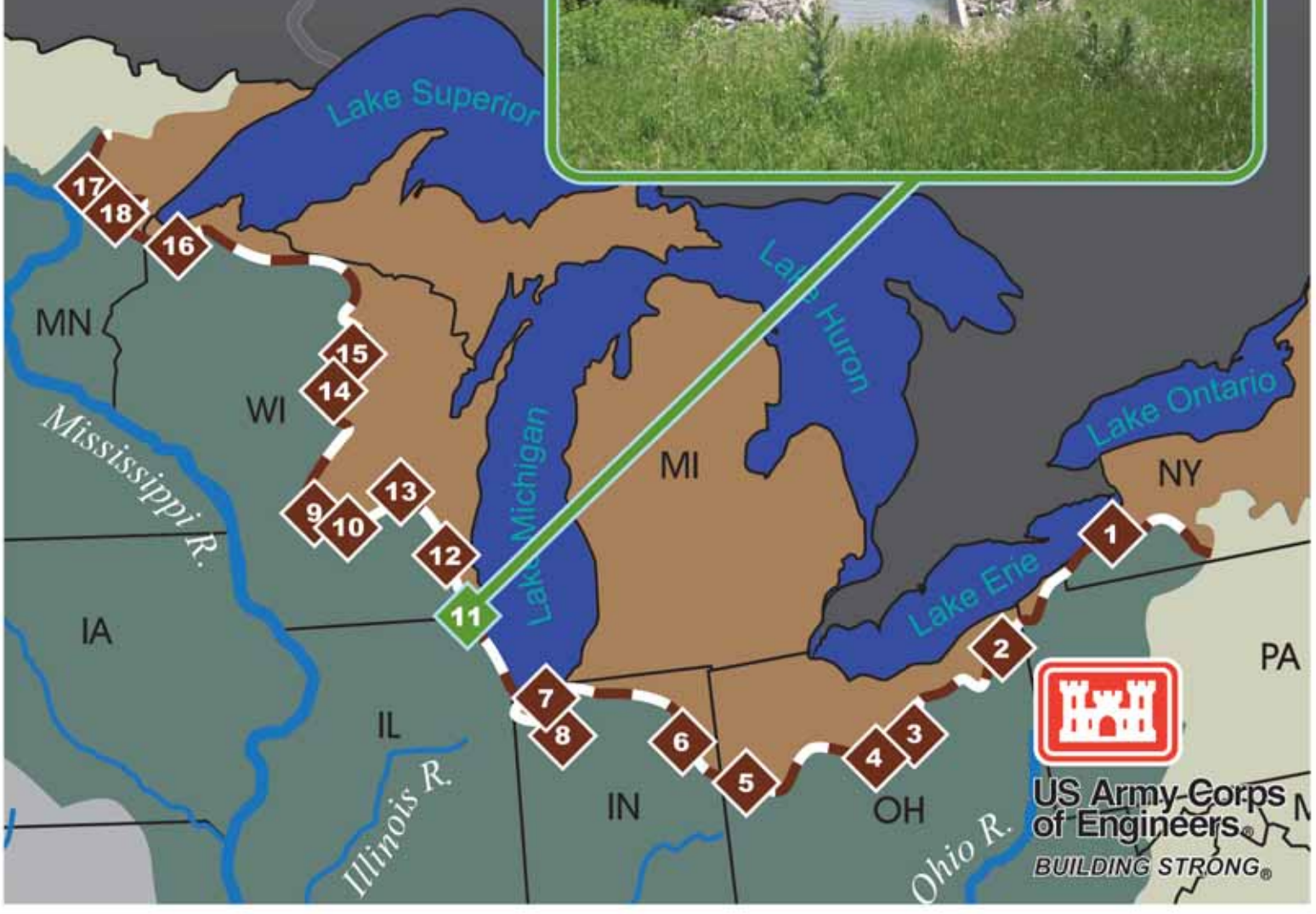
GLMRIS

Great Lakes and Mississippi River Interbasin Study

Aquatic Nuisance Species | Ecosystems | Navigation | Recreation | Flood Risk Management | Water Use

Focus Area 2
Aquatic Pathway Assessment Report

Jerome Creek, Wisconsin



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Jerome Creek Report

May, 2013

Executive Summary

This assessment characterizes the potential for an aquatic pathway to form between the Great Lakes and Mississippi River Basins at any of three locations that are in close proximity along the basin divide and that comprise the Jerome Creek Pathway study area in Pleasant Prairie, Wisconsin. Although Jerome Creek is only about three miles from Lake Michigan, it drains into the Mississippi River Basin. The probability of a viable aquatic pathway being able to form at the Jerome Creek potential pathway was determined to be low in either direction, meaning that larger than a one percent annual recurrence interval flood event would likely be required for a surface water connection to develop between streams in both basins. Two of the locations involve potential urban storm drain connections and a third location is a possible connection between the headwaters of Jerome Creek and Kenosha Creek in a more rural and residential area. Interpretation of available flood and soils mapping for all three locations indicates that a flood from an event somewhere in excess of the one percent annual recurrence interval storm would be needed for surface water to cross the basin divide. No channels or other evidence of an existing or intermittent aquatic connection were found at the locations during a site visit.

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Acronyms

ANS . . . . . Aquatic Nuisance Species
ANSTF. . . . Aquatic Nuisance Species Task Force
ATR . . . . . Agency Technical Review
CAWS . . . . Chicago Area Waterway System
CEQ. . . . . Council on Environmental Quality
CMP. . . . . Corrugated Metal Pipe
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
INDNR . . . . Indiana Department of Natural Resources
MNDNR . . . Minnesota Department of Natural Resources
NAS . . . . . Nonindigenous Aquatic Species
NCDC . . . . National Climatic Data Center
NEPA. . . . . National Environmental Policy Act
NOAA. . . . . National Oceanic and Atmospheric Administration
NRCS . . . . Natural Resources Conservation Service
USACE . . . U.S. Army Corps of Engineers
USFWS . . . U.S. Fish and Wildlife Service
USGS . . . . U.S. Geological Survey
WRDA . . . . Water Resources Development Act

Jerome Creek Report

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1 Introduction

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

> *"(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 Jerome Creek location, in Kenosha County, Wisconsin. This location is one of 18 locations identified in the Great Lakes and Mississippi River Interbasin Study Other Pathways Preliminary Risk Characterization (USACE, 2010) 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). This report is downloadable from the GLMRIS web site (glmris.anl.gov/).

The dashed line in Figure 1 depicts the nearly 1,500-mile (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 previously identified. The Jerome Creek, Wisconsin location is shown as location number 11 on Figure 1, near the border of Wisconsin and Illinois.

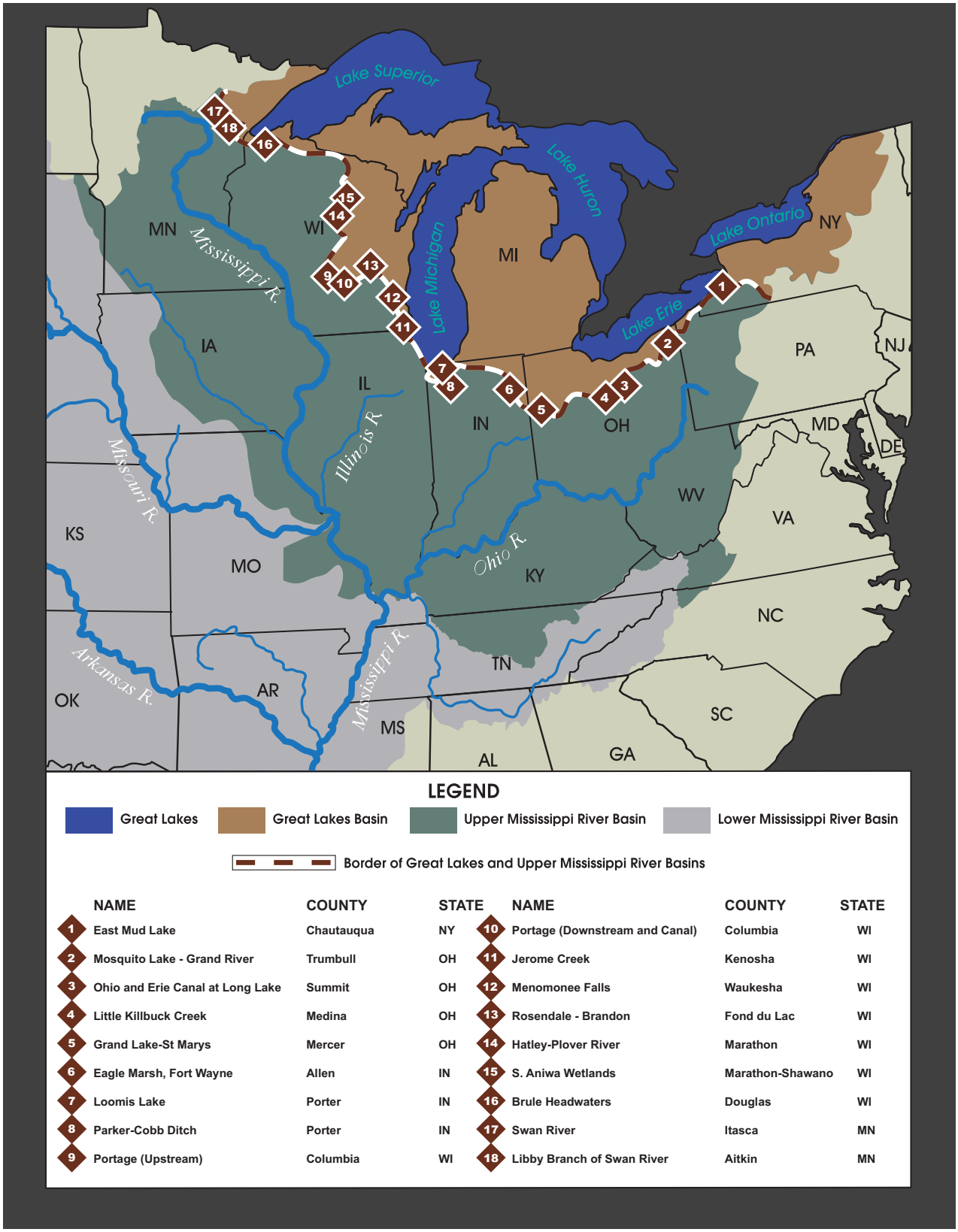
The GLMRIS is a very large and complicated task involving multiple USACE Districts and Divisions. Program Management of the study is conducted by the Great Lakes and Ohio River Division. The study considers all aquatic nuisance species (ANS) of concern. However, the proximity of Asian carp in the Mississippi 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. 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 in 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, 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.

