - Biologist High	Ч	VC
		USACE, Detroit - Biologist High	Ч	RC
		NRCS - Biologist Medium	nm	VC
		Indiana DNR - AIS Coordinator Medium	nm	VC
		Team Rating High	Ч	VC
2. How do you rate the p	orobability o	How do you rate the probability of ANS occuring within either basin?		
Qualitative Rating	Qualitative	Qualitative Rating Category Criteria		
High	Target ANS exist within 20 years.	Target ANS exists on connected waterways in close enough proximity to be capable of moving to the aquatic pathway within 20 years.	capable	of moving to the aquatic pathway
Medium	Target ANS exists on comoving to the aquatic I	Target ANS exists on connected waterways, but based on current proximity and mobility, is considered incapable of moving to the aquatic pathway within 20 years.	and mot	illity, is considered incapable of
Low	Target ANS i	Target ANS is not known to exist on a connected waterway.		
	Symbol			
Very Certain	VC	As certain as I am going to get.		
Reasonably Certain	RC	Reasonably certain.		
Moderately Certain	MC	More certain than not.		
Reasonably Uncertain	RU	Reasonably uncertain		
Very Uncertain	٧U	A guess		
Remarks: Silver carp and bighead carp are establish have been recorded in significant numbers in the III Channahon, Illinois (CBS Chicago, 2011). Black carp black carp is not as extensive as that of the silver an	ghead carp ar ficant numbe (cago, 2011). e as that of th	Remarks: Silver carp and bighead carp are established throughout the middle and lower Mississippi River Basin. Both silver carp and bighead carp have been recorded in significant numbers in the Illinois River. In the spring of 2011, an adult bighead carp was taken from the Kankakee River near Channahon, Illinois (CBS Chicago, 2011). Black carp may be established in portions of the lower Mississippi River Basin. The known distribution of black carp is not as extensive as that of the silver and bighead carp.	er Basin. arp was t ppi River	Both silver carp and bighead carp aken from the Kankakee River near Basin. The known distribution of

		Loomis Lake, Porter County, IN - Asian Carp	Carp			
3. Probability of ANS :	surviving t	Probability of ANS surviving transit to aquatic pathway				
Aquatic Pathway Team	ſeam	Expertise Position title or team role	3A Rating	Certainty	3B Rating	Certainty
		USACE, Louisville - Biologist	Low	VC	Medium	RC
		USACE, Louisville - Biologist	Low	VC	Medium	RC
		USACE, Detroit - Biologist	Low	RC	Medium	MU
		NRCS - Biologist	Low	VC	Medium	RC
		Indiana DNR - AIS Coordinator	Low	VC	Medium	RC
		Team Ratings	Low	VC		
3A. How do you rate the	probability	3A. How do you rate the probability of ANS surviving transit to aquatic pathway through connecting streams?	igh connectir	ig streams?		
3B. How do you rate the	probability	3B. How do you rate the probability of ANS surviving transit to aquatic pathway through other means?	gh other mea	sut?		
Qualitative Rating	Qualitative	Qualitative Rating Category Criteria				
High	Target ANS a to successful 10-20 years.	Target ANS are established in relatively close proximity to location and have ample opportunity, capability and motivation to successfully navigate through the aquatic pathway and/or through other means to arrive at the subject pathway within 10-20 years.	nd have ample other means	opportunity, o to arrive at th	capability and e subject path	motivation way within
Medium	Target ANS a passage thro	Target ANS are established at locations in close enough proximity to location and have limited capability to survive passage through the aquatic pathway within 20-50 years.	location and hi	ave limited ca ect pathway w	pability to surv ithin 20-50 ye	<i>i</i> ive ars.
Low	Target ANS a locations by	Target ANS are not in proximity to the pathway, and/or it is highly unlikely that they could survive transit from current locations by aquatic pathway or other means to arrive at subject pathway within next 50 years.	likely that the hway within ne	y could survive ext 50 years.	e transit from	current
	Symbol					
Very Certain	VC	As certain as I am going to get.				
Reasonably Certain	RC	Reasonably certain.				
Moderately Certain	MC	More certain than not.				
Reasonably Uncertain	RU	Reasonably uncertain				
Very Uncertain	NΝ	A guess				
Remarks: 3A. Probability of	of ANS Surviving	J Transit to Aquatic Pathway Through Connecting Streams	ns.			
As stated in Section 2.6, of the	he pathway a	As stated in Section 2.6, of the pathway assessment, there is a definite hydrologic connection that occurs at Loomis Lake, but only from the Great Lakes	t occurs at Loo	mis Lake, but	only from the	Great Lakes
Basin toward the Mississippi not spread into either lake.	i River Basin. As mentioned	Basin toward the Mississippi River Basin. Due to the obstructions of the Flint and Loomis Lake control structures, even the strongest swimmers could not spread into either lake. As mentioned in Section 2.7, of the pathway assessment, there are also several in-stream obstructions within the	ntrol structure so several in-st	s, even the str tream obstruc	ongest swimm tions within th	iers could ie
Mississippi River Basin that <i>F</i> to find their way into Flint La	orovide a ranç ake or Loomis	Mississippi River Basin that provide a range of potential ANS migratory obstructions. Therefore, there is a low probability that Asian carp would be able to find their way into Flint Lake or Loomis Lake solely through the aquatic pathway.	here is a low p	robability that	t Asian carp we	ould be able
Domorke, 20 Dechobility, of	ANIC CLARKER	a Transit ta Asuratis Dethusse Through Other Moone				
Remarks: 3B. Propability of	AINS SULVINING	vemarks: 3b. Probability of ANS Surviving Iransit to Aquatic Pathway Infough Uther Means		la a contra contra to contra	and the second	an an
It is likely that most of the Al aquaculture operations or ex	NS of concerr xotic pet trad	It is likely that most of the ANS of concern could become established in, and spread from Loomis Lake if they were infroduced from sources such as aquaculture operations or exotic pet trade, bait bucket transfer, eco-terrorism, bilge releases, contaminated tackle, wading birds, and other natural	-ake if they we ntaminated tac	re introduced kle, wading bi	Irom sources rds, and other	such as natural
and anthropogenic sources.	Loomis and F	and anthropogenic sources. Loomis and Flint Lakes provide a variety of habitat types that are suitable for most of the ANS considered in this	table for most	of the ANS cor	nsidered in thi	S
evaluation. One reason mos conditions. The motivation f	st invasive spe for anthropoc	evaluation. One reason most invasive species are successful is the fact that they are able to survive and reproduce in a wide range of environmental conditions. The motivation for anthropogenic introductions range from accidental to intentional and malicious. Public education regarding the	ve and reprodu and malicious.	uce in a wide r Public educa	ange of envirc tion regarding	inmental the
detrimental impacts of ANS a	and how to p	detrimental impacts of ANS and how to prevent their spread are likely the best tools to prevent anthropogenic transfer from occurring. The	nthropogenic t	ransfer from o	occurring. The	
recreational use of the Valps to it their location along the	araiso Lakes, i basin divide.	recreational use of the Valparaiso Lakes, including Loomis and Flint Lakes, poses some residual risk associated with the interbasin transfer of ANS due to it their location along the basin divide. The residual risk of ANS transfer by such "other means" did not influence the overall pathway viability rating	k associated w did not influe	vith the interba nce the overal	asin transfer o I pathway viał	f ANS due bility rating
in this Loomis Lake Pathway Report.	Report.					

4. Probability of ANS establishing in proximity to the aquatic pathway Aquatic Pathway Team Position title or team role USACE, Louisville - Biologist				
Aquatic Pathway Team	oximity to the aquatic pathway			
	Expertise Position title or team role	Rating	Certainty	
	USACE, Louisville - Biologist			
	USACE, Louisville - Biologist			
	USACE, Detroit - Biologist			
	NRCS - Biologist			
	Indiana DNR - AIS Coordinator			
	Team Ratings			
$4.\;$ How do you rate the probability of ANS establishing in proximity of the aquatic pathway?	tablishing in proximity of the aquatic path	iway?		
Oualitative Rating Qualitative Rating Category Criteria	ategory Criteria			
Sources of food and hi	Sources of food and habitat suitable to the ANS are plentiful in close proximity to support all life stages from birth to	proximity to s	upport all life stages	rom birth to
High adult, abiotic condition	adult, abiotic conditions align with native range and there are no known predators or conditions that would significantly	wn predators	or conditions that we	uld significantly
impede survivability or	r reproduction.			
Limited and disconnect conditions are within la be expected to effectiv	Limited and disconnected areas and sources of food and habitat suitable to the ANS are available in proximity, abiotic conditions are within latitude limits of native range, but only a portion of the healthy individuals arriving at location can be expected to effectively compete and survive.	able to the AN on of the healt	IS are available in pro hy individuals arrivinç	timity, abiotic at location can
	Habitat and abiotic conditions in proximity are outside the range where ANS has been known to survive; there is very	ere ANS has b	een known to survive	there is very
Low limited availability hat competition with nativ	limited availability habitat area suitable for ANS cover, sustainable food supply and reproduction; or native predators or competition with native species would likely prevent establishment of a sustainable population.	od supply anc of a sustainabl	l reproduction; or nat e population.	ve predators or
Symbol				
Very Certain VC As certai	As certain as I am going to get.			
Reasonably Certain RC Reasonal	Reasonably certain.			
Moderately Certain MC More cer	More certain than not.			
Reasonably Uncertain RU Reasonal	Reasonably uncertain			
Very Uncertain VU A guess				
Remarks: Species-specific ratings for this section were not completed because the ratings for the likelihood that any of the ANS of concern for Loomis Lake would be able to survive transit from their current locations in either basin to the pathway were all low (Step 3).	vere not completed because the ratings for the their current locations in either basin to the pa	likelihood th: Ithway were a	at any of the ANS of c II low (Step 3).	oncern for

		Loomis Lake, Porter County, IN - Asian Carp
5. Probability of ANS spreading across	spreading	across aquatic pathway into the new basin
Aquatic Pathway Team	ſeam	Expertise Position title or team role Rating Certainty
		USACE, Louisville - Biologist
		USACE, Louisville - Biologist
		USACE, Detroit - Biologist
		NRCS - Biologist
		Indiana DNR - AIS Coordinator
		Team Ratings
5. How do you rate the probability of ANS spr	probability c	* ANS spreading across aquatic pathway into the new basin?
Qualitative Rating	Qualitative	Qualitative Rating Category Criteria
Hinb	Sources of fo	Sources of food and habitat suitable to the ANS are available, and the species has demonstrated capabilities to
1.1911	significantly	significantly expand range from locations where initially introduced.
Medium	There are limited sourc significant distances be	There are limited sources of food and suitable habitat, and/or the species has demonstrated limited ability to spread significant distances beyond areas where it has been introduced.
Low	There are se to spread be	There are severely limited sources of food and suitable habitat, and/or the species has demonstrated very limited ability to spread beyond areas where it has been introduced.
	Symbol	
Very Certain	VC	As certain as I am going to get.
Reasonably Certain	RC	Reasonably certain.
Moderately Certain	MC	More certain than not.
Reasonably Uncertain	RU	Reasonably uncertain
Very Uncertain	٧U	A guess
Remarks: Species-specific ra Loomis Lake would be able t	itings for this to survive tra	Remarks: Species-specific ratings for this section were not completed because the ratings for the likelihood that any of the ANS of concern for Loomis Lake would be able to survive transit from their current locations in either basin to the pathway were all low (Step 3).