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 Jerome Creek, Wisconsin that will enable the interbasin spread of ANS. It is also intended to meet the four objectives identified in the USACE 2011 plan for any site ultimately rated as medium or high for probability of a viable aquatic pathway existing:

- A definitive determination of whether the Jerome Creek, Wisconsin location should be included in the inventory of locations where a viable surface water connection between headwater



	NAME	COUNTY	STATE		NAME	COUNTY	STATE
1	East Mud Lake	Chautauqua	NY	10	Portage (Downstream and Canal)	Columbia	WI
2	Mosquito Lake - Grand River	Trumbull	OH	11	Jerome Creek	Kenosha	WI
3	Ohio and Erie Canal at Long Lake	Summit	OH	12	Menomonee Falls	Waukesha	WI
4	Little Killbuck Creek	Medina	OH	13	Rosendale - Brandon	Fond du Lac	WI
5	Grand Lake-St Marys	Mercer	OH	14	Hatley-Plover River	Marathon	WI
6	Eagle Marsh, Fort Wayne	Allen	IN	15	S. Aniwa Wetlands	Marathon-Shawano	WI
7	Loomis Lake	Porter	IN	16	Brule Headwaters	Douglas	WI
8	Parker-Cobb Ditch	Porter	IN	17	Swan River	Itasca	MN
9	Portage (Upstream)	Columbia	WI	18	Libby Branch of Swan River	Aitkin	MN

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

streams on both sides of the drainage divide exists or is likely to form between the Great Lakes and Mississippi River Basins;

- A standalone report that characterizes the probability that a viable aquatic pathway exists at Jerome Creek, Wisconsin and will enable the interbasin spread of ANS;

- Development of clear problem statements that frame the means, constraints, and likelihood of the interbasin spread of ANS via the potential aquatic pathway at Jerome Creek, Wisconsin; 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 Jerome Creek, Wisconsin location.

1.2 Summary of 2010 Preliminary Risk Characterization for Jerome Creek, Wisconsin

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 aquatic 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), 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 estimating the individual 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 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 Jerome Creek pathway as a location where there is a near term risk for the interbasin spread of ANS, there was some uncertainty regarding whether or not an aquatic pathway could form between the basins. The preliminary effort therefore recommended that a more

detailed assessment be conducted at this location. This was subsequently done in collaboration with the USGS, Natural Resources Conservation Service (NRCS), Wisconsin Department of Natural Resources (WDNR), and other government agencies. The following actions were taken:

- Federal, State, and local stakeholders (e.g., USGS Water Science Center, WDNR Division of Water, County Surveyor, and local NRCS representatives) were briefed on the preliminary risk characterization results. A detailed site visit was conducted to observe potential connection locations and the available topographic mapping and flood hazard information was compiled and reviewed.

- The dams on the connecting streams to the Great Lakes and the Mississippi River were evaluated relative to the potential for ANS passage through, around, or over each in-stream structure in both directions.

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 Federal, State, local, and national hydrologists and biologists to assess conditions at each potential aquatic pathway (USACE, 2011a). The results of this assessment reflect the collective experience, expertise, and focused effort of these experts from USACE, NRCS, and WDNR. The results also reflect the guidance, input, review comments, and concurrence of the multi-organization Agency Technical Review (ATR) which was comprised of experts from USACE 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 on April 23, 2012 that "we have reviewed the Jerome Creek pathway report and we don't have any objections to it moving forward."

2 Study Methodology

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 external partner agencies, including NOAA and the 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 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 Jerome Creek 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 (e.g., anthropogenic, movement by animals) that may enable ANS to transit across the aquatic pathway or across the basin divide but that are not included within this 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 the 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 Non-indigenous 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.

Table 1. ANS of Concern for GLMRIS				
Taxon	**Scientific Name**	**Common Name**	**Basin**	**Interbasin Dispersal Mechanism**
fish	*Alosa aestivalis*	blueback herring	GL	swimmer
fish	*Alosa chrysochloris*	skipjack herring	MS	swimmer
fish	*Alosa pseudoharengus*	Alewife	GL	swimmer
crustacean	*Apocorophium lacustre*	a scud	MS	ballast water
algae	*Bangia atropupurea*	red macro-algae	GL	ballast / recreational 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 / recreational 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 / recreational boating
fish	*Gasterosteus aculeatus*	threespine stickleback	GL	swimmer
plant	*Glyceria maxima*	reed sweetgrass	GL	recreational boating & trailers
fish	*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
fish	*Mylopharyngodon piceus*	black carp	MS	swimmer
crustacean	*Neoergasilus japonicus*	a parasitic copepod	GL	parasite to fish
plant	*Oxycaryum cubense*	Cuban bulrush	MS	recreational boating & trailers
fish	*Petromyzon marinus*	sea lamprey	GL	swimmer
mollusk	*Pisidium amnicum*	greater European pea clam	GL	ballast water
fish	*Proterorhinus semilunaris*	tubenose goby	GL	swimmer
protozoan	*Psammonobiotus communis*	testate amoeba	GL	ballast water
protozoan	*Psammonobiotus dziwnowi*	testate amoeba	GL	ballast water
protozoan	*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

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, habitats, and distributions and dispersal status.

However, no assessment of specific ANS of concern was completed for the Jerome Creek potential pathway since it was determined that there is a low likelihood of an aquatic pathway existing at up to a one percent annual recurrence interval storm event (Section 3.6). 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 recurrence interval storm (formerly referred to as a ten year event) is a smaller event that has a one in ten chance of being exceeded during any given year, and a 0.2 percent annual recurrence interval 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.

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

$$R_{Establishment} = P_{Establishment} \times C_{Establishment}$$

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, Reasonably Certain, Moderately Certain, Reasonably Uncertain, Very Uncertain). 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 = P *ANS transits pathway*
P_{2a} = P *ANS surviving transit to aquatic pathway*
P_{2b} = P *ANS establishing in proximity to the aquatic pathway*
P_{2c} = P *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:

P_0 = P *Pathway exists*
$P_{1'}$ = P *ANS occurring within either basin*
P_{2a} = P *ANS surviving transit to aquatic pathway*
P_{2b} = P *ANS establishing in proximity to the aquatic pathway*
P_{2c} = P *ANS spreading across aquatic pathway into new basin*

Notice the overall probability is now the "probability a viable pathway exists" ($P_{Viable\ pathway}$) and is no longer the original "probability of 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. At those locations where the probability of a pathway existing (P_0) was determined to be medium or high, 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.