1. Probability of aquatic pathway existence Aquatic Pathway Team Aquatic Pathway Team Pathway Team Aquatic Pathway Team India USACE USACE USACE India Intermitent stream and wetla Medium Intermitent stream or mains Low Intermitent stream or mains Symbol	am hood of the hood of the rface water i face water i frace wa	1. Probability of aquatic pathway existence Expertise Rating Flow Certainty Aquatic Pathway Team USACE. Detroit - Hydraulic Engineer Reating Flow Certainty Reting Flow Certainty Aquatic Pathway Team USACE. Detroit - Hydraulic Engineer Medium RC Low RC USACE. Louisville USSCS - Hydraulic Engineer Low VC Low RC USSCS - Hydraulic Engineer Low RC Low RC Low RC USSCS - Hydraulic Engineer Low RC Low RC Low RC Indiana DNR - Engineering Geologist Medium RC Low VC Commany Caration where untreated surface water flow across the divide is deemed likely to occur and connect headwater streams in both basins from any stom whet mainterun frequency stom. VC Low VC High Retining streams and wetlands or intermittent stream known/documented to convery significant volumes of water High Medium RC Low VC Medium RC Low Commany Commany Cow Commany	Rating Flow into GLB Medium Low Medium Medium inented to con innect headw ion to streams storm: or, location ion to streams there and co	Certainty RC VC RC RC RC RC RC RC RC RC RC RC RC RC RC	Rating Flow into MRB Low Low Low Low Low Low Low to the basins in both basins in both basin di d spanning bas reams on both le of the basin	Certainty RC RC RC RC VC VC VC VC VC vide any from any from any from any from any divide sides of divide
Aquatic Pathway Te Aquatic Pathway Te	am hood of the hood of the rface water rface water rface of the rface water recross the bat which mainter which mainter which mainter the basin the basin which mainter symbol NC RC RC	Expertise Expertise Position title or team role USACE, Detroit - Hydraulic Engineer USACE, Louisville - Hydraulic Engineer USACE, Louisville - Hydraulic Engineer USACE, Louisville - Hydraulic Engineer USACE, Louisville - Hydraulic Engineer USACE, Louisville - Hydraulic Engineer USACE, Louisville - Hydraulic Engineer USACE, Louisville - Hydraulic Engineer USACE, Louisville - Hydraulic Engineer Usace - Louisville - Hydraulic Engineer USACE, Hydrologist Indiana DNR - Engineering Geologist Team Ratings existence of a viable aquatic pathway at the subject treation stating a variance and corrand correctors stream capable of maintaining a surface water connection seinal divide for multiple days from a 10% annual return frequency storm. exterain as 1 am going to get. As certain as 1 am going to get.	Rating Flow into GLB Medium Low Nedium Medium Medium Medium Medium Ion tow costion? Assu onnect headwi onnect headwi onnect headwi nected and co	Certainty RC VC RC	Rating Flow into MRB Low Low Low uou Low datic pathwe in both basins in both basin d spanning basins ie of the basin	Certainty RC RC RC VC VC VC VC VC VC VC VC VC Si any from any from any from any from any from any from any
1. How do you rate the likelil location where untreated sur storm up to the 1% annual re Qualitative Rating C P P High al High al Nedium α Low f	hood of the frace water iturn freque transfrace water iturn freque erennial str continuously which mainte which mainte the basin the basin the mittent to symbol VC VC RC RC	USACE. Detroit - Hydraulic Engineer USACE, Louisville - Hydraulic Engineer USGS - Hydraulic Engineer USGS - Hydraulic Engineer Indiana DNR - Engineering Geologist Fream Ratings rexistence of a viable aquatic pathway at the subject to flow across the divide is deemed likely to occur and cc arcy storm. Rating Category Criteria eams and wetlands or intermittent stream known/docur isin divide for days to weeks multiple times per year. Stream capable of maintaining a surface water connectit for multiple days from a 10% annual return frequency stains significant ponds that are likely to become inter con ide from a 10% annual return frequency storm. As certain as I am going to get.	Medium Low Low Low Low Medium Medium Medium Icon Medium Icon Passu onnect headwing the streams of the streams o	RC VC RC	Low Low Low Low Low tournes of w t volumes of w d spanning basins eams on both le of the basin	RC RC VC VC VC VC rc rc rc rc rc rc rc rc rc rc rc rc rc
1. How do you rate the likelii location where untreated sur storm up to the 1% annual re Qualitative Rating R High ai nedium k Low f	hood of the rface water turn freque erennial str continuously which mainte which mainte the mainte the frager the Symbol VC RC RC	USACE, Louisville - Hydraulic Engineer USGS - Hydrologist Indiana DNR - Engineering Geologist Feam Ratings existence of a viable aquatic pathway at the subject Ic flow across the divide is deemed likely to occur and cc mcy storm. Rating Category Criteria eams and wetlamds or intermittent stream known/doccu sin divide for days to weeks multiple times per year. Stream capable of maintaining a surface water connectit from utippie days from a 10% annual return frequency storm. As the form a 10% annual return frequency storm. As certain as I am going to get.	Low Low Medium Medium Innented to con Innected and co nnected and co	VC RC RC RC RC rc rc rc rc rc rc rc rc rc rc rc rc rc	Low Low Low Low in both basins in both basin in both basins in both basins in both basins in both basins in both basins in both basins in both basin in basin basin in basin basin in basin basin in basin basin in basin in basin basin in basin inb	RC RC VC VC VC VC rom any from any from any from any from any alter sides of alvide
1. How do you rate the likeli location where untreated sur storm up to the 1% annual re Aualitative Rating C High ai Aedium c c Low f	hood of the rface water aturn freque erennial stru- britantical stru- termituously which maints which maints which maints the maints which	USGS - Hydrologist Indiana DNR - Engineering Geologist Team Ratings • existence of a viable aquatic pathway at the subject Ic flow across the divide is deemed likely to occur and cc arrey storm. Rating Category Criteria earns and wetlands or intermittent stream known/docur usin divide for days to weeks multiple times per year. Fiream capable of maintaining a surface water connectit from ultiple days from a 10% annual return frequency sins significant ponds that are likely to become inter con ide from a 10% annual return frequency storm. Stream or marsh forming a surface water connection be han a 1.0% annual return frequency storm.	Low Medium Medium iocation? Assu ionnect headwi umented to con innected and co nnected and co	RC RC RC RC RC RC NC RC RC RC RC RC RC RC RC RC RC RC RC RC	Low Low Low addic pathwa quatic pathwa in both basins t volumes of w d spanning ba: reams on both le of the basin	RC VC VC VC vite ater vide sides of divide
1. How do you rate the likelih location where untreated sur storm up to the 1% annual re Oualitative Rating P High ai high ai Low Low	hood of the rface water iturn freque erennial stru- termittent: which mainta which mainta which mainta thermittent: rom larger th Symbol VC RC MC	Indiana DNR - Engineering Geologist Team Ratings rexistence of a viable aquatic pathway at the subject Ic flow across the divide is deemed likely to occur and co arry storm. Rating Category Criteria earns and wetlands or intermittent stream known/docur usin divide for days to weeks multiple times per year. Isteam capable of maintaining a surface water connectit for multiple days from a 10% annual return frequency ains significant ponds that are likely to become inter con- ide from a 10% annual return frequency stream or marsh forming a surface water connection be han a 1.0% annual return frequency storm. As certain as 1 am going to get.	Medium Medium iocation? Assu umented to con innot streams ion to streams innected and co	RC RC Rc ater streams ater streams on both stides tion of wetlan nnect with sti s on either sic	Low Low aquatic pathwa in both basins t volumes of w d spanning ba: reams on both le of the basin	VC VC VC item any from any ater sides of divide
1. How do you rate the likelih location where untreated sur storm up to the 1% annual re- Oualitative Rating P High ai n High ai high r Low Low f	hood of the frace water i turn freque erennial stru- erennitant: which maints which maints which maints intermittent i riom larger th Symbol VC RC MC	Team Ratings rexistence of a viable aquatic pathway at the subject Ic flow across the divide is deemed likely to occur and co incy storm. Rating Category Criteria eams and wetlands or intermittent stream known/docur isin divide for days to weeks multiple times per year. Tor multiple days from a 10% annual return frequency storm. Ide from a 10% annual return frequency storm. As certain as I am going to get. As certain.	Medium location? Assuur onnect headware the adware the adware the adware the adware to contract the advare to the	RC me a viable a ater streams is a vey significan on both sides on both sides s on either sid	Low quatic pathwa quatic pathwa in both basins of the basin di d spanning ba: reams on both le of the basin	VC yr is any from any ater vide sin divide sides of divide
1. How do you rate the likelit location where untreated sur storm up to the 1% annual re High a High a Medium α Low f	hood of the frace water i turn freque erennial stru- erennial stru- erennial stru- termittent : nontinuously which maints the basin divit he basin divit from larger th Symbol VC RC MC	existence of a viable aquatic pathway at the subject Ic flow across the divide is deemed likely to occur and co incy storm. Rating Category Criteria eams and wetlands or intermittent stream known/docur usin divide for days to weeks multiple times per year. Tor multiple days from a 10% annual return frequency stains significant ponds that are likely to become inter con its significant ponds that are likely to become inter con the at a 1.0% annual return frequency storm. As certain as I am going to get.	iocation? Assui onnect headwa umented to con unected and co nnected and co etween streams	me a viable a ater streams i vey significan vey significan ion both sides tion of wetlan nnect with sti s on either sic	quatic pathwa in both basins t volumes of w of the basin di d spanning ba: reams on both le of the basin	ry is any from any ater ater sin divide sides of divide
storm up to the 1% annual reacting O Oualitative Rating O P High High all high low c α t r t t t t t t t t t t t t t t t t t	turn freque valitative bennial strevential strevential termittent: vhich mainte vhich mainte termittent: Symbol RC MC	Incy storm. Rating Category Criteria eams and wetlands or intermittent stream known/docur isin divide for days to weeks multiple times per year. for multiple days from a 10% annual return frequency s ains significant ponds that are likely to become inter con- ide from a 10% annual return frequency storm. stream or marsh forming a surface water connection be han a 1.0% annual return frequency storm. As certain as 1 am going to get. Reasonably certain.	ion to streams , ion to streams , etween streams	vey significan on both sides ition of wettan nnect with str s on either sic	t volumes of w of the basin di d spanning ba: reams on both le of the basin	ater vide sin divide divide
	Dualitative erennial stre erennial stre recross the ba netermittent: ontinuously which mainte which mainte which mainte the mainte the mainte the mainte symbol VC RC RC MC	Rating Category Criteria earns and wetlands or intermittent stream known/docur isin divide for days to weeks multiple times per year. for multiple days from a 10% annual return frequency s ains significant ponds that are likely to become inter con ide from a 10% annual return frequency storm. As the annual return frequency storm. As certain as I am going to get.	Immented to con ion to streams a storm; or, locat nnected and co etween streams	vey significan on both sides tion of wethan nnect with str s on either sic	t volumes of w of the basin di d spanning ba: reams on both le of the basin	rater vide sin divide sides of divide
	erennial stre cross the ba ntermittent is which mainte which mainte thermittent div intermittent div rom larger th Symbol VC RC MC	eams and wetlands or intermittent stream known/docur is divide for days to weeks multiple times per year. the multiple days from a 10% annual return frequency s ains significant ponds that are likely to become inter con stream or marsh forming a surface water connection be han a 1.0% annual return frequency storm. As certain as I am going to get.	imented to con ion to streams of storm: or, locat nnected and co etween streams	vey significan on both sides tion of wetlan nnect with sti s on either sid	t volumes of w of the basin d d spanning bas reams on both le of the basin	ater vide sin divide sides of divide
	which tremittent: anticuousity which mainte he basin divit antermittent: Symbol VC RC MC	stream capable of maintaining a surface water connectit for multiple days from a 10% annual return frequency s ains significant ponds that are likely to become inter con ide from a 10% annual return frequency storm. stream or marsh forming a surface water connection be han a 1.0% annual return frequency storm. As certain as I am going to get. Reasonably certain.	ion to streams of the streams of the streams of the storm of the streams of the s	on both sides tion of wetland innect with str s on either sid	of the basin di d spanning bas reams on both le of the basin-	vide sin divide sides of divide
	ontinuously which mainta he basin divi intermittent : rom larger th Symbol VC RC MC	for multiple days from a 10% annual return frequency s ins significant ponds that are likely to become inter con ide from a 10% annual return frequency storm. stream or marsh forming a surface water connection be han a 1.0% annual return frequency storm. As certain as I am going to get.	storm; or, locat nnected and co etween streams	ion of wetlan nnect with str	d spanning bas eams on both le of the basin	sin divide sides of divide
	he basin divi ntermittent s rom larger th Symbol VC RC RC	ide from a 10% annual return frequency storm. stream or marsh forming a surface water connection be han a 1.0% annual return frequency storm. As certain as I am going to get. Reasonably certain.	etween streams	s on either sid	e of the basin	divide
	itermittent s rom larger th Symbol VC RC MC	stream or marsh forming a surface water connection be han a 1.0% annual return frequency storm. As certain as I am going to get. Reasonably certain.	etween streams	s on either sid	e of the basin	divide
=	Symbol VC RC MC	Reasonably certain.				
	VC RC	As certain as I am going to get. Reasonably certain.				
Very Certain	RC	Reasonably certain.				
Reasonably Certain	MC					
Moderately Certain		More certain than not.				
Reasonably Uncertain	RU	Reasonably uncertain				
Very Uncertain	٧U	A guess				
very oncertain the Filow is regularly connected to both watersheds, but it is probability of backwater inundation to permit transfer of species conduit into Filnit.Lake will infrequently create a connection, and 1% frequency) connected from Loomis Lake to Damon Run tribut spillway would impede transfer of ANS upstream from the GLB at Filmit Lake. The observed drop at the outlet structure from Loomis Lake, making it a low probability connection from frequent transfer of ANS into Loomis Lake, moving a low probability connection from frequent to establish an occasional connection during spring mor addition: * If the Basin boundary were appropriately drawn, the ransfer into the MRB. and 2.3 of the attached report. Loomis Lake is a man-made lake the Profitts Dam is intermittent and therefore a Low rating (VC). I Dam is intermittent and therefore the H& Hraingy and Profitts the Profitts Dam is intermited discharge from Loomis Lake.		We process the sequency connected to both watersheds, but it is professional judgment that flow is likely in downstream direction only. The probability of backwater inundation to permit transfer of species into Loomis Lake appears highly unlikely from the Great Lakes. Surcharge of the conduit into Flint Lake will infrequently create a connection, and velocities in the conduit are expected to be high. Flow is very occasionally (less than 1% frequently connected from Loomis Lake to Dillivation to permit transfer of species into Loomis Lake appears highly unlikely from the Great Lakes. Surcharge of the conduit into Flint Lake will infrequently create a connection, and velocities in the conduit are expected to be high. Flow is very occasionally (less than 1% frequency) connected from Loomis Lake to Dillivation the SLB and up the spillway uctos the outer and shallow depth of the narrow spillway would impede transfer of ANS instructure from Loomis Lake to Flint Lake. The observed drop at the outel structure from Loomis Lake to Flint Lake. The observed drop at the outel structure from Loomis Lake to Flint Lake into Loomis Lake appears highly unlikely except under very high water levels in Lake Loomis Lake would be shered to be high. Flow is regularly connected from Domis Lake to Flint Lake. The observed drop at the outel structure from Loomis Lake would be based on only the northern outel structure with a low raing for morediment to ANS transfer accept to reade and sport. The transfer into the MRB. The Basin Boundary were appropriately drawn, the risk would be based on only the northern outel structure of points Lake base basin Boundary. The Admaker Base houndary were appropriated base and and the refore the watershed for the lake. Flow from the GLB had and ad Spliway (Profitts Dam is highly unlikely, therefore a Low raing for the lake. Flow from the GLB had and ad Spliway artificial take to the Great Lakes Basin Boundary. Shifting the peremial drainage and threader the watershed for the lake. Flow from the CB mad a l	wi is likely in dc y unlikely from exerted to be hig moeted to be hig the dam. The s we. Flow is regu ment to adult A sublity of back sels in Lake Loon rels in Lake Loon elevels if at allout router flow cor northern outle to the Mississip the CLB as a dis sfer would be v	wwnstream di the Great Lak h. Flow is vera slope and shal llarly connect NNS swimming water inunda water inunda mis during co the Kankakee R mputations by t structure wi t structure	rection only. rection only. i.es. Surcharge so sossionally. Ilow depth of the ed from Loomi a upstream froi pupstream froi a upstream froi a upstrea	y. The arge of the ally (less than of the narrow omis Lake to i from Flint Flint Lake to f pipe full flow f not an tung for see Section 1.3 nically shifted his rating has on of Loomis ce (MRB) over escting drop

	Loomis L	Loomis Lake, Porter County, IN - Northern Snakehead (Channa argus	argus)
2. Probability of ANS occurring within either basin	occurring	within either basin	
Aquatic Pathway Team	Team	Expertise Position title or team role Rating	Certainty
		USACE, Louisville - Biologist Medium	RC
		USACE, Louisville - Biologist Medium	RC
		USACE, Detroit - Biologist Medium	RC
		NRCS - Biologist Medium	VC
		Indiana DNR - AIS Coordinator Medium	VC
		Team Rating High	VC
2. How do you rate the p	orobability c	How do you rate the probability of ANS occuring within either basin?	
Oualitative Rating	Qualitative	Qualitative Rating Category Criteria	
High	Target ANS exis within 20 years.	Target ANS exists on connected waterways in close enough proximity to be capable of moving to the aquatic pathway within 20 years.	of moving to the aquatic pathway
Medium	Target ANS exists on comoving to the aquatic	Target ANS exists on connected waterways, but based on current proximity and mobility, is considered incapable of moving to the aquatic pathway within 20 years.	bility, is considered incapable of
Low	Target ANS i	Target ANS is not known to exist on a connected waterway.	
	Symbol		
Very Certain	VC	As certain as I am going to get.	
Reasonably Certain	RC	Reasonably certain.	
Moderately Certain	MC	More certain than not.	
Reasonably Uncertain	RU	Reasonably uncertain	
Very Uncertain	ΛU	A guess	
Remarks: The northern sna population is within the Mis this species is also establish watershed, its population d location within the next 20	kehead was f sissippi River ed in the Pot oes not seem years withou	Remarks: The northern snakehead was found in 2008 near Monroe, Arkansas, and has since established a reproducing population in the area. This population is within the Mississippi River Basin and represents a population that could spread throughout the basin. Although in a different basin, this species is also established in the Potomac River in Maryland and Virginia (USGS, 2011). While this species is within the Mississippi River watershed, its population does not seem to be spreading at a high rate at this time and it is unlikely that it would reach the Loomis Lake divide location within the next 20 years without the assistance of some non-aquatic vector.	ducing population in the area. This Isin. Although in a different basin, within the Mississippi River d reach the Loomis Lake divide