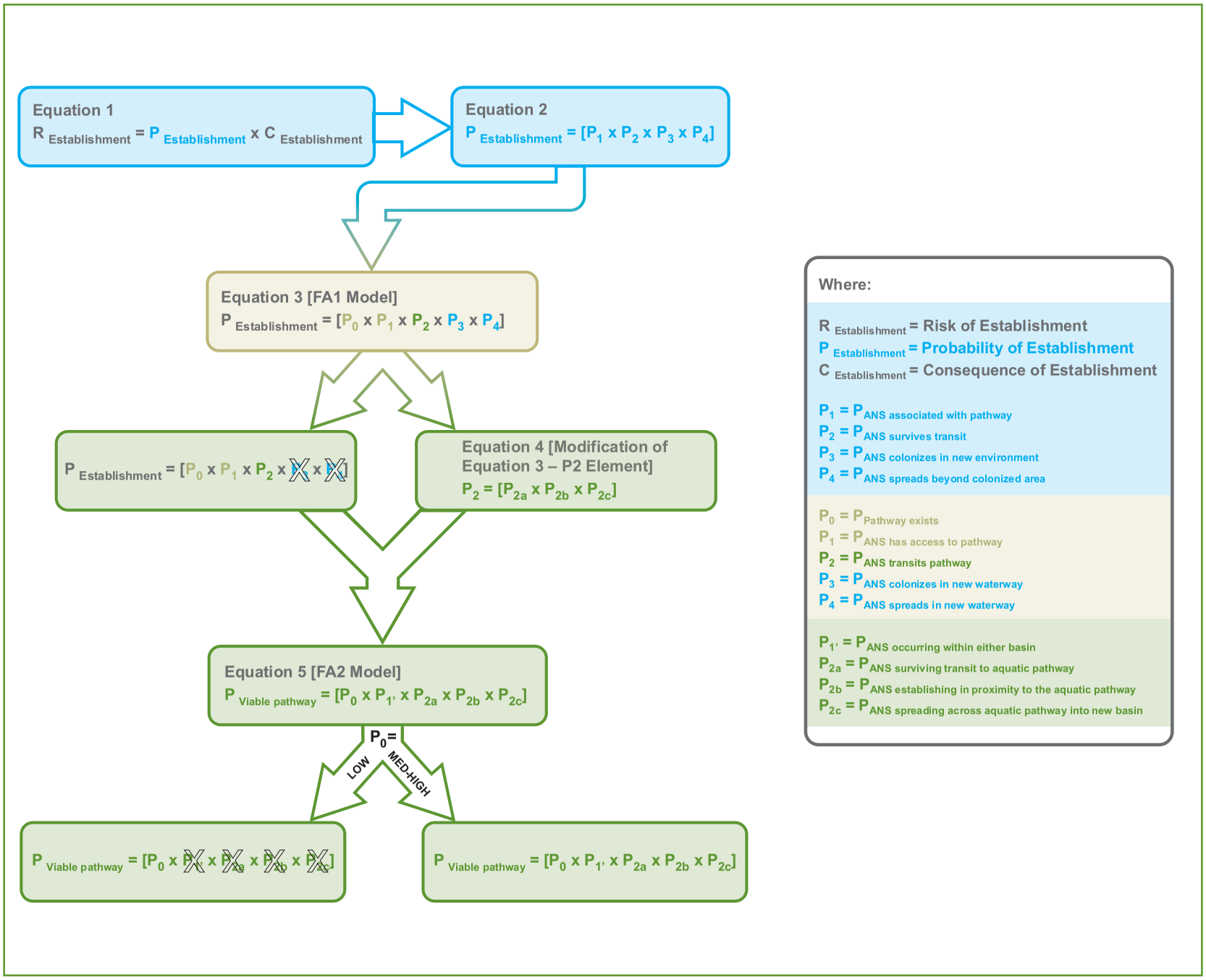


Figure 2. Diagram of the derivation of the GLMRIS Focus Area 2 aquatic pathway assessment model.

3 Aquatic Pathway Characterization

This section describes and illustrates the topography and features in the vicinity of the potential pathway and is intended to present the compilation of the 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 significant hydrologic and hydraulic conditions near the drainage divide. Also, this section identifies any significant data gaps and uncertainties related to the available topographic information and hydrologic modeling in the area of interest.

3.1 Location

Jerome Creek is located in Pleasant Prairie, Wisconsin in Kenosha County. Pleasant Prairie is approximately 35 miles (56 km) south of Milwaukee. Jerome Creek is about three miles (4.8 km) from the Lake Michigan shoreline. Figure 3 shows Jerome Creek and its tributaries and associated floodplains, along with the Great Lakes and Mississippi River Basin divide. Three potential locations for interbasin flow were investigated.

- Location 1 (middle circle in Figure 3): 42°32’45.74”N & 87°52’18.93”W
- Location 2 (bottom circle in Figure 3): 42°32’8.56”N & 87°52’17.56”W
- Location 3 (top circle in Figure 3): 42°33’34.78”N & 87°52’26.06”W

3.2 Climate

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 southeast Wisconsin is classified as “continental” with large seasonal temperature variance, four distinct seasons, and relatively small or moderate precipitation. Temperatures in winter typically range from 16ºF to 32ºF (-9ºC to 0ºC), while summers are usually around 60ºF to 75ºF (15.5ºC to 24ºC). Normal annual precipitation is about 35 inches (89 cm) and the normal snowfall is around 40 inches (102 cm). See Table 2 for National Climatic Data Center (NCDC) data, from 1971-2000.

The highest precipitation accumulation occurs in the summer months, primarily during June through August. Although rainfall amounts do not always conform to averages, they suggest that substantial precipitation does not occur frequently. Given that annual temperatures reach down to or below the freezing mark on an annual basis, purely climatic conditions will restrict the time during which any ANS movement might occur by natural vectors.

3.3 Location Specific Surface Water Features

The information contained in this section is intended 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. Jerome Creek is connected to the Mississippi River as it flows into the Des Plaines River in Wisconsin which then flows south into Illinois, through Chicago to Joliet, where it then joins the Kankakee River and becomes the Illinois River. The Illinois River then flows southwest to the Mississippi River at Grafton (near St. Louis). Jerome Creek originates near the Great Lakes and Mississippi River Basin boundary between the cities of Pleasant Prairie and Kenosha, Wisconsin. The total length of Jerome Creek is about 4.75 miles (7.6 km) before it reaches the Des Plaines River and it receives water from five unnamed tributaries. There are no dams on Jerome Creek or on any adjacent Great Lakes Basin tributaries, but there are several dams located further downstream in the Mississippi River Basin from Jerome Creek (e.g. Des Plaines River, Illinois River)

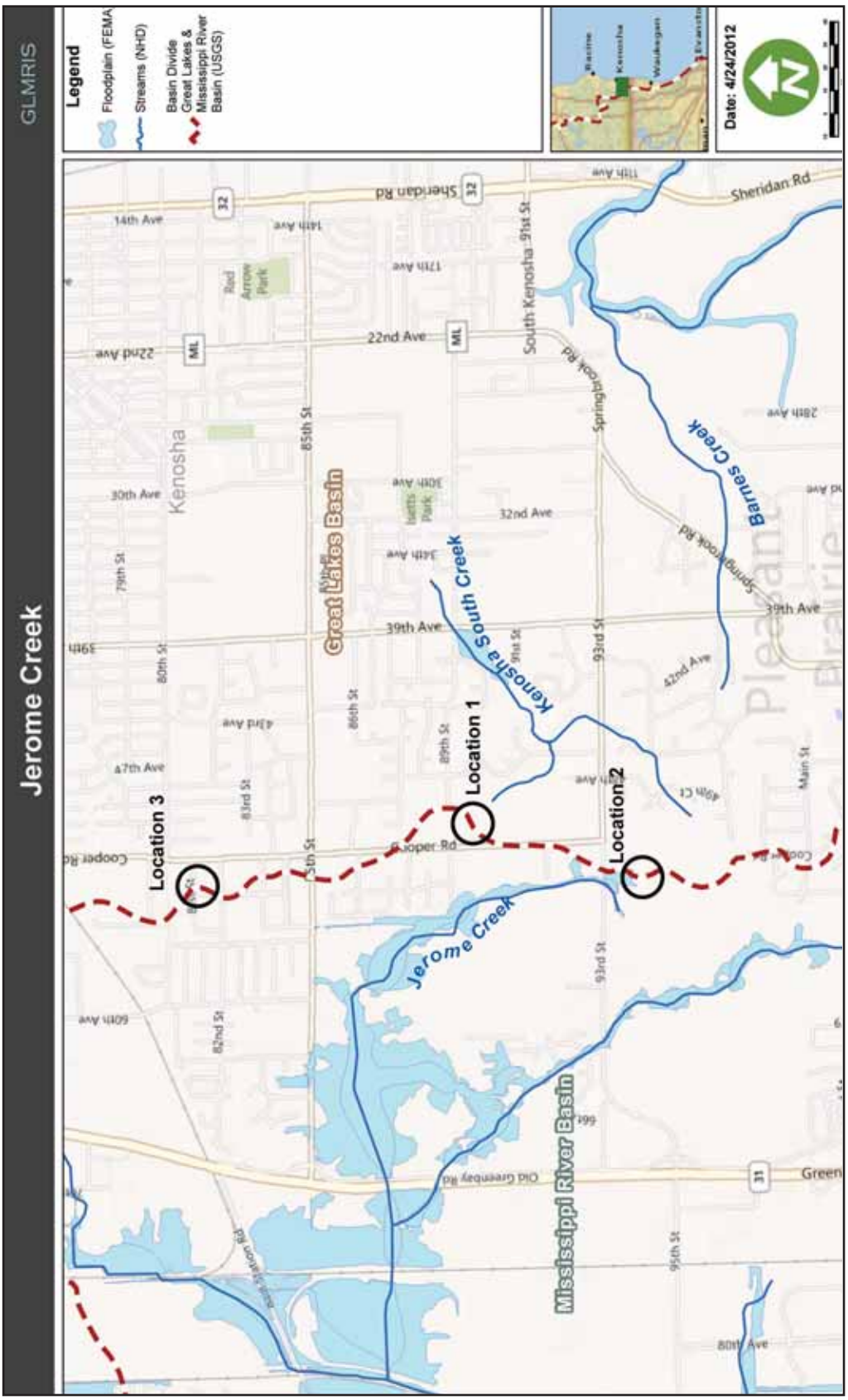


Figure 3. Jerome Creek and adjacent watersheds in vicinity of Pleasant Prairie, Wisconsin showing the three areas of concern. Background imagery courtesy of Bing Maps.

Table 2. Climate Information from the Midwestern Regional Climate Center's (MRCC) Kenosha, WI Station, 1971-2000.

Element	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Mean Temperature°F	20.8	25.1	34.4	44.1	54.9	65.0	71.3	70.8	62.9	51.7	38.8	26.9	47.2
Mean Temperature °C	-6.2	-3.8	1.3	6.7	12.6	18.3	21.8	21.5	17.1	10.9	3.7	-2.8	8.4
Normal Precip (in)	1.67	1.29	2.34	3.85	3.38	3.59	3.68	4.19	3.49	2.49	2.68	2.09	34.74
Normal Precip (cm)	4.2	3.2	5.9	9.7	8.5	9.1	9.3	10.6	8.8	6.3	6.8	5.3	88.2
Mean Snow (in)	12.6	9.3	5.6	1.1	0.0	0.0	0.0	0.0	0.0	0.1	1.4	8.4	38.5
Mean Snow (cm)	32	23.6	14.2	2.8	0	0	0	0	0	0.3	3.5	21.3	97.8

where upstream fish passage may be questionable, or at least possible through associated lock systems. The only potential in-stream obstructions for ANS movement in Jerome Creek itself are potentially roadway culverts and debris.

The Jerome Creek Watershed and adjacent watersheds are shown in Figures 3 and 4. The Great Lakes connection for this site is via Barnes Creek directly to Lake Michigan. Kenosha Creek near Location 2 is also close to the basin divide, but ends in the city of Kenosha where it goes into urban storm drains and then to Lake Michigan.

Jerome Creek is located in the Mississippi River Basin, however, it comes within about 250 (76 m) to 1,000 feet (305 m) of the basin divide at several locations. Barnes and Kenosha Creeks, located in the Great Lakes Basin, start about 3,250 feet (990 m) and 1,000 feet from the divide, respectively. The NRCS Web Soil Survey (WSS) map of flood frequency classes for this area supports there is little likelihood of interbasin transfer of surface water from flooding events, and the soils with a flood frequency class of "frequent" do not cross the basin divide. Near the basin divide, the soil flood frequency class is "none", meaning that neither flooding nor ponding occur regularly in this area (Figure 5). Flooding is defined by the NRCS WSS as:

> "…the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding."

Therefore, a "none" category indicates that this area does not experience flooding by overflowing streams or runoff from slopes, and a surface water connection due to a large storm event would be unlikely to occur at this location since the area is not classified as subject to "flooding" or "ponding" (Figure 5).

Three locations along the basin divide near Pleasant Prairie were assessed for possible hydraulic connections between the Great Lakes and the Mississippi River Basins (Figure 6). These are:

1) Eastern Jerome Creek through residential ditches, street overtopping, and storm drains in Pleasant Prairie;

2) Southeastern Jerome Creek overland flow across farm fields, and through ditches and culverts south of 93rd Street near Cooper Road in Pleasant Prairie; and

3) Northeastern Jerome Creek through a 3,000 foot (914 m) culvert from 85th Street to a detention basin north of 80th Street and west of 55th Avenue in Kenosha and continuing through a culvert to Lake Michigan. Upon closer examination of available topographic information, it was determined that an event larger than a 0.2 percent annual recurrence interval storm would be required to initiate any

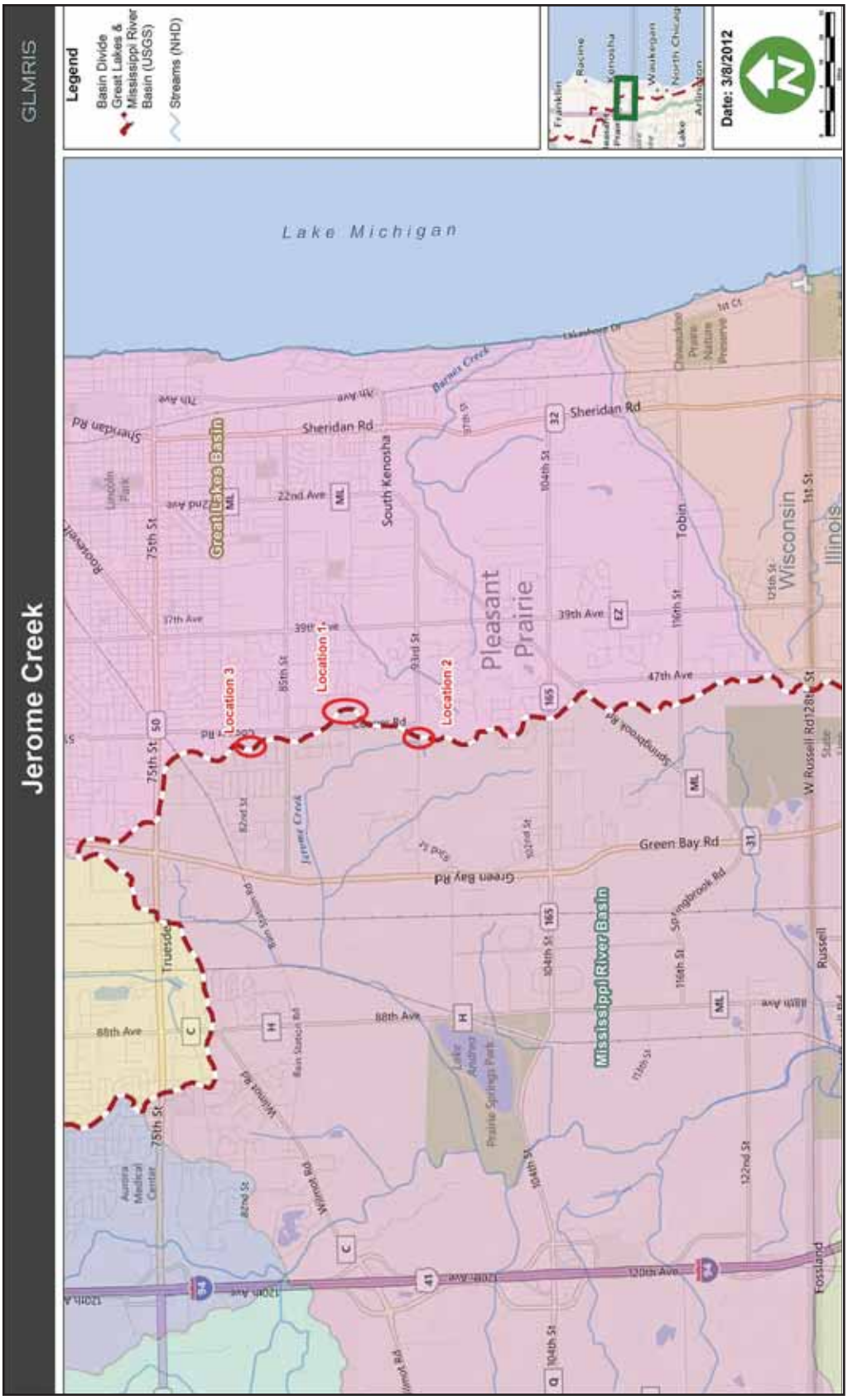


Figure 4. Jerome Creek and adjacent watersheds in vicinity of Pleasant Prairie, Wisconsin. Background imagery courtesy of Bing Maps.