	Loomis L	Loomis Lake, Porter County, IN - Northern Snakehead (Channa argus	d (Channa	argus)		
3. Probability of ANS s	surviving t	3. Probability of ANS surviving transit to aquatic pathway				
Aquatic Pathway Team	「eam	Expertise Position title or team role	3A Rating	Certainty	3B Rating	Certainty
		USACE, Louisville - Biologist	Low	VC	Medium	RC
		USACE, Louisville - Biologist	Low	RC	Medium	RC
		USACE, Detroit - Biologist	Low	RC	Low	RU
		NRCS - Biologist	Low	VC	Medium	RC
		Indiana DNR - AIS Coordinator	Low	VC	Medium	RC
		Team Ratings	Low	VC		
3A. How do you rate the	probability	3A. How do you rate the probability of ANS surviving transit to aquatic pathway through connecting streams?	gh connectin	ig streams?		
3B. How do you rate the p	probability	3B. How do you rate the probability of ANS surviving transit to aquatic pathway through other means?	h other mea	ns?		
Qualitative Rating	Qualitative	Qualitative Rating Category Criteria				
High	Target ANS & motivation to pathway with	Target ANS are established in relatively close proximity to location and have ample opportunity, capability and motivation to successfully navigate through the aquatic pathway and/or through other means to arrive at the subject pathwav within 10-20 vears.	id have ample I/or through c	e opportunity other means t	, capability and o arrive at the	d subject
Medium	Target ANS &	Target ANS are established at locations in close enough proximity to location and have limited capability to survive passage through the aquatic pathway or through other means to arrive at the subject pathway within 20-50 years.	location and h	nave limited c ject pathway	apability to su within 20-50 y	irvive ears.
row	Target ANS <i>i</i> locations by	Target ANS are not in proximity to the pathway, and/or it is highly unlikely that they could survive transit from current locations by aquatic pathway or other means to arrive at subject pathway within next 50 years.	llikely that the hway within r	ey could survi iext 50 years.	ve transit from	r current
	Svmbol					
Verv Certain	NC	As certain as I am noinn to net				
Prosonably Cortain		Dosconshir cortain				
		Macontauly certaint.				
		INIOTE CETTAIN TNAN NOL.				
Reasonably Uncertain	RU	Reasonably uncertain				
Very Uncertain	N	A guess				
Remarks: 3A. Probability of	ANS Survivin	Remarks: 3A. Probability of ANS Surviving Transit to Aquatic Pathway Through Connecting Streams.	ns.			
In addition to the locks and would prevent even the stro study would be able to find 1	dams within ongest swimn their way into	In addition to the locks and dams within the Mississippi River Basin side of the pathway (Section 2.7), the control structures in Flint and Loomis Lakes would prevent even the strongest swimmers from reaching the pathway. Therefore, there is a low probability that any of the ANS evaluated for this study would be able to find their way into the pathway from the Mississippi River Basin.	2.7), the contr w probability	ol structures that any of th	in Flint and Lo ne ANS evaluat	omis Lakes ed for this
Remarks: 3B. Probability of	ANS Survivin	Remarks: 3B. Probability of ANS Surviving Transit to Aquatic Pathway Through Other Means				
It is likely that most of the A aquaculture operations or e: and anthropogenic sources. evaluation. One reason mos conditions. The motivation 1 detrimental impacts of ANS,	NS of concer xotic pet trac Loomis and st invasive sp for anthropo and how to p	It is likely that most of the ANS of concern could become established in, and spread from Loomis Lake if they were introduced from sources such as aquaculture operations or exotic pet trade, bait bucket transfer, eco-terrorism, bilge releases, contaminated tackle, wading birds, and other natural and anthropogenic sources. Loomis and Flint Lakes provide a variety of habitat types that are suitable for most of the ANS considered in this evaluation. One reason most invasive species are successful is the fact that they are able to survive and reproduce in a wide range of environmental conditions. The motivation for anthropogenic introductions range from accidental to intentional and malicious. Public education regarding the detrimental impacts of ANS and how to prevent their spread are likely the best tools to prevent anthropogenic transfer from occurring. The	Lake if they w ntaminated ta table for mos ve and reproo and malicious nthropogenic	ere introduce ickle, wading t of the ANS c duce in a wide s. Public educ transfer from	ed from source birds, and oth onsidered in t e range of envi ation regardir o occurring. TI	es such as er natural his ronmental ng the ne
recreational use of the Valparaiso Lakes, ir to it their location along the basin divide. rating in this Loomis Lake Pathway Report.	araiso Lakes, basin divide. ithway Repor	ecreational use of the Valparaiso Lakes, including Loomis and Flint Lakes, poses some residual risk associated with the interbasin transfer of ANS due to it their location along the basin divide. The residual risk of ANS transfer by such "other means" did not influence the overall pathway viability rating in this Loomis Lake Pathway Report.	k associated did not influ	with the inter ence the ove	basin transfer all pathway vi	of ANS due ability

	Loomis Lake, Pol	ake, Porter County, IN - Northern Snakehead (Channa argus)
4. Probability of ANS	establishi	Probability of ANS establishing in proximity to the aquatic pathway
Aquatic Pathway Team	Team	Expertise Position title or team role Rating Certainty
		USACE, Louisville - Biologist
		USACE, Louisville - Biologist
		USACE, Detroit - Biologist
		NRCS - Biologist
		Indiana DNR - AIS Coordinator
		Team Ratings
4. How do you rate the p	orobability c	How do you rate the probability of ANS establishing in proximity of the aquatic pathway?
Oualitative Rating	Qualitative	Qualitative Rating Category Criteria
	Sources of fo	Sources of food and habitat suitable to the ANS are plentiful in close proximity to support all life stages from birth to
High	adult, abioti	adult, abiotic conditions align with native range and there are no known predators or conditions that would significantly
	impede surv	impede survivability or reproduction.
Medium	Limited and conditions a be expected	Limited and disconnected areas and sources of food and habitat suitable to the ANS are available in proximity, abiotic conditions are within latitude limits of native range, but only a portion of the healthy individuals arriving at location can be expected to effectively compete and survive.
	Habitat and	Habitat and abiotic conditions in proximity are outside the range where ANS has been known to survive; there is very
8 0 1	competition with nativ	infined availability habitat area suitable for Aivs cover, sustainable four suppry and reproduction, or hative predators or competition with native species would likely prevent establishment of a sustainable population.
	Symbol	
Very Certain	VC	As certain as I am going to get.
Reasonably Certain	RC	Reasonably certain.
Moderately Certain	MC	More certain than not.
Reasonably Uncertain	RU	Reasonably uncertain
Very Uncertain	٧U	A guess
Remarks: Species-specific r Loomis Lake would be able	atings for this to survive tra	Remarks: Species-specific ratings for this section were not completed because the ratings for the likelihood that any of the ANS of concern for Loomis Lake would be able to survive transit from their current locations in either basin to the pathway were all low (Step 3).

	Loomis L	Loomis Lake, Porter County, IN - Northern Snakehead (Channa argus)
5. Probability of ANS spreading across	spreading	across aquatic pathway into the new basin
Aquatic Pathway Team	ſeam	Expertise Position title or team role Rating Certainty
		USACE, Louisville - Biologist
		USACE, Louisville - Biologist
		USACE, Detroit - Biologist
		NRCS - Biologist
		Indiana DNR - AIS Coordinator
		Team Ratings
5. How do you rate the p	probability o	How do you rate the probability of ANS spreading across aquatic pathway into the new basin?
Qualitative Rating	Qualitative	Qualitative Rating Category Criteria
	Sources of fo	Sources of food and habitat suitable to the ANS are available, and the species has demonstrated capabilities to
Пуп	significantly	significantly expand range from locations where initially introduced.
Medium	There are lin significant di	There are limited sources of food and suitable habitat, and/or the species has demonstrated limited ability to spread significant distances beyond areas where it has been introduced.
Low	There are severely limit to spread beyond areas	There are severely limited sources of food and suitable habitat, and/or the species has demonstrated very limited ability to spread beyond areas where it has been introduced.
	Symbol	
Very Certain	VC	As certain as I am going to get.
Reasonably Certain	RC	Reasonably certain.
Moderately Certain	MC	More certain than not.
Reasonably Uncertain	RU	Reasonably uncertain
Very Uncertain	٧U	A guess
Remarks: Species-specific ra Loomis Lake would be able t	itings for this to survive tra	Remarks: Species-specific ratings for this section were not completed because the ratings for the likelihood that any of the ANS of concern for Loomis Lake would be able to survive transit from their current locations in either basin to the pathway were all low (Step 3).

1. Probability of aquatic pathway existence Aquatic Pathway Team P Aquatic Pathway Team USAC 1. How do you rate the likelihood of the existence of a location where untreated surface water flow across the storm up to the 1% annual return frequency storm. Indian 1. How do you rate the likelihood of the existence of a location where untreated surface water flow across the storm up to the 1% annual return frequency storm. Indian 1. How do you rate the likelihood of the existence of a location where untreated surface water flow across the storm and wetla High	atic pathwa	atic pathway existence				
Aquatic Pathway Aquatic Pathway 1. How do you rate the like location where untreated s storm up to the 1% annual Aualitative Rating High						
 How do you rate the like location where untreated s storm up to the 1% annual Qualitative Rating High 	Team	Expertise Position title or team role	Rating Flow into GLB	Certainty	Rating Flow into MRB	Certainty
 How do you rate the like location where untreated s storm up to the 1% annual Qualitative Rating High 		USACE, Detroit - Hydraulic Engineer	Medium	RC	Low	RC
 How do you rate the like location where untreated s storm up to the 1% annual Qualitative Rating High 		USACE, Louisville - Hydraulic Engineer	Low	VC	Low	RC
 How do you rate the like location where untreated s storm up to the 1% annual Qualitative Rating High 		USGS - Hydrologist	Low	RC	Low	RC
 How do you rate the like location where untreated s storm up to the 1% annual Qualitative Rating High 		Indiana DNR - Engineering Geologist	Medium	RC	Low	VC
1. How do you rate the like location where untreated s storm up to the 1% annual Qualitative Rating High		Team Ratings	Medium	RC	Low	VC
location where untreated s storm up to the 1% annual Oualitative Rating High	elihood of the	1. How do you rate the likelihood of the existence of a viable aquatic pathway at the subject location? Assume a viable aquatic pathway is any	location? Assu	ime a viable a	iquatic pathw	ay is any
Oualitative Rating High	surtace water return freque	location where untreated surface water flow across the divide is deemed likely to occur and connect headwater streams in both basins from any storm up to the 1% annual return frequency storm.	connect headw	ater streams	in both basin(s trom any
High	Qualitative	Qualitative Rating Category Criteria				
	Perennial stru across the ha	Perennial streams and wetlands or intermittent stream known/documented to convey significant volumes of water across that basin divide for dave to worke multiplia times our war	umented to cor	nvey significan	it volumes of v	vater
	Intermittent:	across the basin divide tot users to weeks induciple times per year. Intermittent stream capable of maintaining a surface water connection to streams on both sides of the basin divide	tion to streams	on both sides	of the basin d	ivide
Medium	continuously which mainte	continuously for multiple days from a 10% annual return frequency storm; or, location of wetland spanning basin divide which maintains significant ponds that are likely to become inter connected and connect with streams on both sides of the beside divided from a 10% annual returns from one come	storm; or, loca nnected and cc	tion of wetlar	id spanning ba reams on both	isin divide sides of
	Intermittent	ure davin divide itom a towanidan reduti irequency storm. Intermittent stream or marsh forming a surface water connection between streams on either side of the basin divide	etween stream	s on either sic	le of the hasin	divide
Low	from larger th	from larger than a 1.0% annual return frequency storm.				
	Symbol					
Very Certain	VC	As certain as I am going to get.				
Reasonably Certain	RC	Reasonably certain.				
Moderately Certain	MC	More certain than not.				
Reasonably Uncertain	RU	Reasonably uncertain				
Very Uncertain	٧U	A guess				
Remarks: Flow is regularly connected to both watersheds, but it is probability of backwater inundation to permit transfer of species conduit into Flint Lake will infrequently create a connection, and 1% frequency) connected from Loomis Lake to Damon Run tribut spillway would impede transfer of ANS upstream from the GLB an Flint Lake. The observed drop at the outlet structure from Loomi Lake into Loomis Lake, making it a low probability connection from the GLB an emitt transfer of ANS upstream from the GLB an Flint Lake. The observed drop at the outlet structure from Loomis Lake into Loomis Lake, making it a low probability connection from premit transfer of ANS upstream from the GLB and that the observed drop at the outlet structure and ly undikely equent to establish an occasional connection during spiring moraddition: * If the Basin boundary were appropriately drawn, the transfer into the MRB. and 2.3 of the attached report. Loomis Lake is a man-made lake the Basin Boundary shifting the perennial drainage and therefore the Basin Boundary shifting the perennial drainage and therefore the Basin Boundary shifting the perennial drainage and therefore the Re the form the MRB. The Profitts Dam is highly unlikely, therefore a Low rating (VC). Dam is intermittent and therefore the H& H rating will evolute Lake.	onnected to b indation to pe indation to pe indequently or om Lequently or om the quently or om the ow pro- pop at the outife on part the outife ing it a low pro- tow pro- dary were applied of the actual fut in vie the dam in vie the dam in vie the dam in vie the dam in vie the	Remarks: Flow is regularly connected to both watersheds, but it is professional judgment that flow is likely in downstream direction only. The probability of backwater inundation to permit transfer of species into Loomis Lake appears highly unlikely from the Great Lakes. Surcharge of the conduit into Flint Lake will infrequently create a connection, and velocities in the conduit are expected to be high. Flow is very occasionally (less than splitway would impede transfer of ANS upstream from the SIM was pross the dam. The slope and shallow depto if the narrow splitway would impede transfer of ANS upstream from the GLB and up the splitway to Loomis Lake. Flow is regularly connected from Loomis Lake to Flint Lake. The observed drop at the outlet structure from Loomis Lake to Flint Lake. The observed drop at the outlet structure from Loomis Lake to Flint Lake is an impediment to adult ANS upstream from Flint Lake into Loomis Lake. The observed drop at the outlet structure from Loomis Lake to Flint Lake is a normal substream from Flint Lake into Loomis Lake and a cable what flow combuted in the ANS into Loomis Lake and the advited at the outlet structure from Loomis Lake into Loomis Lake and a cable what flow combuted in the attack flow date revel flow computations by K. Lamkin). Agrees in Lake into Loomis Lake into downstream tributaries of the Kanakee River would be sufficiently frequent to establish an occasional connection during spring months, (evel 848 / 11, based on curver flow computations by K. Lamkin). Afree. In addition. * If the Basin boundary were appropriately drawn, the risk would be based on only the northern outlet structure with a low rating for transfer into the MBB. The Basin Boundary shifting the peremial drainage and therefore the watershed for the lake. Flow from the GLB as discharge over the split and a low flow flam. * If the Basin boundary were appropriately drawn, the risk would be based on only the northern outlet structure with a low rating for the Basin Boundary shifting the premilal dr	wis likely in di y unlikely from bected to be hig the dam. The: the dam. The: ke. Flow is regu iment to adult J sublicht of back sisbility to fback sisbility to fback elei Lake Loo northern outle unvert flow coi northern outle the Mississippi th describing th ke. Flow from it of CLB as a dis sfer would be v	yh. Flow is ver Lah h. Flow is ver Lah h. Flow is ver and sha slope and sha slope and sha water innunda mis during co The 3-inch tr a kankakee F mputations b tr structure wi tr structure wi the GLB into L the GLB into L the GLB into L the GLB into L	rection only. ees. Surcharge ees. Surcharge ed from Loom a upstream from Loom notitions of pir tition from Filin notitions of pir tition from Filin notitions of pir tition from Lankin, b th a low rating th a low rating the connection o comis Lake (MRB). This r to the connection o to the connection o	y. The arge of the ally (less than of the narrow pomis Lake to r from Flint Flint Lake to f pipe full flow is not an ble sufficiently J. Agree. In titing for See Section 1.3 nically shifted his rating has on of Loomis ce (MRB) over y at Profifits