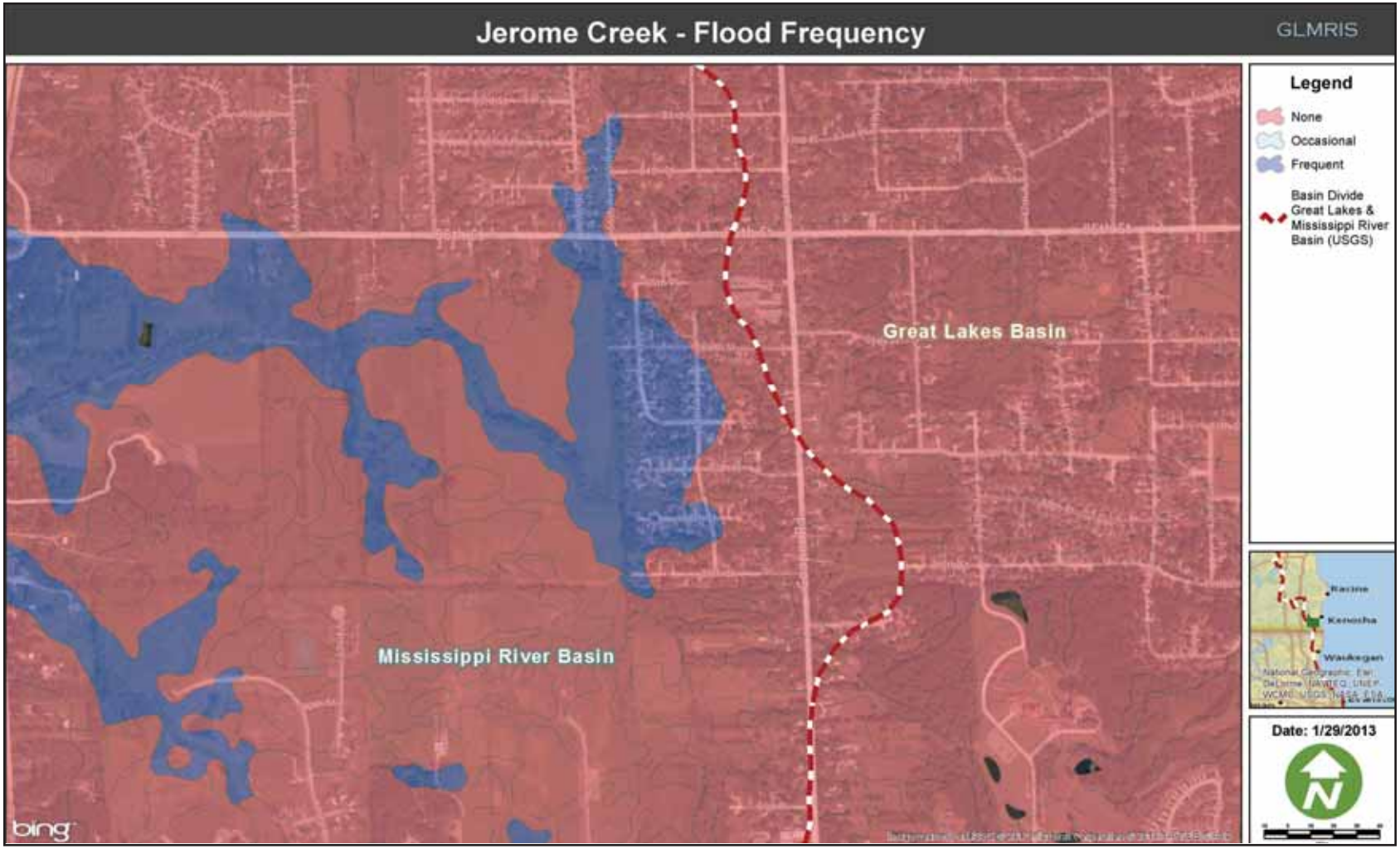


Figure 5. NRCS Web Soil Survey Map of Soil Flood Frequency Classes for the Jerome Creek Area. The blue areas indicate frequent flooding and red areas indicate no flooding.

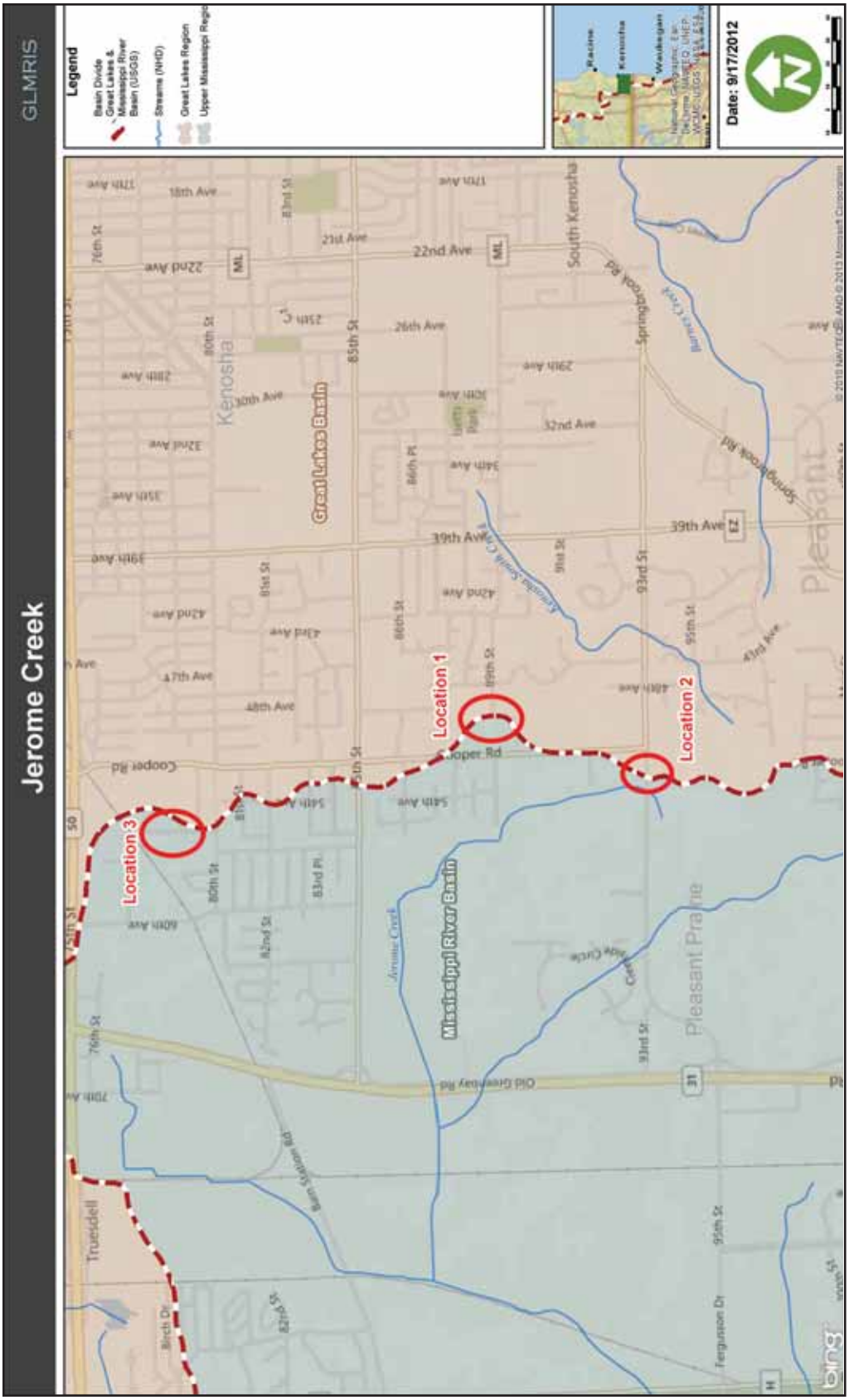


Figure 6: Location of three areas evaluated for potential interbasin flow near Jerome Creek in Pleasant Prairie, Wisconsin. Background imagery courtesy of Bing Maps.

surface water connection between streams on either side of the basin divide at Location 3. A more detailed assessment of Locations 1 and 2 was conducted and is summarized below.

Location 1.

During a site visit on June 6, 2011, the observed water level of Jerome Creek at this location near 88th Street was four to five feet (1.2 to 1.5 m) below the "top of street" elevation of 88th Street (Figure 7 and Figure 8). In order for a surface water connection to form, water would need to rise four to five feet from Jerome Creek to overtop the street and flow into a curbside storm drain. According to the Federal Emergency Management Agency (FEMA) floodplain mapping for the one percent recurrence interval event, 88th Street is above the one percent floodplain (Figure 7). This floodplain is also located well away from the basin divide supporting the determination that an aquatic pathway is unlikely to form at this location. South of 88th Street, roadside ditches were examined along 89th Street. There are a few driveway culverts along 89th Street that allow Jerome Creek floodwater to flow eastward in a ditch towards the basin divide, but eventually this flow is blocked by driveways without culverts, thus eliminating the possibility of interbasin transfer by this route for up to a one percent annual recurrence interval storm/flood event.

The team next examined the topography of the area. Representative surface elevations are shown in Figure 9, which also depicts a representative cross-section through the area of interest, based on the best available Geographic Information System (GIS) data. This figure shows the profile along the HUC boundary to depict the 'saddle point' along the basin divide and a cross section that cuts through the HUC boundary to depict the typical ground elevation along the potential flow path. This saddle point is the location of the basin divide and the point at which a hydrologic connection is most likely to be established at this location. The cross-section shows the general ground elevation only and vertical accuracy is limited. Figure 9 indicates that there is a prominent vertical elevation peak at about the 1,000 foot mark along the cross section profile. The profile along the basin divide supports the selection of this location as an area that needed further evaluation since it is a relative low point along the basin divide where interbasin flow was originally thought might be possibly.

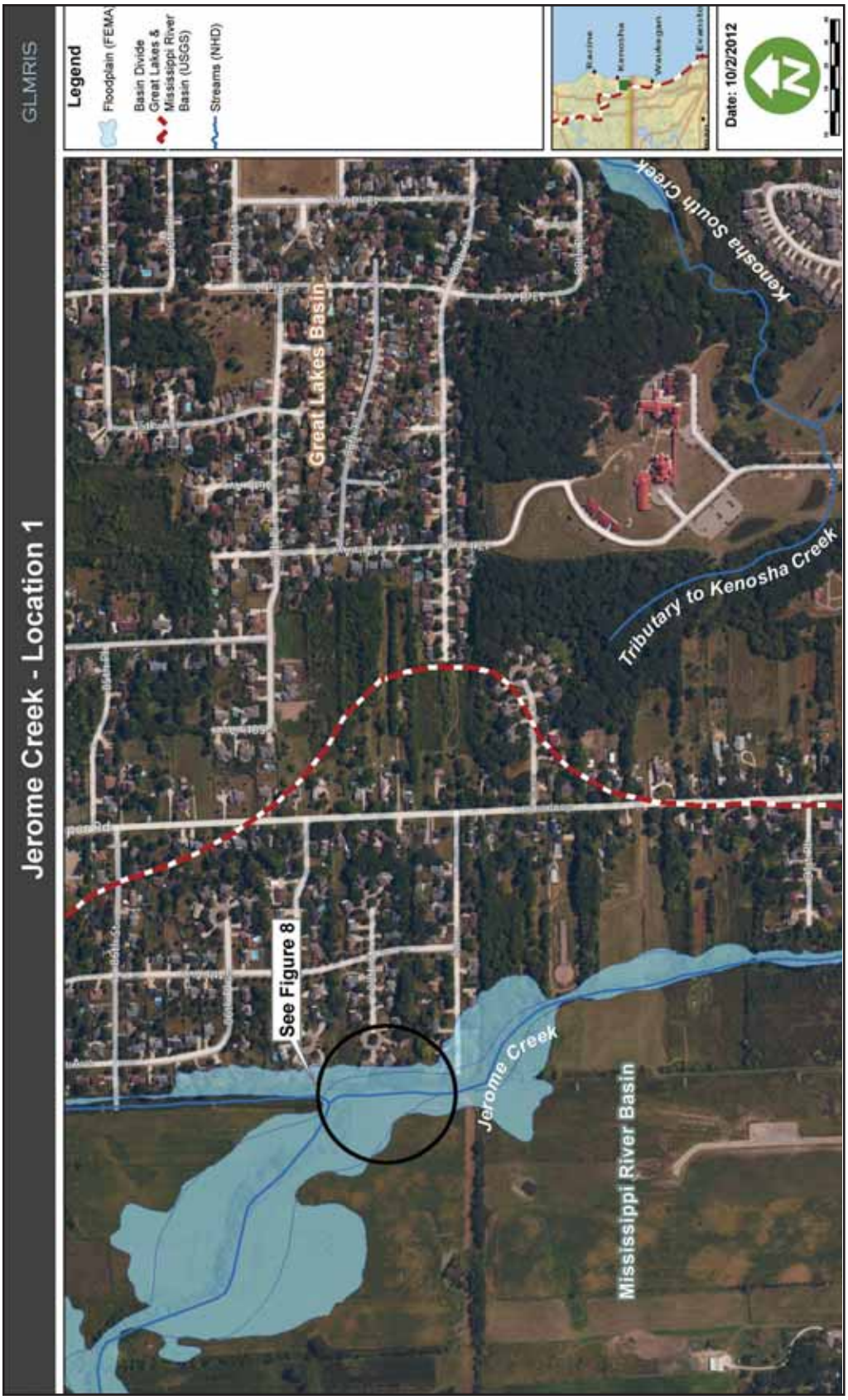


Figure 7. Aerial photo of features and one percent floodplain in area of Location 1. Background imagery courtesy of Bing Maps.

Figure 8. View looking west toward Jerome Creek (trees in background) at west end of 88th Street. Potential Jerome Creek floodwaters could inundate the low-lying area in middle of photograph. Photo by USACE.

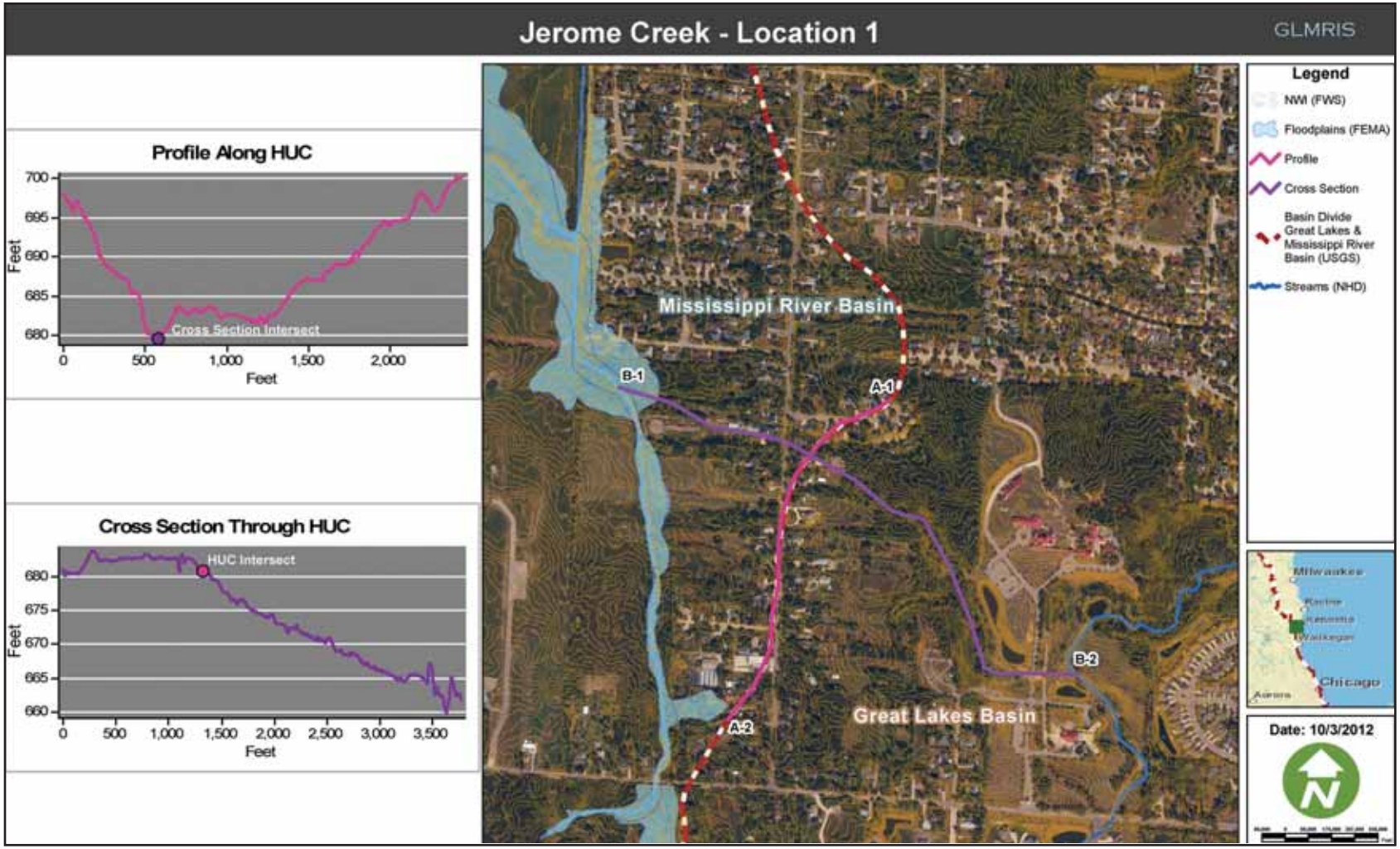


Figure 9. Profiles and contours near the drainage divide at Location 1. Red/white line is the basin divide and blue lines are streams. The pink line in the aerial photograph and the graph on the top left is the profile along the basin divide. The purple line that intersects the pink line in the figure and the bottom left graph is the cross section through the basin divide. Verticle accuracy is +/- one foot (0.3 m). Background imagery courtesy of Bing Maps.

Location 2.

The headwater area of Jerome Creek was also evaluated during the site visit in June 2011 (Figure 10). There was no observable flow within the creek or between the basins and the creek appears to be an intermittent stream. In addition, information from Pleasant Prairie City officials (City Engineer and Community Development Director) confirmed that this area has been under heavy development since 2005 when the aerial in Figure 10 was taken.

Available floodplain mapping for Location 2 shows the one percent floodplain extending south of 93rd Street and just barely crosses the basin divide (Figure 11). However, a flood larger than the one percent annual recurrence interval storm event would likely be needed to induce flow towards Kenosha Creek in the Great Lakes Basin to the east. Based on a cross section between Jerome Creek and Kenosha Creek through the basin divide (Figure 11), the actual basin divide may be slightly more to the west than is currently represented by the HUC-12 boundary (red-white line) and therefore the FEMA floodplain may not actually cross the basin divide as illustrated in Figure 11. To protect against a flood larger than the one percent annual recurrence interval storm event, the ground elevations could be raised across this swale to the 710-foot (216 m) contour on either side, a distance of about 225 feet (69 m) and depicted by the yellow line in Figure 11.