L	omis Lake	Loomis Lake, Porter County, IN - Parasitic Copepod (Neoergasilus japonicus	is japonicus)
2. Probability of ANS occurring within either basin	occurring \	within either basin	
Aquatic Pathway Team	eam	Expertise Position title or team role Rating	Certainty
		USACE, Louisville - Biologist High	RC
		USACE, Louisville - Biologist High	RC
		USACE, Detroit - Biologist Medium	MC
		NRCS - Biologist Medium	RC
		Indiana DNR - AIS Coordinator Medium	RC
		Team Rating Medium	RC
2. How do you rate the probability of	robability o	ANS occuring within either basin?	
Qualitative Rating	Qualitative		
High	Target ANS exist within 20 years.	Target ANS exists on connected waterways in close enough proximity to be capable of moving to the aquatic pathway within 20 years.	able of moving to the aquatic pathway
Medium	Target ANS e moving to th	Target ANS exists on connected waterways, but based on current proximity and mobility, is considered incapable of moving to the aquatic pathway within 20 years.	mobility, is considered incapable of
Low	Target ANS is	s not known to exist on a connected waterway.	
	Symbol		
Very Certain	VC	As certain as I am going to get.	
Reasonably Certain	RC	Reasonably certain.	
Moderately Certain	MC	More certain than not.	
Reasonably Uncertain	RU	Reasonably uncertain	
Very Uncertain	٨U	A guess	
Remarks: The parasitic copepod has a life minnow, sunfish, and catfish families, and (Hudson and Bowen, 2002). Females can and is likely found throughout the Great L Lake from Lake Michigan. While other hos host species because of the life cycle capal parasitic copepod and a necessary host sp upstream. The literature indicates that th Therefore, the parasitic copepod may be r	pod has a life families, and Females can ut the Great L hile other ho life cycle capa essary host sp essary host sp licates that th licates that th	Remarks: The parasitic copepod has a life cycle in which the female adopts a parasitic phase on several fish species, including members of the minnow, sunfish, and catfish families, and potentially other fish species. The common carp (Cyprinus carpio) is a frequent host of this parasite (Hudson and Bowen, 2002). Females can detach and re-attach to host species. The invasive copepod has been detected in Lake Huron and Lake Erie, and is likely found throughout the Great Lakes. The common carp is established in Lake Michigan as well as the rivers and streams leading to Loomis Lake from Lake Michigan. While other host fish species are known to exist in the pathway system, the common carp was selected as the most likely host species because of the life cycle capabilities of the common carp and the likelihood it would use, and survive within, the pathway habitats. The parasitic copepod and a necessary host species are in the Great Lakes Basin. The males are free living but do not have the capability of migration upstream. The literature indicates that the parasitic copepod is small and relatively easy to miss in field surveys, even by trained biologists. Therefore, the parasitic copepod may be much more prevalent than the distribution maps depict.	species, including members of the is a frequent host of this parasite en detected in Lake Huron and Lake Erie, the rivers and streams leading to Loomis ion carp was selected as the most likely rvive within, the pathway habitats. The not have the capability of migration eys, even by trained biologists.

P	omis Lake	Loomis Lake, Porter County, IN - Parasitic Copepod (Neoergasilus japonicus	gasilus j	aponicus		
3. Probability of ANS :	surviving t	3. Probability of ANS surviving transit to aquatic pathway				
Aquatic Pathway Team	eam	Expertise 3A R Position title or team role	3A Rating	Certainty	3B Rating	Certainty
		USACE, Louisville - Biologist Lo	Low	VC	Medium	RC
		USACE, Louisville - Biologist Lo	Low	RC	Medium	RC
		USACE, Detroit - Biologist Lo	Low	MC	Low	MC
		NRCS - Biologist Lo	Low	VC	Medium	MC
		Indiana DNR - AIS Coordinator	Low	VC	Medium	MC
		Team Ratings Lo	Low	VC		
3A. How do you rate the	probability	3A. How do you rate the probability of ANS surviving transit to aquatic pathway through connecting streams?	onnectin	g streams?		
3B. How do you rate the p	probability	3B. How do you rate the probability of ANS surviving transit to aquatic pathway through other means?	her mea	ns?		
Qualitative Rating	Qualitative	Qualitative Rating Category Criteria				
	Target ANS a	Target ANS are established in relatively close proximity to location and have ample opportunity, capability and	ive ample	opportunity,	capability and	
High	motivation t pathwav wit	motivation to successfully navigate through the aquatic pathway and/or through other means to arrive at the subject pathway within 10-20 vears.	chrough ot	her means to	arrive at the s	subject
Medium	Target ANS a	Target ANS are established at locations in close enough proximity to location and have limited capability to survive passage through the aquatic pathway or through other means to arrive at the subject pathway within 20-50 years.	ion and h	ave limited ca	apability to sur vithin 20-50 ye	vive ars.
Low	Target ANS a locations by	Target ANS are not in proximity to the pathway, and/or it is highly unlikely that they could survive transit from current locations by aquatic pathway or other means to arrive at subject pathway within next 50 years.	y that they within ne	y could surviv ext 50 years.	e transit from	current
	Symbol					
Very Certain	, VC	As certain as I am going to get.				
Reasonably Certain	RC	Reasonably certain.				
Moderately Certain	MC	More certain than not.				
Reasonably Uncertain	RU	Reasonably uncertain				
Very Uncertain	ΝU	A guess				
Remarks: 3A. Probability of ,	ANS Survivin	Remarks: 3A. Probability of ANS Surviving Transit to Aquatic Pathway Through Connecting Streams.				
The common carp is being u: to reach the Mississippi Rive the Proffitts Dam at the head the dam, back flooding and s	sed as the su r Basin throu d of Damon F subsequent c	The common carp is being used as the surrogate species (potential host) for the parasitic copepod for the evaluation of the likelihood of the copepod to reach the Mississippi River Basin through the Loomis Lake aquatic pathway. The only obstruction for a potential host fish to reach Loomis Lake is the Proffitts Dam at the head of Damon Run. As there is an approximate 17-foot elevation difference between the bed of Damon Run and the top of the dam, back flooding and subsequent overtopping of the dam into Loomis Lake would be highly unlikely. Accordingly, a rating of low was assigned.	the evalua or a poten between i kely. Acco	ation of the li tial host fish the bed of Da ordingly, a ra	kelihood of th to reach Loom mon Run and ting of low was	e copepod s Lake is the top of assigned.
Remarks: 3B. Probability of <i>i</i>	ANS Survivin	kemarks: 3B. Probability of ANS Surviving Transit to Aquatic Pathway Through Other Means				
It is likely that most of the Al	NS of concern	It is likely that most of the ANS of concern could become established in, and spread from Loomis Lake if they were introduced from sources such as	if they we	re introduce	d from sources	such as
aquaculture operations or ex and anthropogenic sources. evaluation. One reason mos	xotic pet trad Loomis and st invasive sp	aquaculture operations or exotic pet trade, bait bucket transfer, eco-terrorism, bilge releases, contaminated tackle, wading birds, and other natural and anthropogenic sources. Loomis and Flint Lakes provide a variety of habitat types that are suitable for most of the ANS considered in this evaluation. One reason most invasive species are successful is the fact that they are able to survive and reproduce in a wide range of environmental	inated tac for most nd reprodu	kle, wading t of the ANS co uce in a wide	virds, and othe Insidered in th range of envir	r natural is onmental
conditions. The motivation for anthropoge detrimental impacts of ANS and how to pre recreational use of the Valparaiso Lakes, in to it their location along the basin divide.	for anthropo and how to p araiso Lakes, basin divide.	conditions. The motivation for anthropogenic introductions range from accidental to intentional and malicious. Public education regarding the detrimental impacts of ANS and how to prevent their spread are likely the best tools to prevent anthropogenic transfer from occurring. The recreational use of the Valparaiso Lakes, including Loomis and Flint Lakes, poses some residual risk associated with the interbasin transfer of ANS due to it their location along the basin divide. The residual risk of ANS transfer by such "other means" did not influence the overall pathway viability contaction along the basin divide. The residual risk of ANS transfer by such "other means" did not influence the overall pathway viability contaction along the basin divide.	malicious. ppogenic t sociated w not influe	Public educ: ransfer from /ith the interh nce the over	ation regardin occurring. The basin transfer c all pathway via	g the e of ANS due bility
ו מנוווט דמעפי דמ	шмау керо	-				

Ľ	Loomis Lake, Porter	, Porter County, IN - Parasitic Copepod (Neoergasilus japonicus)
4. Probability of ANS	establishi	Probability of ANS establishing in proximity to the aquatic pathway
Aquatic Pathway Team	Team	Expertise Position title or team role Rating Certainty
		USACE, Louisville - Biologist
		USACE, Louisville - Biologist
		USACE, Detroit - Biologist
		NRCS - Biologist
		Indiana DNR - AIS Coordinator
		Team Ratings
4. How do you rate the p	probability c	How do you rate the probability of ANS establishing in proximity of the aquatic pathway?
Oualitative Rating	Qualitative	Qualitative Rating Category Criteria
	Sources of fo	Sources of food and habitat suitable to the ANS are plentiful in close proximity to support all life stages from birth to
High	adult, abioti	adult, abiotic conditions align with native range and there are no known predators or conditions that would significantly
	impede surv	impede survivability or reproduction.
Medium	Limited and conditions a be expected	Limited and disconnected areas and sources of food and habitat suitable to the ANS are available in proximity, abiotic conditions are within latitude limits of native range, but only a portion of the healthy individuals arriving at location can be expected to effectively compete and survive.
Low	Habitat and ablotic cor limited availability hab competition with nativ	Habitat and ablotic conditions in proximity are outside the range where ANS has been known to survive; there is very limited availability habitat area suitable for ANS cover, sustainable food supply and reproduction; or native predators or competition with native species would likely prevent establishment of a sustainable population.
	Symbol	
Very Certain	VC	As certain as I am going to get.
Reasonably Certain	RC	Reasonably certain.
Moderately Certain	MC	More certain than not.
Reasonably Uncertain	RU	Reasonably uncertain
Very Uncertain	٧U	A guess
Remarks: Species-specific r Loomis Lake would be able	atings for this to survive tra	Remarks: Species-specific ratings for this section were not completed because the ratings for the likelihood that any of the ANS of concern for Loomis Lake would be able to survive transit from their current locations in either basin to the pathway were all low (Step 3).

Γo	Loomis Lake, Porter	Porter County, IN - Parasitic Copepod (Neoergasilus japonicus)
5. Probability of ANS spreading across	spreading	
Aquatic Pathway Team	「eam	Expertise Position title or team role Rating Certainty
		USACE, Louisville - Biologist
		USACE, Louisville - Biologist
		USACE, Detroit - Biologist
		NRCS - Biologist
		Indiana DNR - AIS Coordinator
		Team Ratings
5. How do you rate the probability of ANS spr	robability c	ANS spreading across aquatic pathway into the new basin?
Qualitative Rating	Qualitative	Qualitative Rating Category Criteria
	Sources of fo	Sources of food and habitat suitable to the ANS are available, and the species has demonstrated capabilities to
ырн	significantly	significantly expand range from locations where initially introduced.
Medium	There are limited sourc significant distances be	There are limited sources of food and suitable habitat, and/or the species has demonstrated limited ability to spread significant distances beyond areas where it has been introduced.
Low	There are se to spread be	There are severely limited sources of food and suitable habitat, and/or the species has demonstrated very limited ability to spread beyond areas where it has been introduced.
	Symbol	
Very Certain	VC	As certain as I am going to get.
Reasonably Certain	RC	Reasonably certain.
Moderately Certain	MC	More certain than not.
Reasonably Uncertain	RU	Reasonably uncertain
Very Uncertain	ΛU	A guess
Remarks: Species-specific ra Loomis Lake would be able t	tings for this to survive tra	Remarks: Species-specific ratings for this section were not completed because the ratings for the likelihood that any of the ANS of concern for Loomis Lake would be able to survive transit from their current locations in either basin to the pathway were all low (Step 3).