Topography between the two basins at Location 2 indicates that unimpeded surface water flow might be possible from Jerome Creek to Kenosha Creek (Figure 12). However, the position of this location upstream in the watershed of both Jerome and Kenosha Creeks makes any interbasin flow at this location very unlikely for an event more frequent than the one percent annual recurrence interval storm event/flooding event due to the small size of the drainage basin. Although mapping in the area is fairly accurate, recent residential and commercial developments on the Great Lakes side of the basin divide may have altered drainage patterns.

Figure 10. Aerial photo and the drainage divide at Location 2. Red-white line is the basin divide and blue lines are streams closest to the divide. Base imagery courtesy of Bing Maps.

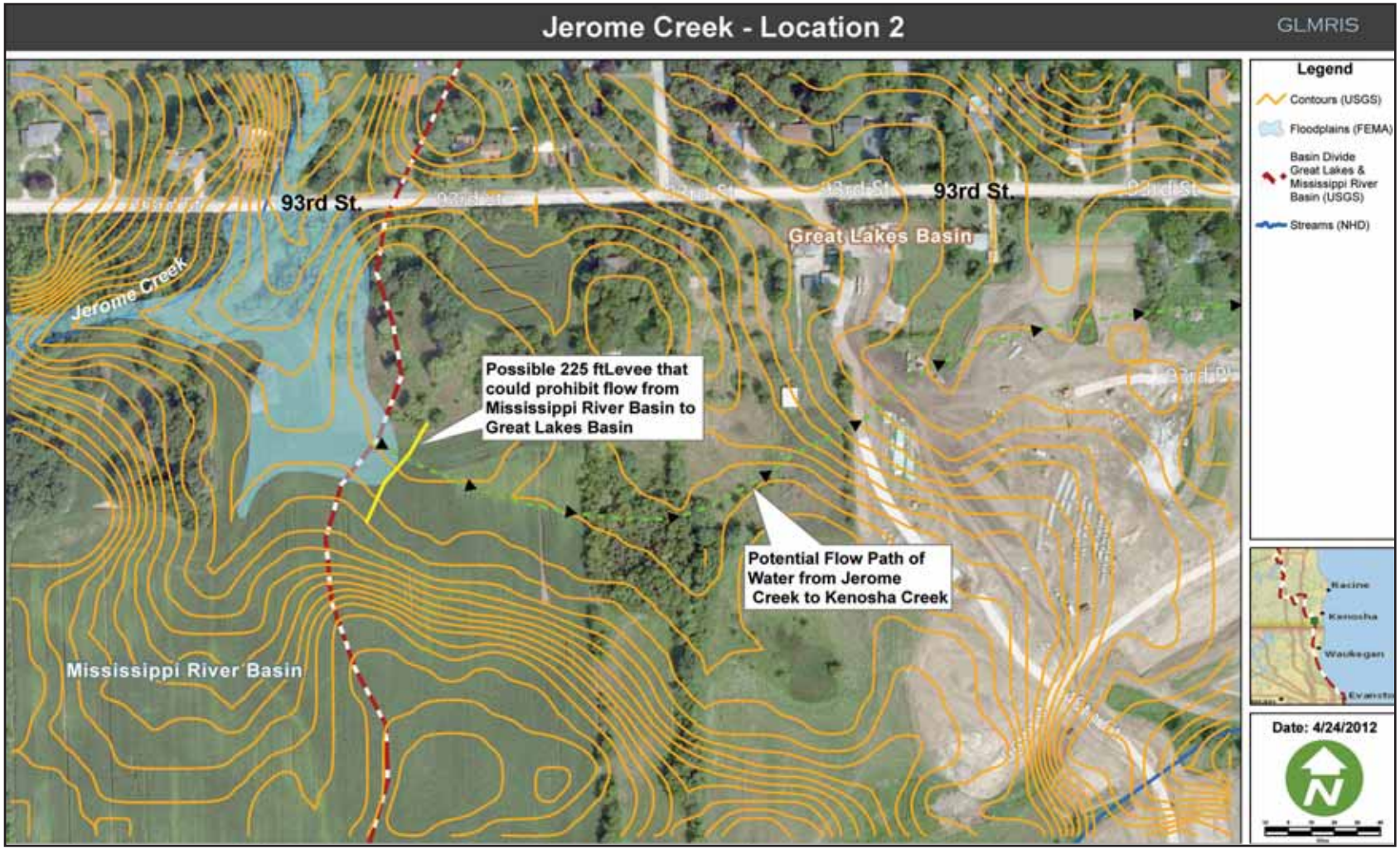


Figure 11. Basin divide and FEMA one percent floodplain for Jerome Creek headwater area with one foot contours. Green line indicates potential flow path of flood waters from the Mississippi River Basin (Jerome Creek) to Great Lakes Basin (Kenosha Creek). Yellow line indicates location of possible berm. Background imagery courtesy of Bing Maps.

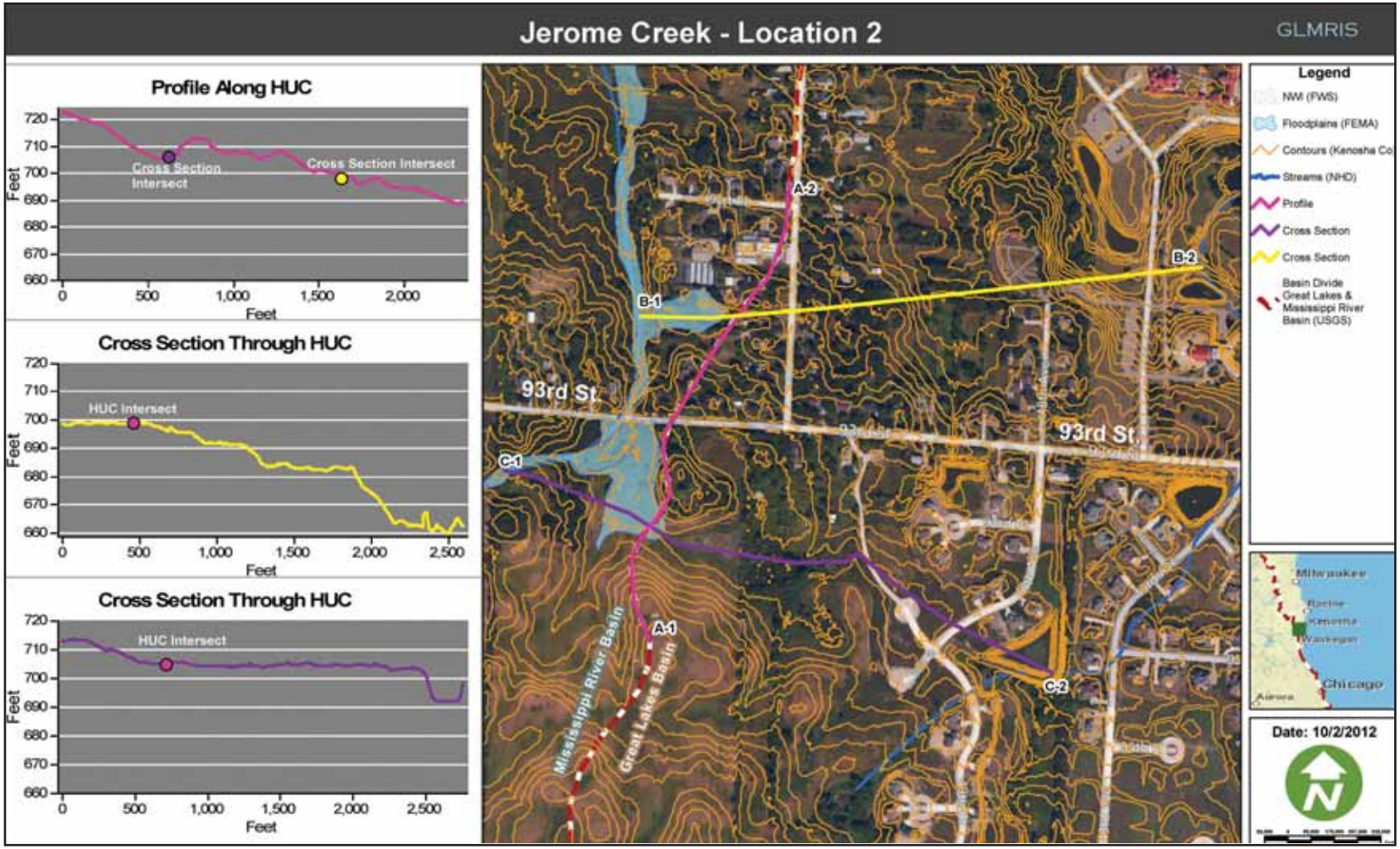


Figure 12. Profiles and contours near the drainage divide at Location 2. Red/white line is the basin divide and blue lines are streams. The pink line in the aerial photograph and the graph on the top left is the profile along the basin divide. The yellow line and purple line that intersect the pink line in the photograph and the middle and bottom left graphs are the cross section through the basin divide. Vertical accuracy +/- one foot (0.3 m). Background imagery courtesy of Bing Maps.