1. Probability of aquatic pathway existence Aquatic Pathway Team Aquatic Pathway Team Pack USAC USAC 1. How do you rate the likelihood of the existence of a location where untreated surface water flow across the storm up to the 1% annual return frequency storm. Aligh Perennial streams and wetla streams and wetla here of a location where rating	atic pathwa	atic pathway existence				
Aquatic Pathway Aquatic Pathway 1. How do you rate the lik location where untreated s storm up to the 1% annual Aligh	ŀ					
 How do you rate the like location where untreated is storm up to the 1% annual Qualitative Rating High 	leam	Expertise Position title or team role	Rating Flow into GLB	Certainty	Rating Flow into MRB	Certainty
 How do you rate the likk location where untreated s storm up to the 1% annual Qualitative Rating High 		USACE, Detroit - Hydraulic Engineer	Medium	RC	Low	RC
 How do you rate the like location where untreated s storm up to the 1% annual Qualitative Rating High 		USACE, Louisville - Hydraulic Engineer	Low	VC	Low	RC
 How do you rate the like location where untreated s storm up to the 1% annual Qualitative Rating High 		USGS - Hydrologist	Low	RC	Low	RC
 How do you rate the like location where untreated s storm up to the 1% annual Qualitative Rating High 		Indiana DNR - Engineering Geologist	Medium	RC	Low	VC
1. How do you rate the like location where untreated s storm up to the 1% annual Oualitative Rating High		Team Ratings	Medium	RC	Low	VC
iocation writere untreated s storm up to the 1% annual Qualitative Rating High	elihood of the	1. How do you rate the likelihood of the existence of a viable aquatic pathway at the subject location? Assume a viable aquatic pathway is any	location? Assu	ime a viable a	aquatic pathw	ay is any
Qualitative Rating High	surrace water return freque	location where untreated surface water flow across the givide is geemed likely to occur and connect neadwater streams in both basins from any storm up to the 1% annual return frequency storm.	connect neadw	ater streams	in doth dasing	s trom any
High	Qualitative	Qualitative Rating Category Criteria				
	Perennial stra	Perennial streams and wetlands or intermittent stream known/documented to convey significant volumes of water across the basin divide for daws to weeks multiple times per vear	umented to cor	wey significar	it volumes of v	water
	Intermittent	Intermittent stream capable of maintaining a surface water connection to streams on both sides of the basin divide	tion to streams	on both sides	of the basin d	livide
Medium	continuously which maints	continuously for multiple days from a 10% annual return frequency storm; or, location of wetland spanning basin which maintains applicant points that are likely to become inter connected and connect with streams on both sides of the becide data of some a non-stream frequency and	storm; or, loca nnected and cc	tion of wetlar nnect with st	nd spanning ba reams on both	isin divide 1 sides of
	the basin div.	the basin divide from a 10% annual return frequency storm.		:		
Low	from larger th	intermittent stream or marsh forming a surrace water connection between streams on either sloe of the basin divide from larger than a 1.0% annual return frequency storm.	etween stream	s on either sic	te of the basin	aivide
	Symbol					
Very Certain	VC	As certain as I am going to get.				
Reasonably Certain	RC	Reasonably certain.				
Moderately Certain	MC	More certain than not.				
Reasonably Uncertain	RU	Reasonably uncertain				
Very Uncertain	٧U	A guess				
vey oncertaint Remarks: Flow is regularly connected to both watersheds, but it i probability of backwater inundation to permit transfer of species conduit into Flint Lake will infrequently create a connection, and 1% frequency) connected from Loomis Lake to Damon Run tribut spillway would impede transfer of ANS upstream from the GLB at Flint Lake. The observed drop at the outlet structure from Loomi Lake into Loomis Lake, making it a low probability connection fro permit transfer of ANS into Loomis Lake appears highly unlikely e conditions necessary to achieve that flow could happen only und impediment to ANS transfer except for larger adult carp. Flow fro frequent to establish an occasional connection during spring mor addition. [*] If the Basin boundary were appropriately drawn, the i transfer into the MRB. and 2.3 of the attached report. Loomis Lake is a man-made lake the Profitts Dam is highly unlikely, therefore a Low rating (VC). Dam is intermittent and therefore the H& H rating will be Mediu structure and pipe for the perennial discharge from Loomis Lake.	connected to b indation to pe frequently or om Loomis Lal isfer of ANS ur op at the outle ing it a low pro- toomis Lake a lieve that flow a lieve that flow a lieve that flow a dary were apl ort. Loomis La a preperentia of the actual flu in vie the dam in lievie the H& refore the H& erennial disch	We process the sequency connected to both watersheds, but it is professional judgment that flow is likely in downstream direction only. The probability of backwater inundation to permit transfer of species into Loomis Lake appears highly unlikely from the Great Lakes. Surchange of the conduit into Flint Lake will infrequently connected from noomis Lake to Brill way across the dam. The slope and shallow depth of the narrow spillway would impede transfer of ANS upstream from the fund take into Loomis Lake to Brill way across the dam. The slope and shallow depth of the narrow spillway would impede transfer of ANS upstream from the GLB and up the spillway across the dam. The slope and shallow depth of the narrow spillway bound impede transfer of ANS upstream from the GLB and up the spillway stores the dam. The slope and shallow depth of the narrow spillway would impede transfer of ANS into Loomis Lake to Damis Lake to Flint Lake. The observed dop at the outlet structure from Loomis Lake to Flint Lake. The observed dop at the outlet structure from Loomis Lake to Flint Lake. The observed dop at the outlet structure from Loomis Lake to Flint Lake. The observed dop at the outlet structure from Loomis Lake to MBB to the GLB. The possibility of backwater inundation from Flint Lake into Loomis Lake and the spillway connection from the MBB to the Carability and the spillway to Loomis Lake to ANS intransfer screep for larger autor from the KBB to the CAR Towis regulary connection from the MB to the CAR Towis regulary connection from the MB to the CAR Towis regulary connection from the MB to the CAR Towis regulary connection from the GLB and and 2.3 of the attracker except for larger and therefore the watershed to the lake into dowis Lake to the CAR Towis the attracker except for larger and the section to the connection of noomis Lake to the CAR the attracker except for attracker the watershed for the lake into dowis the decades ago technically shifted the Basin Boundary. Were Basin Boundary, shifting the peremital drainge s	vow is likely in diversifiely from sected to be hit the dam. The: the dam. The: the adml. the adml. the adml to adult to adult of back sessifiely of back sessifiely of back assiming to flack the tar adml. the target adml. the target adml the target adml the target adml to the Mississipili ke. Flow from the target adml the target adm	with the Great Lal the Great Lal h. Flow is vera larly connect slope and sha allarly connect MNS swimmin mis during co mis during co mis during co mis during co the Kankake F mputations b the Stankake F state decade pi River Basin the GLB into I the I the GLB into I the GLB i	rection only. (es. Surcharge (es. Surcharge y occasionally llow depth of ed from Loom g upstream frr uption from Filin nditions of pir ash rack is no Wer would be 'Wr Lamkin). A tha a low rating tha a low rating See is ago technica (MRB). This r (MRB). This to comection o oomis Lake (M	 y. The arge of the arge of the arge of the ally (less than of the narrow bomis Lake to n from Flint Lake to finite functant of a see Section 1.3 Agree. In titing for nically shifted his rating has on of Loomis an of Loomis an ecting drop heating drop heating drop

	Loomis Lake,	e, Porter County, IN - Viral Hemorrhagic Septicemia virus (VHSv)	cemia vin	us (VHSv)
2. Probability of ANS occurring wit	occurring v	within either basin		
Aquatic Pathway Team	Feam	Expertise Position title or team role	Rating	Certainty
		USACE, Louisville - Biologist	High	VC
		USACE, Louisville - Biologist	High	VC
		USACE, Detroit - Biologist	High	RC
		NRCS - Biologist	Medium	VC
		Indiana DNR - AIS Coordinator	Medium	AC VC
		Team Rating	High	VC
2. How do you rate the p	robability o	How do you rate the probability of ANS occuring within either basin?		
Qualitative Rating	Qualitative	Qualitative Rating Category Criteria		
High	Target ANS exist within 20 years.	xists on connected waterways in close enough proximity to be capable of moving to the aquatic pathway ars.	be capable	of moving to the aquatic pathway
Medium	Target ANS exist moving to the a	Target ANS exists on connected waterways, but based on current proximity and mobility, is considered incapable of moving to the aquatic pathway within 20 years.	nity and mo	bility, is considered incapable of
Low	Target ANS is	Target ANS is not known to exist on a connected waterway.		
	Symbol			
Very Certain	VC	As certain as I am going to get.		
Reasonably Certain	RC	Reasonably certain.		
Moderately Certain	MC	More certain than not.		
Reasonably Uncertain	RU	Reasonably uncertain		
Very Uncertain	٨U	A guess		
Remarks: Viral Hemorrhagit internal pathology, includinç virus. Seemingly healthy inc al., 2005). This virus has be many species of fish includir Lake from Lake Michigan. M host species because of the habitats. Viral Hemorrhagic	c Septicemia v g death of the lividuals that en reported fr ng common ca Vhile other hc life cycle capa Septicemia (v	Remarks: Viral Hemorrhagic Septicemia virus (Novirhabdovirus sp) can infect a wide range of host fish species causing a variety of external and internal pathology, including death of the host fish. Variables such as the species of host fish and water temperature can impact the pathology of the virus. Seemingly healthy individuals that have been previously infected with VHSv can have chronic infections and be carriers of the disease (Skall et al., 2005). This virus has been reported from throughout the Great Lakes Basin (USGS, 2011). Viral Hemorrhagic Septicemia (VHSv) has been found in many species of fish including common carp. The common carp is established in Lake Michigan, as well as the rivers and streams leading to Loomis Lake from Lake Michigan. While other host fish species are known to exist in the pathway system, the common carp was selected as the most likely host species because of the life cycle capabilities of the common carp and the likelihood the common carp would use and survive in the pathway habitats. Viral Hemorrhagic Septicemia (VHSv) and a necessary host species are both within the Great Lakes Basin.	sh species c iter temper: infections a Hemorrhagit vell as the ri ne common n carp woul at Lakes Bas	ausing a variety of external and ature can impact the pathology of th nd be carriers of the disease (Skall e Septicemia (VHSv) has been found vers and streams leading to Loomis carp was selected as the most likely d use and survive in the pathway tin.

	omis Lak	coomis Lake, Porter County, IN - Viral Hemorrhagic Septicemia virus (VHSv)	emia vir	(VHSV) sn.		
3. Probability of ANS	surviving t	3. Probability of ANS surviving transit to aquatic pathway				
Aquatic Pathway Team	Feam	Expertise 3A Position title or team role	3A Rating	Certainty	3B Rating	Certainty
		USACE, Louisville - Biologist	Low	VC	Medium	RC
		USACE, Louisville - Biologist	Low	RC	Medium	RC
		USACE, Detroit - Biologist	Low	RC	Medium	RC
		NRCS - Biologist	Low	VC	Medium	RC
		Indiana DNR - AIS Coordinator	Low	VC	Medium	RC
		Team Ratings I	Low	VC		
3A. How do you rate the	probability	3A. How do you rate the probability of ANS surviving transit to aquatic pathway through connecting streams?	connectin	g streams?		
3B. How do you rate the p	probability (3B. How do you rate the probability of ANS surviving transit to aquatic pathway through other means?	ther mea	ns?		
Qualitative Rating	Qualitative	Qualitative Rating Category Criteria				
	Target ANS a	Target ANS are established in relatively close proximity to location and have ample opportunity, capability and	ave ample	opportunity,	capability and	
High	motivation to pathway wit	motivation to successfully navigate through the aquatic pathway and/or through other means to arrive at the subject pathway within 10-20 years.	through o	ther means to	o arrive at the	subject
Medium	Target ANS a passage thro	Target ANS are established at locations in close enough proximity to location and have limited capability to survive passage through the aquatic pathway or through other means to arrive at the subject pathway within 20-50 years.	ation and h at the subje	ave limited c ect pathway v	apability to sur vithin 20-50 ye	vive ars.
Low	Target ANS a locations by	Target ANS are not in proximity to the pathway, and/or it is highly unlikely that they could survive transit from current locations by aquatic pathway or other means to arrive at subject pathway within next 50 years.	ly that the y within ne	y could surviv ext 50 years.	/e transit from	current
	Symbol					
Very Certain	VC	As certain as I am going to get.				
Reasonably Certain	RC	Reasonably certain.				
Moderately Certain	MC	More certain than not.				
Reasonably Uncertain	RU	Reasonably uncertain				
Very Uncertain	ΠΛ	A guess				
Remarks: 3A. Probability of	ANS Survivin	Remarks: 3A. Probability of ANS Surviving Transit to Aquatic Pathway Through Connecting Streams.				
The common carp is also bei the Mississippi River Basin th Profifits Dam at the head of dam, back flooding and subs	ng used as th rrough the Lc Damon Run. sequent over	The common carp is also being used as the surrogate species (potential host) for VHSv for the evaluation of the likelihood of this pathogen to reach the Mississippi River Basin through the Loomis Lake aquatic pathway. The only obstruction for a potential host fish to reach Loomis Lake is the Proffitts Dam at the head of Damon Run. As there is an approximate 17-foot elevation difference between the bed of Damon Run and the top of the dam, back flooding and subsequent overtopping of the dam into Loomis Lake would be highly unlikely. Accordingly, a rating of low was assigned.	tion of the ential host tween the y. Accordi	likelihood of fish to reach bed of Damo ngly, a rating	this pathogen Loomis Lake is n Run and the of Iow was as:	to reach the top of the signed.
Remarks: 3B. Probability of	ANS Surviving	Remarks: 3B. Probability of ANS Surviving Transit to Aquatic Pathway Through Other Means				
It is likely that most of the Al	NS of concerr	It is likely that most of the ANS of concern could become established in, and spread from Loomis Lake if they were introduced from sources such as	if they we	ere introduce	d from sources	such as
aquaculture operations or e) and anthropogenic sources. evaluation. One reason mos	xotic pet trad Loomis and st invasive sp	aquaculture operations or exotic pet trade, bait bucket transfer, eco-terrorism, bilge releases, contaminated tackle, wading birds, and other natural and anthropogenic sources. Loomis and Flint Lakes provide a variety of habitat types that are suitable for most of the ANS considered in this evaluation. One reason most invasive species are successful is the fact that they are able to survive and reproduce in a wide range of environmental	ninated tac e for most ind reprodi	:kle, wading t of the ANS co uce in a wide	birds, and othe phytered in th range of envir	r natural is onmental
conditions. The motivation I detrimental impacts of ANS is recreational use of the Valps to it their location along the	for anthropo and how to p araiso Lakes, basin divide.	conditions. The motivation for anthropogenic introductions range from accidental to intentional and malicious. Public education regarding the detrimental impacts of ANS and how to prevent their spread are likely the best tools to prevent anthropogenic transfer from occurring. The recreational use of the Valparaiso Lakes, including Loomis and Flint Lakes, poses some residual risk associated with the interbasin transfer of ANS due to it their location along the basin divide. The residual risk of ANS transfer by such "other means" did not influence the overall pathway viability	I malicious opogenic 1 ssociated w 1 not influe	Public educ ransfer from vith the interl nce the over	ation regardin occurring. Th oasin transfer (all pathway via	g the e of ANS due bility
rating in this Loomis Lake Pathway Report.	ithway Repor	ţ.				

	Loomis Lake, Porte	،, Porter County, IN - Viral Hemorrhagic Septicemia virus (VHSv)
4. Probability of ANS	establishi	Probability of ANS establishing in proximity to the aquatic pathway
Aquatic Pathway Team	Team	Expertise Position title or team role Rating Certainty
		USACE, Louisville - Biologist
		USACE, Louisville - Biologist
		USACE, Detroit - Biologist
		NRCS - Biologist
		Indiana DNR - AIS Coordinator
		Team Ratings
4. How do you rate the probability of ANS est	probability c	f ANS establishing in proximity of the aquatic pathway?
Qualitative Rating	Qualitative	Qualitative Rating Category Criteria
	Sources of fo	Sources of food and habitat suitable to the ANS are plentiful in close proximity to support all life stages from birth to
High	adult, abiotio	adult, abiotic conditions align with native range and there are no known predators or conditions that would significantly
	impede surv	impede survivability or reproduction.
Medium	Limited and conditions a be expected	Limited and disconnected areas and sources of food and habitat suitable to the ANS are available in proximity, abiotic conditions are within latitude limits of native range, but only a portion of the healthy individuals arriving at location can be expected to effectively compete and survive.
	Hahitat and	Habitat and abiotic conditions in provimity are dutside the rande where ANS has been known to survive: there is very
Low	limited avail competition	limited availability habitat area suitable for ANS cover, sustainable food supply and reproduction; or native predators or competition with native species would likely prevent establishment of a sustainable population.
	Symbol	
Very Certain	VC	As certain as I am going to get.
Reasonably Certain	RC	Reasonably certain.
Moderately Certain	MC	More certain than not.
Reasonably Uncertain	RU	Reasonably uncertain
Very Uncertain	٧U	A guess
Remarks: Species-specific ratings for this section w Loomis Lake would be able to survive transit from t	atings for this to survive tra	Remarks: Species-specific ratings for this section were not completed because the ratings for the likelihood that any of the ANS of concern for Loomis Lake would be able to survive transit from their current locations in either basin to the pathway were all low (Step 3).

	omis Lak	Loomis Lake, Porter County, IN - Viral Hemorrhagic Septicemia virus (VHSv)
5. Probability of ANS spreading across	spreading	across aquatic pathway into the new basin
Aquatic Pathway Team	eam	Expertise Position title or team role Rating Certainty
		USACE, Louisville - Biologist
		USACE, Louisville - Biologist
		USACE, Detroit - Biologist
		NRCS - Biologist
		Indiana DNR - AIS Coordinator
		Team Ratings
5. How do you rate the probability of ANS spr	robability c	ANS spreading across aquatic pathway into the new basin?
Qualitative Rating	Qualitative	Qualitative Rating Category Criteria
	Sources of fo	Sources of food and habitat suitable to the ANS are available, and the species has demonstrated capabilities to
шдп	significantly	significantly expand range from locations where initially introduced.
Medium	There are limited sourc significant distances be	There are limited sources of food and suitable habitat, and/or the species has demonstrated limited ability to spread significant distances beyond areas where it has been introduced.
Low	There are se to spread be	There are severely limited sources of food and suitable habitat, and/or the species has demonstrated very limited ability to spread beyond areas where it has been introduced.
	Symbol	
Very Certain	VC	As certain as I am going to get.
Reasonably Certain	RC	Reasonably certain.
Moderately Certain	MC	More certain than not.
Reasonably Uncertain	RU	Reasonably uncertain
Very Uncertain	٧U	A guess
Remarks: Species-specific ra Loomis Lake would be able	tings for this o survive tra	Remarks: Species-specific ratings for this section were not completed because the ratings for the likelihood that any of the ANS of concern for Loomis Lake would be able to survive transit from their current locations in either basin to the pathway were all low (Step 3).

1. Probability of aquatic pathway existence Aquatic Pathway Team Aquatic Pathway Team P Aquatic Pathway Team B Aquatic Pathway Team P I. How do you rate the likelihood of the existence of a location where untreaded surface water flow across the storm up to the 1% annual return frequency storm. Oualitative Rating Oualitative Rating Categor High Perennial streams and wetla the maintain signame and wetla the basin divide for days to vintiously for multiple day to vintionate the maintain signame and wetla the basin divide for and 10% annual return the acting the basin divide for and 10% annual return the acting the basin divide for and 10% annual return the acting the basin divide for and 10% annual return the acting the basin divide for and 10% annual return the acting the basin divide for and 10% annual return the acting the basin divide for and 10% annual return the acting the basin divide for and 20% annual return the acting the basin divide for and 20% annual return the acting the basin divide for and 20% annual return the acting the basin divide for and 20% annual return the acting the basin divide for and 20% annual return the acting the basin divide for and 20% annual return to basin the basin divide for and 20% annual return the acting the basin divide for and 20% annual return to basin the basin divide for and 20% annual return the acting the basin divide for and 20% annual return the acting the basin divide for and 20% annual return the acting the basin divide for and 20% annual return the acting the basin divide for and 20% annual return the acting the basin divide for and 20% annual return the acting the basin divide for and 20% annual return the basin divide for and 20% annual return	1. Probability or aquatic pathway sexistence Expertise Rating flow Rating flow Aquatic Pathway Team Expertise Rating flow Certainty Rating flow Aquatic Pathway Team USACE. Detroit - Hydraulic Engineer Medium RC Low RC USACE. Louisville - Hydraulic Engineer Medium RC Low RC RC USACE. Louisville - Hydraulic Engineer Medium RC Low RC RC I. How do you rate the likelihood of the existence of a viable aquatic pathway at the subject location? Assume a viable aquatic pathway is any tom up to the 1% annual return frequency stom. RC Low VC Oualitative Rating Qualitative Rating Category Criteria Assume a viable aquatic pathway at the subject location? Assume a viable aquatic pathway is any tom up to the 1% annual return frequency stom. NC Low VC Medium RC Low NC Low NC Low NC Mathin RC Low RC Low NC NC NC Mathin RC Low RC Low NC NC NC Mathin RC Low RC Low NC NC NC Mathin RC Low RC Low NC <td< th=""><th>Rating Flow into GLB Medium Low Low Nedium bject location? Assu and connect headwa and connect headwa and connect headwa ter connect of the con recy storm: or, locat ter connected and co ter connected and co ter connected and co</th><th>Certainty Certainty RC VC RC RC RC RC RC RC RC no viable a ater streams i ater streams i on both stlean none of wetlan</th><th>Rating Flow into MRB Llow Llow Llow Llow noth basins in both basins in both basind d spanning basind d spanning basind d spanning basind</th><th>Certainty RC RC RC VC VC VC VC VC VC VC VC Si any from any sindivide</th></td<>	Rating Flow into GLB Medium Low Low Nedium bject location? Assu and connect headwa and connect headwa and connect headwa ter connect of the con recy storm: or, locat ter connected and co ter connected and co ter connected and co	Certainty Certainty RC VC RC RC RC RC RC RC RC no viable a ater streams i ater streams i on both stlean none of wetlan	Rating Flow into MRB Llow Llow Llow Llow noth basins in both basins in both basind d spanning basind d spanning basind d spanning basind	Certainty RC RC RC VC VC VC VC VC VC VC VC Si any from any sindivide
Aquatic Pathway Team 1. How do you rate the likelihood of location where untrated surface with storm up to the 1% annual return free oualitative Rating 1. How do you rate the likelihood of location 1. How do you rate to location 1. How do you rate to location 1. Worly Uncertain	Position title or team role USACE, Louisville - Hydraulic Engineer Use a viable aquatic pathway at the su atter flow across the divide is deemed likely to occur iffequency storm iffative Rating Category Criteria intal streams and wetlands or intermittent stream know asin divide for days to weeks multiple times per year. mittent stream capable of maintaining a surface water or uousity for multiple days from a 10% annual return frequency storm. mittent stream or marsh forming a surface water conner	rearing Frow into GLB Medium bject location? Assu and connect headwo nonection to streams and connected and co ter connected and co ter connected and co	Certainty RC VC RC RC RC RC RC RC RC RC RC RC RC RC RC	rating row into MRB Low Low Low Low in both basins in both basins of the basin d d spanning ba: reams on both reams on both	Certainty RC RC RC VC VC VC VC VC VC VC VC Si Si S
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1. How do you rate the likelihood of location where untreated surface wa storm up to the 1% annual return fre atom up to the 1% annual return fre Qualitative Rating Qualitative Rating Oualitative Rating Internition Prerentia Prerentia Prerentia Preside High Prerentia Prerentia Preside High Prerentia Prerentia Preside High Prerentia Prerentia Preside Very Certain RC Symbol Symbol Very Uncertain Very Uncertain RU Very Uncertain Very Uncertain NU	I of the existence of a viable aquatic pathway at the su water flow across the divide is deemed likely to occur frequency storm. Itative Rating Category Criteria intal streams and wetlands or intermittent stream known asin divide for days to weeks multiple times per year. multiple for days to weeks multiple times per year. Intert stream capable of maintaining a surface water of nously for multiple days from a 10% annual return frequency storm. Intert stream or marsh forming a surface water conner multiple from a 10% annual return frequency storm.	bject location? Assu and connect headwa n/documented to cor nonection to streams hency storm; or, locat ter connected and co ter connected and co ter connected and co	ime a viable a ater streams i nvey significar on both sides on both sides nonect with str	n both basins n both basins nt volumes of v s of the basin d d spanning bas reams on but	ay is any from any vater across inide sin divide sides of the
Activity of the 1% annual return free activity of the 1% annual return free activity of the lasting and the mark of the basing high the basing high the basin diverties of the basin di	Interpret now across the underst ucentred invery to occur frequency storm. Interview Rating Category Critteria Intal streams and wetlands or intermittent stream know asin divide for days to weeks multiple times per year. Intern stream capable of maintaining a surface water or uously for multiple days from a 10% annual return freq maintains significant ponds that are likely to become in divide from a 10% annual return frequency storm.	n/documented to cor n/documented to cor nnection to streams and co ter connected and co tion between stream	are streams the significar new significar on both sides on both sides on either sides on either sides are sides on either side	th volumes of v to the basin d d spanning ba: reams on both	vater across vater across livide sin divide sides of the
atariye coo	Itative Rating Category Criteria Inial streams and wetlands or intermittent stream known asin divide for days to weeks multiple times per year. Inittent stream capable of maintaining a surface water or nuously for multiple days from a 10% annual return freq maintains significant ponds that are likely to become in divide from a 10% annual return frequency storm. Inittent stream or marsh forming a surface water connec than a 1.0% annual return frequency storm.	n/documented to con onnection to streams lency storm: or, locat ter connected and co tion between stream	vey significan on both sides tion of wetlan onnect with str	t volumes of w s of the basin d d spanning ba: reams on both de of the basin	vater across livide sin divide sistes of the
atariy co	inial streams and wetlands or intermittent stream known asin divide for days to weeks multiple times per year. inittent stream capable of maintaining a surface water or nuously for multiple days from a 10% annual return freq in maintains significant ponds that are likely to become in divide from a 10% annual return frequency storm. inittent stream or marsh forming a surface water conner than a 1.0% annual return frequency storm.	n/documented to con nnection to streams uency storm: or, locat ter connected and co ction between stream	They significant on both sides onnect with str annect with str as on either sic	it volumes of w of the basin d d spanning bat reams on both de of the basin	vater across livide sin divide sides of the
arrly co	nittent stream capable of maintaining a surface water co nuously for multiple days from a 10% annual return freq n maintains significant ponds that are likely to become in divide from a 10% annual return frequency storm. nittent stream or marsh forming a surface water conner r than a 1.0% annual return frequency storm.	onnection to streams Lency storm: or, locat ter connected and co tion between stream	on both sides tion of wetlan- nnect with sti ns on either sid	of the basin d d spanning bas reams on both de of the basin	ivide sin divide sides of the
arrly co	mittent stream or marsh forming a surface water connec r than a 1.0% annual return frequency storm.	tion between stream	is on either sic	de of the basin	
In the second se	Indria 1.0% diffual feturin frequency storm.				divide from
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Very Uncertain VU Very Uncertain VU Remarks: Flow is regularly connected	Reasonably uncertain				
Remarks: Flow is regularly connected nerobability of backwarer in inclation t	VU Aguess				
The Ground in the finit Lake will infragramments to comment of frequency) connected from Loomis Lake to Damon spillway would impede transfer of ANS upstream from Flint Lake. The observed drop at the outlet structure fr Lake into Loomis Lake, making it a low probability cont protections Lake, making it a low probability cont protection transfer of ANS into Loomis Lake appears highly conditions necessary to achieve that flow could happen impediment to ANS transfer except for larger adult car frequent to establish an occasional connection during s addition: " If the Basin boundary were appropriately dr into the MRB. 2.3 of the attached report. Loomis Lake is a man-made Basin Boundary, shifting the perennial drainage and the based on knowledge of the actual flow characteristics the Great Lakes Basin vie the dam and spillway (Proffitt Proffitts Dam is highly unlikely, therefore a Low rating intermittent and therefore the H& H rating will be Med and pipe for the perennial discharge from Loomis Lake.	Remarks: Flow is regularly connected to both watersheds, but it is professional judgment that flow is likely in downstream direction only. The probability of backwater inundation to permit transfer of species into Loomis Lake appears highly unlikely from the Great Lakes. Surcharge of the conduit lane texpected to be high. Flow is regularly connected from Loomis Lake to Brind and up the spillway to Loomis Lake. Flow is regularly connected from Loomis Lake to Flint Lake. The observed drop at the outlet structure from Loomis Lake to Flint Lake. The observed drop at the outlet structure from Loomis Lake to Flint Lake. The observed drop at the outlet structure from Loomis Lake to Flint Lake. The observed drop at the outlet structure from Loomis Lake to Flint Lake. The observed drop at the outlet structure from Loomis Lake to Flint Lake. The observed drop at the outlet structure from Loomis Lake to Flint Lake. The observed drop at the outlet structure from Loomis Lake to Flint Lake. The observed drop at the outlet structure from Loomis Lake to Flint Lake. The observed drop at the outlet structure from Loomis Lake to Flint Lake into Loomis Lake to the static structure from Loomis Lake appears fliptify unlikely unkely except under very high water (breaks in Lake Loomis drup and proving the except for larger adult carp. Flow (from Flint Lake into downstream ritbutaries of the Rankakee River would be sufficiently frequent to establish an occasional connection during spring months. (revised 8/5/1, based on culvert flow computations by K. Lamkin). Agree. In impediment to AMS transfer structure from Loomis Lake to Flow Law and the flow computations by K. Lamkin). Agree in the Basin Boundary were appropriately drawn, the risk would be based on only the northern outlet structure with a bar atdition of toomis Lake to the RMS. The Basin Boundary shifting the perennial drainage and therefore the watershed for the lake. Flow from the CBB as a discharge of the canading from thas too the CBB as a discharge over the spingh varing fo	hat flow is likely in dc s highly unlikely from the expected to be hig across the dam. The s mis Lake. Flow is regu- mpediment to adult / the possibility of back the leake levels if at all. leake levels if at all. team tributaries of th ream tributaries of th reation of Loomis Lak up the northern outle if the Mississippi Rin to the Mississippi Rin the describing the intle into GLB as a dischar fer would be very low	wwnstream dii the Great Lak Ip. Flow is wer slope and shal alarly connecti ANS swimming water inunda mis during con mis during con the Kankaken structure wi et structure wi et decades ag ke decades ag ke decades ag ke decades ag ke decades ag ver Basin (MR	ection only. The cestion only. The ces. Surcharge of the ces. Surcharge of the gupstream from Flint tion from Flint Leak to nditons of pipe full flow where would be sufficient ver would be sufficient as track is not an as track is not an tha low rating for transi See Section 1.3 and o technically shifted the B. This rating has beer B. This rating has beer B. This rating has beer bell way at Profifts Dam onnecting drop structur	The of the (less than he narrow is Lake to m Flint Lake to an sufficiently gree. In ifor transfer n 1.3 and hifted the fifts Dam is fifts Dam is structure o structure