Location 3.

To the north of Jerome Creek in the Mississippi River Basin there is a detention basin that is prone to flooding from backwater associated with storm sewer capacity (Figure 6). There are several culverts between 80th and 85th Streets that connect with this basin, and the basin divide is located just east of the detention basin. The storm sewer which connects to the detention basin and comes the closest to the headwaters of Jerome Creek is approximately 3,000 feet (914 m) long. The City Engineer indicated that the detention basin was designed for the ten percent annual recurrence interval storm event. The detention basin was deepened in 1999 in order to provide more capacity following a large storm event that occurred earlier that year. The site visit conducted on June 6, 2011 confirmed that there are no visible surface water or storm sewer connections at the Jerome Creek potential pathway at Location 3. A storm larger than the one percent annual recurrence interval event would likely be needed to initiate a surface water connection between the basins.

3.4 Groundwater

Groundwater was investigated as part of determining the likelihood a pathway exists because groundwater can serve as a source of baseflow for streams. Water levels in the aquifers typically fluctuate in response to seasonal variations; this is known as 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 frozen ground conditions, snowmelt, and higher groundwater conditions, may be more likely to facilitate formation of an aquatic connection between the basins. Groundwater levels generally decline in summer because evapotranspiration rates are high, continued discharge to streams, and withdrawals by wells collectively exceed recharge. Thus, groundwater likely plays very little role in any establishment of an aquatic connection. Net recharge to the aquifers also occurs in the Fall of most years, due to rainfall and low evapotranspiration rates. The nearest available groundwater data, USGS Groundwater Watch site 423214087503801, is 1.4 miles (2.3 km) southeast of the pathway site. Although no groundwater data in the immediate vicinity of the pathway is available, groundwater conditions are not believed to increase the likelihood of creating or maintaining a surface water connection between these watersheds

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 movement, reproductive patterns, and abilities to survive and establish populations in various areas. The area of the Jerome Creek potential pathway site has been identified by FEMA to be within the one percent annual recurrence interval flood zone; no site specific base flood elevations have been determined. The NRCS Web Soil Survey (WSS) indicates large expanses of soils in the pathway area that may be frequently flooded during April and May (blue shaded areas in Figure 5). However, the pathway through these soils is interrupted at the western end by soils that have a ponding frequency class of "None" (red shaded areas in Figure 5). This agrees generally with observations in the field that more significant flows than the one percent annual recurrence interval storm event would be needed to create the potential for a connection at this location. Ponding frequency indicates how often soils are subjected to standing water, therefore a "None" indicates an area that is rarely inundated. No other information was found regarding the temporal characteristics for this aquatic pathway. However, considering the rainfall, depth to groundwater conditions, topographic features, and surface water features identified during the site visit, it is likely that only an extreme storm event, in excess of the one percent annual recurrence interval, could possibly cause a surface water connection between the two basins. In addition, given that the area is subjected to freezing temperatures on an annual basis (Table 2) for four to five months, biological activity and water flow would be further restricted on a temporal basis since the water

would be frozen and biological activity of ANS would likely be dormant.

3.6 Probability 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) at up to a one percent annual recurrence interval storm. The low probability rating assigned to the existence of an aquatic pathway at this site does provide a high level of confidence that ANS will not be able to use this site to traverse between the basins. A surface water connection between the Great Lakes and Mississippi River Basins is unlikely based on these six key points:

- No ditches, swales or other evidence of surface water flow was observed during site visits in June 2011 that would indicate interbasin flow ever occurs at either of the locations evaluated.
- Average rainfall levels are low to moderate, so only rare storm events of intense rainfall could potentially produce a surface water connection.
- Recent updates to the FEMA Flood Insurance Rate Maps indicate the one percent floodplain does not span the basin divide anywhere except for one very small segment of the floodplain at Location 2 at the headwaters of Jerome Creek, which is shown in Figure 11.
- NRCS soil flood frequency mapping indicates that frequent flooding does not occur at or accross the basin divide.
- Groundwater levels do not likely directly contribute to headwater flow in Jerome Creek and flow is predominantly from surface runoff.
- The topographic information indicates that the elevation of Jerome Creek is substantially higher in elevation than the tributaries to Kenosha Creek; therefore, if interbasin flow were ever to occur at this location, it would likely be from the Mississippi River Basin into the Great Lakes Basin.

Due to the above evidence, it is very unlikely that a surface water connection exists or could form at this location on a perennial or intermittent basis, from a one percent annual recurrence interval storm. Consequently, the probability of the existence of an aquatic pathway at Jerome Creek is rated low in either direction and supports the ratings assigned during the preliminary assessment in 2010. There are intermittent streams at this location leading into both basins, but a surface water connection would not form between them from less than a one percent annual recurrence interval storm event.

This rating is considered “moderately certain” with the primary source of uncertainty being the possible effects of on-going residential and commercial development in the area on the Great Lakes side of the basin divide, which may alter drainage patterns. The field form used in the assessment of this site is located in Appendix A.

4 Overall Aquatic Pathway Viability

As discussed in Section 2.4, at those locations along the basin divide where the first element in Equation 5 (i.e., likelihood that an aquatic pathway exists) was estimated to be low, no further assessment of that location was necessary (Table 3). 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.

Table 3: Summary of Individual Probability Elements and Overall Aquatic Pathway Viability for ANS Spreading between the Mississippi River and Great Lakes Basins at Jerome Creek, WI location.

	Form 1 P_0	Form 2 P_1	Form 3 P_{2a}	Form 4 P_{2b}	Form 5 P_{2c}	$P_{viable\ pathway}$
Direction of Movement	**Pathway Exists?**	**ANS Occuring Within Either Basin?**	**ANS Surviving Transit to Pathway?**	**ANS Establishing in Proximity to Aquatic Pathway?**	**ANS Spreading Across Aquatic Pathway into New Basin?**	**ANS/Pathway Viability Rating**
MRB[1] to GLB[2]	L (MC)	NN[3]	NN	NN	NN	L
GLB to MRB	L (MC)	NN	NN	NN	NN	L
Overall Pathway Viability for Spread of ANS Between MRB and GLB:						**L**

[1]MRB: Mississippi River Basin
[2]GLB: Great Lakes Basin
[3]NN: Not Necessary
MC: Moderately Certain

5 Conclusions

During the site visit in June of 2011, no channels or other evidence of an aquatic connection was observed between the two basins. A review of all available data, as well as collaboration with USGS, NRCS, and WDNR, led the interagency pathway team to conclude that there is little likelihood of a surface water connection existing on a perennial or intermittent basis from a one percent annual recurrence interval storm. Thus the probability that an aquatic pathway exists was rated low and in turn the overall aquatic pathway viability at Jerome Creek, WI was rated “low”.

6 References:

ANSTF (1996). 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.

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USACE. (2011a). GLMRIS Focus Area 2 Study Plan. Great Lakes and Ohio River Division.

USACE. (2011b). Non-Native Species of Concern and Dispersal Risk for the Great Lakes and Mississippi River Interbasin Study.

USGS. (2012). Nonindigenous Aquatic Species (NAS) website http://nas.er.usgs.gov/about/faq.aspx

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].

Appendix A

Evaluation Forms for the Jerome Creek Pathway

Jerome Creek Report
May, 2013

Jerome Creek, Pleasant Prairie, WI, Area 2 (South East)

1. Probability of aquatic pathway existence

Aquatic Pathway Team		Expertise Position title or team role	Rating Flow into GLB	Certainty	Rating Flow into MRB	Certainty
		USACE, Rock Island - Hydraulic Engineer	Low	RC	Low	VC
		USACE, Detroit - Hydraulic Engineer	Low	RC	Low	VC
		NRCS - Hydraulic Engineer	Low	RC	Low	RC
		Team Ratings	**Low**	**RC**	**Low**	**VC**

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 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.

Qualitative Rating	Qualitative Rating Category Criteria
High	Perennial streams and wetlands or intermittent stream known/documented to convey significant volumes of water across the basin divide for days to weeks multiple times per year.
Medium	Intermittent stream capable of maintaining a surface water connection to streams on both sides of the basin divide 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 basin divide from a 10% annual return frequency storm.
Low	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.

	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	VU	A guess

Remarks: In an event larger than the 1% flood, 2 ft contours show the possibility of water draining eastward towards the Great Lakes; however, the map that we received from the Pleasant Prairie community development director was from a SEWRPC analysis that used 1985 & 2001 contours and features. There has been much development in Pleasant Prairie in the past 10 years, and the SE drainage path has been hindered by multiple roads and subdivisions. The original thought was to place a 225 ft berm connecting 710 ft elevation contours, but after further consideration this is no longer deemed necessary. RC was chosen as a certainty level because 43rd Ave and 48th Ave were not examined during the field trip.