Loomis Lake, Porter County, IN - Ruffe	County, II	IN - Ruffe (Gymnochephalus cernuus) / Tubenose Goby (Proterorhinus semilunaris)	ris)
2. Probability of ANS occurring within ei	occurring	within either basin	
Aquatic Pathway Team	Team	Expertise Position title or team role Rating Certainty	
		USACE, Louisville - Biologist High VC VC	
		USACE, Louisville - Biologist High VC High	
		USACE, Detroit - Biologist High VC	
		NRCS - Biologist Medium VC VC	
		Indiana DNR - AIS Coordinator Medium VC VC	
		Team Rating High VC	
2. How do you rate the p	probability o	How do you rate the probability of ANS occuring within either basin?	
Qualitative Rating	Qualitative	Qualitative Rating Category Criteria	
High	Target ANS exist within 20 years.	Target ANS exists on connected waterways in close enough proximity to be capable of moving to the aquatic pathway within 20 years.	/ay
Medium	Target ANS (moving to th	Target ANS exists on connected waterways, but based on current proximity and mobility, is considered incapable of moving to the aquatic pathway within 20 years.	Ļ
Low	Target ANS i	Target ANS is not known to exist on a connected waterway.	
	Symbol		
Very Certain	VC	As certain as I am going to get.	
Reasonably Certain	RC	Reasonably certain.	
Moderately Certain	MC	More certain than not.	
Reasonably Uncertain	RU	Reasonably uncertain	
Very Uncertain	ΛU	A guess	
Remarks: The ruffe and tub entering the Great Lakes, ar reviews and actual fish surve range includes Lake St. Clair and estuaries.	ienose goby a nd the ruffe h ey data have , Erie, Huron,	Remarks: The ruffe and tubenose goby are located within the Great Lakes and associated with river mouths and estuaries of large river systems entering the Great Lakes, and the ruffe has been identified in Lake Superior, the Green Bay portion of Lake Michigan and Lake Huron. Literature reviews and actual fish survey data have not documented the collection of the ruffe in smaller upstream tributaries. The tubenose goby's introduced range includes Lake St. Clair, Erie, Huron, Superior, and Ontario USGS, 2011). It has been collected in the lower reaches of larger Great Lakes rivers and estuaries.	s e duced 'ers

Loomis Lake, Porter	- County, Il	Loomis Lake, Porter County, IN - Ruffe (Gymnochephalus cernuus) / Tubenose Goby (Proterorhinus semilunaris)	enose Goby	(Proteror	hinus semil	unaris)
3. Probability of ANS	surviving t	Probability of ANS surviving transit to aquatic pathway				
Aquatic Pathway Team	Team	Expertise Position title or team role	3A Rating	Certainty	3B Rating	Certainty
		USACE, Louisville - Biologist	Low	VC	Medium	RC
		USACE, Louisville - Biologist	Low	VC	Medium	RC
		USACE, Detroit - Biologist	Low	RC	Low	MC
		NRCS - Biologist	Low	VC	Medium	RC
		Indiana DNR - AIS Coordinator	Low	VC	Medium	RC
		Team Ratings	Low	VC		
3A. How do you rate the	probability	How do you rate the probability of ANS surviving transit to aquatic pathway through connecting streams?	ugh connectir	ig streams?		
3B. How do you rate the	probability	3B. How do you rate the probability of ANS surviving transit to aquatic pathway through other means?	ugh other mea	ins?		
Udalitative Kating High	Target ANS a motivation t	Cuantative Rating Category Citteria Target ANS are established in relatively close proximity to location and have ample opportunity, capability and motivation to successfully navigate through the aquatic pathway and/or through other means to arrive at the subject	and have ampli nd/or through c	e opportunity other means t	', capability an o arrive at th∈	d e subject
Medium	Target ANS &	Target ANS are established at locations in close enough proximity to location and have limited capability to survive passage through the aquatic pathway within 20-50 years.	to location and rrive at the subj	have limited	capability to si within 20-50 y	urvive Iears.
Low	Target ANS ¿ locations by	Target ANS are not in proximity to the pathway, and/or it is highly unlikely that they could survive transit from current locations by aquatic pathway or other means to arrive at subject pathway within next 50 years.	unlikely that th athway within r	ey could survi 1ext 50 years.	ive transit fror	n current
	Crimbol					
- internet		As something and successful to make				
Very vertain Descendbly Contain		As certain as I am going to get.				
Medoratoly Certain		Reasonably certain. Mars contain thes soft				
Moderately Certain		More certain than hot.				
Verv Hnrertain		Neasuriaury uncertaint A miness				
Remarks: 3A. Probability of	ANS Survivin	na Transit to Aquatic Pathway Through Connecting Stree	ams.			
The ruffe prefers deep wate	irs of lakes ar	The ruffe prefers deep waters of lakes and bools of rivers, usually over sand and gravel, but has a tolerance for different habitats and environmental	a tolerance for	- different hat	oitats and envi	ronmental
conditions (Grav and Best 1	1080) The run	conditions (Cravind Best 1980). The order his formative state and consume justice than under the source of the methods and the providence of the source of the	- The ruffe's at	allity to swim	unstream dur	ing high
flow events and migrate ove	er dams is qui	continuors (vialy and best, 1999). The future has a high recurring year and spawns in clean water. The fuere s admity to swith upstream our rule num flow events and migrate over dams is questionable. The fubenose is found in the open waters and estuaries of slow flowing rivers. The fubenose	ind estuaries of	slow flowing	rivers. The tu	ing nign ibenose
goby appears to be more ca Sufficient forage ranging fro the ruffe and tubenose goby	ipable of livin om zooplankt(v in Salt Creel	goby appears to be more capable of living in more diverse types of riverine habitat than the ruffe (Dopazo, et al. 2008; Jude and DeBoe, 1996). Sufficient forage ranging from zooplankton to fish may be available throughout the Great Lakes side of the connection. However, suitable habitat for the ruffe and tubenose onby in Salt Creek may be limited or even nonexistent.	te (Dopazo, et : side of the cor	al, 2008; Jude inection. Hov	and DeBoe, 1 wever, suitable	996). e habitat for
The only obstruction for eitl foot elevation difference be	her of these s tween the be	The only obstruction for either of these species to reach Loomis Lake is the Proffitts Dam at the head of Damon Run. As there is an approximate 17- foot elevation difference between the bed of Damon Run and the top of the dam, back flooding and subsequent overtopping of the dam into Loomis	e head of Damo j and subseque:	in Run. As the nt overtoppir	ere is an appro g of the dam i	iximate 17- nto Loomis
Lake would be highly unlike!	ly. According	Lake would be highly unlikely. Accordingly, a rating of low was assigned.				
Remarks: 3B. Probability of	ANS Survivin	Remarks: 3B. Probability of ANS Surviving Transit to Aquatic Pathway Through Other Means				
It is likely that most of the ANS of concern aquaculture operations or exotic pet trade and anthropogenic sources. Loomis and Fl evaluation. One reason most invasive spec conditions. The motivation for anthropoge detrimental impacts of ANS and how to pri- recreational use of the Valparaiso Lakes, ir due to it their location along the basin divi- rating in this Loomis Lake Pathway Report.	NNS of concer exotic pet trad Loomis and st invasive sp for anthropo and how to f araiso Lakes, g the basin di sthway Repor	It is likely that most of the ANS of concern could become established in, and spread from Loomis Lake if they were introduced from sources such as aquaculture operations or exotic pet trade, bait bucket transfer, eco-terrorism, bilge releases, contaminated tackle, wading birds, and other natural and anthropogenic sources. Loomis and Flint Lakes provide a variety of habitat types that are suitable for most of the ANS considered in this evaluation. One reason most invasive species are successful is the fact that they are able to survive and reproduce in a wide range of environmental conditions. The motivation for anthropogenic introducctions range from accidental to intentional and malicious. Public education regarding the detrimental impacts of ANS and how to prevent their spread are likely the best tools to prevent anthropogenic transfer from occurring. The recreational use of the Valparaiso Lakes, including Loomis and Flint Lakes, poses some residual risk associated with the interbasin transfer of ANS due to it their location along the basin divide. The residual risk of ANS transfer by such "other means" did not influence the overall pathway viability rating in this Loomis Lake Pathway Report.	is Lake if they v contaminated t uultable for mos vive and reprov al and maliciou al anthropogenic risk associated means" did not	vere introduc ackle, wading st of the ANS, duce in a wid, s. Public edu 5 transfer fror with the inte influence the	ed from sourc birds, and ott considered in e range of env cation regardi n occurring. I rbasin transfei overall pathw	es such as her natural this ironmental ng the he r of ANS ray viability

Loomis Lake, Porter	r County, ll	Loomis Lake, Porter County, IN - Ruffe (Gymnochephalus cernuus) / Tubenose Goby (Proterorhinus semilunaris)
4. Probability of ANS	establishi	Probability of ANS establishing in proximity to the aquatic pathway
Aquatic Pathway Team	Team	Expertise Position title or team role Rating Certainty
		USACE, Louisville - Biologist
		USACE, Louisville - Biologist
		USACE, Detroit - Biologist
		NRCS - Biologist
		Indiana DNR - AIS Coordinator
		Team Ratings
4. How do you rate the p	orobability c	How do you rate the probability of ANS establishing in proximity of the aquatic pathway?
Qualitative Rating	Qualitative Rating	Rating Category Criteria
	Sources of fo	Sources of food and habitat suitable to the ANS are plentiful in close proximity to support all life stages from birth to
High	adult, abioti	adult, abiotic conditions align with native range and there are no known predators or conditions that would significantly
	impede surv	impede survivability or reproduction.
Medium	Limited and disconne conditions are within he expected to effect	Limited and disconnected areas and sources of food and habitat suitable to the ANS are available in proximity, abiotic conditions are within latitude limits of native range, but only a portion of the healthy individuals arriving at location can be expected to effectively compete and survive
Low	Habitat and limited avail competition	Habitat and abiotic conditions in proximity are outside the range where ANS has been known to survive; there is very limited availability habitat area suitable for ANS cover, sustainable food supply and reproduction; or native predators or competition with native species would likely prevent establishment of a sustainable population.
	Sumhol	
Very Certain	VC	As certain as I am going to get.
Reasonably Certain	RC	Reasonably certain.
Moderately Certain	MC	More certain than not.
Reasonably Uncertain	RU	Reasonably uncertain
Very Uncertain	٧U	A guess
Remarks: Species-specific r Lake would be able to survi	atings for this ve transit fror	Remarks: Species-specific ratings for this section were not completed because the ratings for the likelihood that any of the ANS of concern for Loomis Lake would be able to survive transit from their current locations in either basin to the pathway were all low (Step 3).

Loomis Lake, Porter	· County, II	Loomis Lake, Porter County, IN - Ruffe (Gymnochephalus cernuus) / Tubenose Goby (Proterorhinus semilunaris)
5. Probability of ANS spreading across	spreading	across aquatic pathway into the new basin
Aquatic Pathway Team	Team	Expertise Position title or team role Rating Certainty
		USACE, Louisville - Biologist
		USACE, Louisville - Biologist
		USACE, Detroit - Biologist
		NRCS - Biologist
		Indiana DNR - AIS Coordinator
		Team Ratings
5. How do you rate the probability of ANS spr	orobability o	f ANS spreading across aquatic pathway into the new basin?
Qualitative Rating	Qualitative	Qualitative Rating Category Criteria
High	Sources of for significantly	Sources of food and habitat suitable to the ANS are available, and the species has demonstrated capabilities to significantly expand range from locations where initially introduced.
Medium	There are lin significant di	There are limited sources of food and suitable habitat, and/or the species has demonstrated limited ability to spread significant distances beyond areas where it has been introduced.
Low	There are sert to spread be	There are severely limited sources of food and suitable habitat, and/or the species has demonstrated very limited ability to spread beyond areas where it has been introduced.
	Symbol	
Very Certain	VC	As certain as I am going to get.
Reasonably Certain	RC	Reasonably certain.
Moderately Certain	MC	More certain than not.
Reasonably Uncertain	RU	Reasonably uncertain
Very Uncertain	٧U	A guess
Remarks: Species-specific ratings for this section w Loomis Lake would be able to survive transit from	atings for this to survive tra	Remarks: Species-specific ratings for this section were not completed because the ratings for the likelihood that any of the ANS of concern for Loomis Lake would be able to survive transit from their current locations in either basin to the pathway were all low (Step 3).

Aquatic Pathway Team Aquatic Pathway Team U U U U U U U U U U U U U U U U U U U	Team					
 How do you rate the like location where untreated s storm up to the 1% annual Qualitative Rating High 		Expertise Position title or team role	Rating Flow into GLB	Certainty	Rating Flow into MRB	Certainty
 How do you rate the like location where untreated s storm up to the 1% annual Oualitative Rating High 		USACE, Detroit - Hydraulic Engineer	Medium	RC	Low	RC
 How do you rate the like location where untreated s storm up to the 1% annual Qualitative Rating High 		USACE, Louisville - Hydraulic Engineer	Low	VC	Low	RC
 How do you rate the like location where untreated s storm up to the 1% annual Qualitative Rating High 		USGS - Hydrologist	Low	RC	Low	RC
 How do you rate the like location where untreated s storm up to the 1% annual Qualitative Rating High 		Indiana DNR - Engineering Geologist	Medium	RC	Low	VC
1. How do you rate the like location where untreated s storm up to the 1% annual Qualitative Rating High		Team Ratings	Medium	RC	Low	VC
storm up to the 1% annual Oualitative Rating High	elihood of the surface water	 How do you rate the likelihood of the existence of a viable aquatic pathway at the subject location? Assume a viable aquatic pathway is any location where untreated surface water flow across the divide is deemed likely to occur and connect headwater streams in both basins from any 	location? Assu connect headw	ime a viable a ater streams	aquatic pathw. in both basins	ay is any s from any
Oualitative Rating High	return freque	ency storm.				
High	Qualitative	Qualitative Rating Category Criteria				
	Perennial str across the ba	Perennial streams and wetlands or intermittent stream known/documented to convey significant volumes of water across the basin divide for davs to weeks multiple times per vear.	umented to cor	rvey significar	it volumes of v	water
	Intermittent	Intermittent stream capable of maintaining a surface water connection to streams on both sides of the basin divide	tion to streams	on both sides	of the basin d	livide
Medium	continuously which maint	continuously for multiple days from a 10% annual return frequency storm; or, location of wetland spanning basin divide which maintains significant ponds that are likely to become inter connected and connect with streams on both sides of	storm; or, loca innected and cc	tion of wetlar	nd spanning ba reams on both	isin divide 1 sides of
	the basin div	the basin divide from a 10% annual return frequency storm.				
Low	Intermittent	Intermittent stream or marsh forming a surface water connection between streams on either side of the basin divide from Jaroer these a 1.0% annual return formions storm.	etween stream	s on either sic	te of the basin	divide
	Symbol					
Very Certain	NC	As certain as I am going to get.				
Reasonably Certain	RC	Reasonably certain.				
Moderately Certain	MC	More certain than not.				
Reasonably Uncertain	RU	Reasonably uncertain				
Very Uncertain	٨U	A guess				
very uncertaint volumeted to both watersheds, but it i probability of backwater inundation to permit transfer of species conduit into Flint Lake will infrequently create a connection, and 1% frequency) connected from Loomis Lake to Damon Run tribut spillway would impede transfer of ANS upstream from the GLB at Flint Lake. The observed drop at the outlet structure from Loomi Lake into Loomis Lake, making it a low probability connection fro permit transfer of ANS upstream from the GLB at flint Lake. The observed drop at the outlet structure from Loomi Lake into Loomis Lake, making it a low probability connection fro permit transfer of ANS into Loomis Lake appears highly unlikely e conditions necessary to achieve that flow could happen only und impediment to establish an occasional connection during spring mor addition. If the Basin boundary were appropriately drawn, the transfer into the MRB. and 2.3 of the attached report. Loomis Lake is a man-made lake the Basin Boundary shifting the perennial drainge and therefort been based on knowledge of the actual flow characteristics as do been based on knowledge of the actual flow characteristics as do the Profifts Dam is highly unlikely, therefore a Low rating (VC). Dam is intermittent and therefore the H& H rating will be Mediu structure and pipe for the perennial discharge from Loomis Lake.	I volume treduction to prime indation to prime or an to comis Lake a comis Lake a lieve that flow ing it a low prime lieve that flow dary were ap adary were ap ort. Loomis Liste a steronis Liste a the perennis or the actual fl in vie the dam in vie the dam in vie the dam in vie the there refore the Hare	We yonce taim the province test to both watersheds, but it is professional judgment that flow is likely in downstream direction only. The probability of backwater inundation to permit transfer of species into Loomis Lake appears highly unlikely from the Great Lakes. Surcharge of the conduit into Flint Lake will infrequently connected for momentation and velocities in the conduit are expected to be high. Flow is very occasionally (less than 1% frequently connected from Loomis Lake to Dario Manage and shallow depth of the narrow will find take. The observed from Loomis Lake to Dario Risk the making it a low probability connection much will be splitly someted from Domis Lake to Dario Risk the making it a low probability connection from the MRB to the GLB. The possibility of Dackwater Intundation from Flint Lake into Loomis Lake. The abserved from Loomis Lake to Dario Risk the Maximing upstream from Take into Loomis Lake and a put Reset the very high water levels in Lake Loomis Lake to Dario Risk than addition. * If the Basin boundary were appropriately drawn, the risk would be based on only the northern outlet structure with a low rating for manafer and 2.3 of the Ranakee River would be sufficiently frequent to establish an occasional connection during spring months. (wested 8.5/11, based on curvet flow computations by K. Lamkin). Agrees. In addition. * If the Basin boundary were appropriately drawn, the risk would be based on only the northern outlet structure with a low rating for transfer into the MRB.	L L L L L L L L L L L L L L L L L L L	ownstream di i the Great Lal In He Great Lal In He Uw is ver Isope and sha allarly connect ANS swimmin, mis during co me taring co the Kankakee F mputations b it structure wi it structure wi pi River Basin e intermitten the GLB into I the GLB into I the GLB into I the GLB into I	rection only. (es. Surcharge (es. Surcharge y occasionally llow depth of ed from Loom motitions of pic anditions of pic anditions of pic anditions of pic anditions of pic tha low rating sea technica (sago technica (sago technica (sago technica (sago technica (sago technica (sago technica) to the connection of the spillway at io the connection	y. The arge of the ally (less than nof the narrow comis lake to n from Flint Flint Lake to f pipe full flow is not an be sufficiently J. Agree. In thing for See Section 1.3 nically shifted his rating has on of Loomis ce (MRB) over y at Profifits necting drop

Loor	nis Lake, P	Loomis Lake, Porter County, IN - Threespine Stickleback (Gasterosteus aculeatus	
2. Probability of ANS occurring within either basin	occurring	within either basin	
Aquatic Pathway Team	Team	Expertise Rating Certainty Contrainty	
		USACE, Louisville - Biologist High VC	
		USACE, Louisville - Biologist High VC	
		USACE, Detroit - Biologist High RC	
		NRCS - Biologist Medium VC	
		Indiana DNR - AIS Coordinator Medium VC	
		Team Rating High VC	
2. How do you rate the p	orobability o	2. How do you rate the probability of ANS occuring within either basin?	
Oualitative Rating	Qualitative	Qualitative Rating Category Criteria	
High	Target ANS exist within 20 years.	Target ANS exists on connected waterways in close enough proximity to be capable of moving to the aquatic pathway within 20 years.	he aquatic pathway
Medium	Target ANS exists on comoving to the aquatic	Target ANS exists on connected waterways, but based on current proximity and mobility, is considered incapable of moving to the aquatic pathway within 20 years.	ered incapable of
Low	Target ANS is	Target ANS is not known to exist on a connected waterway.	
	Symbol		
Very Certain	VC	As certain as I am going to get.	
Reasonably Certain	RC	Reasonably certain.	
Moderately Certain	MC	More certain than not.	
Reasonably Uncertain	RU	Reasonably uncertain	
Very Uncertain	٧U	A guess	
Remarks: The threespine stickl in some inland river systems (U including lakes and large rivers.	ickleback is fr s (USGS, 2011 ers.	Remarks: The threespine stickleback is found in each of the Great Lakes (Lake Ontario HUC 8 records are within native range) and has been collected in some inland river systems (USGS, 2011). Literature indicates this species prefers to live in smaller streams but may occur in a variety of habitat including lakes and large rivers.	and has been collected a variety of habitat

Loon	nis Lake, F	oomis Lake, Porter County, IN - Threespine Stickleback (Gasterosteus aculeatus)	Sasterostei	us aculeati	(sr	
3. Probability of ANS s	surviving t	3. Probability of ANS surviving transit to aquatic pathway				
Aquatic Pathway Team	eam	Expertise Position title or team role	3A Rating	Certainty	3B Rating	Certainty
		USACE, Louisville - Biologist	Low	VC	Medium	RC
		USACE, Louisville - Biologist	Low	VC	Medium	RC
		USACE, Detroit - Biologist	Low	RC	MEdium	RC
		NRCS - Biologist	Low	VC	Medium	RC
		Indiana DNR - AIS Coordinator	Low	VC	Medium	RC
		Team Ratings	Low	VC		
3A. How do you rate the	probability	3A. How do you rate the probability of ANS surviving transit to aquatic pathway through connecting streams?	gh connectin	ig streams?		
3B. How do you rate the p	orobability	3B. How do you rate the probability of ANS surviving transit to aquatic pathway through other means?	h other mea	ns?		
Qualitative Rating	Qualitative	Qualitative Rating Category Criteria				
High	Target ANS a to successfu 10-20 years.	Target ANS are established in relatively close proximity to location and have ample opportunity, capability and motivation to successfully navigate through the aquatic pathway and/or through other means to arrive at the subject pathway within 10-20 years.	d have ample other means	opportunity, to arrive at th	capability and ne subject path	motivation way within
Medium	Target ANS a	Target ANS are established at locations in close enough proximity to location and have limited capability to survive passage through the aquatic pathway within 20-50 years.	location and h ve at the subje	lave limited co	apability to sur vithin 20-50 y∈	vive ears.
Low	Target ANS a locations by	Target ANS are not in proximity to the pathway, and/or it is highly unlikely that they could survive transit from current locations by aquatic pathway or other means to arrive at subject pathway within next 50 years.	likely that the way within ne	y could surviv ext 50 years.	e transit from	current
	Symbol					
Very Certain	VC	As certain as I am going to get.				
Reasonably Certain	RC	Reasonably certain.				
Moderately Certain	MC	More certain than not.				
Reasonably Uncertain	RU	Reasonably uncertain				
Very Uncertain	٨U					
Remarks: 3A. Probability of ANS Surviving Transit to Aqua The only obstruction for this species to reach Loomis Lake difference between the bed of Damon Run and the top of highly unlikely. Accordingly, a rating of low was assigned	ANS Survivin species to re of Damon Ru a rating of Id	Remarks: 34. Probability of ANS Surviving Transit to Aquatic Pathway Through Connecting Streams. The only obstruction for this species to reach Loomis Lake is the Proffitts Dam at the head of Damon Run. As there is an approximate 17-foot elevation difference between the bed of Damon Run and the top of the dam, back flooding and subsequent overtopping of the dam into Loomis Lake would be highly unlikely. Accordingly, a rating of low was assigned.	ns. on Run. As th overtopping o	ere is an appr of the dam ini	oximate 17-fo o Loomis Lake	ot elevation would be
Remarks: 3B. Probability of <i>I</i>	ANS Survivin	38. Probability of ANS Surviving Transit to Aquatic Pathway Through Other Means				
It is likely that most of the Ar aquaculture operations or ex and anthropogenic sources.	VS of concerr cotic pet trac Loomis and	It is likely that most of the ANS of concern could become established in, and spread from Loomis Lake if they were introduced from sources such as aquaculture operations or exotic pet trade, bait bucket transfer, eco-terrorism, bilge releases, contaminated tackle, wading birds, and other natural and anthropogenic sources. Loomis and Filint Lakes provide a variety of habitat types that are suitable for most of the ANS considered in this	taminated tac able for most	ere introduced skle, wading b of the ANS co	d from sources irds, and othe insidered in th	such as r natural is
evaluations. The motivation for anth conditions. The motivation for anth detrimental impacts of ANS and how recreational use of the Valparaiso La to it their locanic lake Detriviou Boson di	for anthropo or anthropo and how to p iraiso Lakes, basin divide.	evaluation. The network incomments species are accurating the fact that they are active and reproduce in a water angle or any optimization conditions. The motivation for anthropogenic introductions range from accidental to intentional and malicipuous. Public education regarding the detrimental impacts of the Valbaraiso Lakes, including Loomis and Film Lakes, poses some residual risk associated with the interbasin transfer of ANS due to their location along the basin divide. The residual risk of ANS the motivation along the basin divide. The residual risk of ANS transfer by such "other means" did not influence the overall pathway viability rating to the Loomis Loom behavior basin divide.	and malicious. hthropogenic 1 < associated w did not influe	Public educe Public educe transfer from vith the interb nce the overs	ation regarding occurring. Th asin transfer c all pathway via	f the e of ANS due bility rating

A. Probability of ANS establishing in proximity to the aquatic pathway Aquatic Pathway Team Expertise Desition title or team role USACE, Louisville - Biologist USACE, Louisville - Biologist USACE, Louisville - Biologist				
Aquatic Pathway Team	oximity to the aquatic pathway			
	Expertise Position title or team role	Rating	Certainty	
	USACE, Louisville - Biologist			
	USACE, Louisville - Biologist			
	USACE, Detroit - Biologist			
	NRCS - Biologist			
	Indiana DNR - AIS Coordinator			
	Team Ratings			
4. How do you rate the probability of ANS esta	ablishing in proximity of the aquatic pathway?	way?		
Oualitative Rating Oualitative Rating Category Criteria	ategory Criteria			
Sources of food and hat	Sources of food and habitat suitable to the ANS are plentiful in close proximity to support all life stages from birth to	proximity to s	upport all life stages from b	rth to
High adult, abiotic conditions		wn predators	or conditions that would sig	nificantly
impede survivability or I	reproduction.			
Limited and disconnecte conditions are within lat be expected to effective	Limited and disconnected areas and sources of food and habitat suitable to the ANS are available in proximity, abiotic conditions are within latitude limits of native range, but only a portion of the healthy individuals arriving at location can be expected to effectively compete and survive.	able to the AN n of the healt	S are available in proximity, hy individuals arriving at loc	abiotic ation can
Habitat and abiotic conc	Habitat and abiotic conditions in proximity are outside the range where ANS has been known to survive: there is very	ere ANS has he	een known to survive: there	is verv
Low limited availability habit competition with native	limited availability habitat area suitable for ANS cover, sustainable food supply and reproduction; or native predators or competition with native species would likely prevent establishment of a sustainable population.	od supply and of a sustainable	I reproduction; or native pre	dators or
Symbol				
Very Certain VC As certain	As certain as I am going to get.			
Reasonably Certain RC Reasonably certain.	Iy certain.			
Moderately Certain MC More certs	More certain than not.			
Reasonably Uncertain RU Reasonabl	Reasonably uncertain			
Very Uncertain VU A guess				
Remarks: Species-specific ratings for this section were not completed because the ratings for the likelihood that any of the ANS of concern for Loomis Lake would be able to survive transit from their current locations in either basin to the pathway were all low (Step 3).	ere not completed because the ratings for the heir current locations in either basin to the pa	likelihood tha thway were al	at any of the ANS of concerr II low (Step 3).	for

Loon	nis Lake, P	Loomis Lake, Porter County, IN - Threespine Stickleback (Gasterosteus aculeatus)
5. Probability of ANS spreading across	spreading	across aquatic pathway into the new basin
Aquatic Pathway Team	eam	Expertise Position title or team role Rating Certainty
		USACE, Louisville - Biologist
		USACE, Louisville - Biologist
		USACE, Detroit - Biologist
		NRCS - Biologist
		Indiana DNR - AIS Coordinator
		Team Ratings
5. How do you rate the probability of ANS spr	robability c	ANS spreading across aquatic pathway into the new basin?
Qualitative Rating	Qualitative	Qualitative Rating Category Criteria
	Sources of fo	Sources of food and habitat suitable to the ANS are available, and the species has demonstrated capabilities to
ыул	significantly	significantly expand range from locations where initially introduced.
Medium	There are limited sourc significant distances be	There are limited sources of food and suitable habitat, and/or the species has demonstrated limited ability to spread significant distances beyond areas where it has been introduced.
Low	There are se to spread be	There are severely limited sources of food and suitable habitat, and/or the species has demonstrated very limited ability to spread beyond areas where it has been introduced.
	Symbol	
Very Certain	VC	As certain as I am going to get.
Reasonably Certain	RC	Reasonably certain.
Moderately Certain	MC	More certain than not.
Reasonably Uncertain	RU	Reasonably uncertain
Very Uncertain	NΠ	A guess
Remarks: Species-specific ra Loomis Lake would be able t	tings for this o survive tra	Remarks: Species-specific ratings for this section were not completed because the ratings for the likelihood that any of the ANS of concern for Loomis Lake would be able to survive transit from their current locations in either basin to the pathway were all low (Step 3).

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