United States Department of the Interior

FISH AND WILDLIFE SERVICE

5600 American Blvd West, Suite 990
Bloomington, Minnesota 55437-1458

IN REPLY REFER TO:
ECOSphere Project Number 2023-0129763

Timothy C. Holt
Captain, U.S. Coast Guard
Chief, Incident Management Branch
Ninth Coast Guard District
1240 East 9th Street
Cleveland, Ohio 44199-2069

Dear Captain Holt:

This document transmits our biological opinion and conference opinion (Opinion) based on our review of the effects of the proposed RRT5 Spill Response Program (Program) on listed and proposed species and designated and proposed critical habitat pursuant to section 7(a)(2) of the Endangered Species Act of 1973 (Act), as amended (16 U.S.C. 1531 *et seq.*). Your request for formal consultation was received on April 3, 2023, and we initiated consultation on that date. We later requested an extension on the due date for the Opinion as described in the Consultation History of the attached document.

An incidental take statement is not required for framework programmatic actions (50 CFR 402.02 "Framework programmatic action") and we do not provide one with the Opinion. Any incidental take resulting from any action subsequently authorized, funded, or carried out under the program will be addressed in subsequent section 7 consultation, as appropriate.

This Opinion is based on information provided in the September 20, 2022, biological evaluation, and other sources of information. Literature cited in this Opinion is not a complete bibliography of all literature available on the species, effects of the proposed action, or on other subjects considered in this Opinion. A complete administrative record of this consultation is on file at U.S. Fish and Wildlife Service's Midwest Region Regional Office in Bloomington, MN.

Sincerely,
LORI NORDSTROM
Digitally signed by LORI NORDSTROM
Date: 2024.03.19 08:09:52 -05'00'
Lori Nordstrom
Assistant Regional Director – Ecological Services

cc: Ms. Barbi Lee, Environmental Protection Agency, Region 5, Chicago, IL
Mr. Jerome Popiel, U.S. Coast Guard, Ninth Coast Guard District, Cleveland, OH

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2 CONSULTATION HISTORY

2.1 COORDINATION BEFORE PREPARATION OF BIOLOGICAL OPINION

U.S. Fish and Wildlife Service (USFWS) began working in earnest with U.S. Coast Guard and Environmental Protection Agency (EPA) in January 2021 in preparation for the action agencies' preparation of their biological evaluation. At that time, USFWS worked with the two agencies and USCG's contractor, EnviroScience, to establish an approach to identifying listed, proposed, candidate, and species under review for potential listing that could be present in the action area. USFWS, the agencies, and EnviroScience then collaborated to identify key sources of information for each species to prepare to analyze effects of the program.

EnviroScience completed a first draft of the BE in June 2021. USFWS reviewed and provided comment on the draft in collaboration with the U.S. Department of Interior Office of Environmental Policy and Compliance (DOI). USFWS and DOI provided detailed review and comment on later drafts, including each of the appendices, which contained habitat- and species-specific determinations for each proposed spill response activity in each potentially affected environment. USFWS reviewers included employees from the Midwest Region Regional Office and from each Ecological Services Field Office (ESFO) in the states covered by EPA Region 5.

In early 2022, EnviroScience produced a "90% Draft" of the BE, for which USFWS and DOI also provided thorough review and comment. USFWS/DOI comments on the 90% Draft were finalized in the spring of 2022. EnviroScience and the action agencies applied those comments to prepare the final BE, which EnviroScience delivered to the USCG in January 2023. The action agencies then completed their review of the document and delivered it to USFWS in April 2023, with a request to initiate formal consultation.

In July 2023, USFWS requested an extension for the completion of the biological opinion to November 14, 2023. USFWS did not meet that deadline but coordinated informally with the agencies as it neared completion of the BO in December 2023.

2.2 CHANGES IN DETERMINATIONS AGREED TO DURING FORMAL CONSULTATION

During formal consultation and while preparing the biological opinion, USFWS changed some determinations as summarized below.

1. Did not address the Scioto madtom (*Noturus trautmani*) in the biological opinion. The action agencies included this species in the biological evaluation, but USFWS delisted due to extinction in October 2023.
2. Changed effects determinations for Hine's emerald dragonfly (*Somatochlora hineana*) from 'not likely to adversely affect' to 'likely to adversely affect for the following activities:
    a. Construction of barriers, pits, and trenches
    b. Manual removal/cleaning of oil, sediment, debris, or vegetation
3. Changed effects determinations for Houghton's goldenrod (*Solidago houghtonii*) to 'likely to adversely affect for the same activities that are were found to be likely to adversely affect the

dwarf lake iris (*Iris lacustris*). These species occur in areas that are likely to be similarly affected by the subject activities.

4. Changed effects determinations for several activities for Hungerford's crawling water beetle (*Brychius hungerfordi*) from 'not likely to adversely affect' to 'likely to adversely affect.

Except for Scioto madtom, these changes are detailed further in the biological opinion.

3 Concurrence with 'Not Likely to Adversely affect' Determinations

The action agencies found, in informal consultation with USFWS, that actions implemented under the spill response program may affect but are not likely to adversely affect some species (Table 1). The low likelihood of adverse effects for these species and critical habitats is due to the nature of the activities themselves, the general and activity specific BMPs outlined in the BE and our anticipation that interagency coordination during spill responses will further ensure that adverse effects are avoided. These details are articulated for each species and response activity in the species-specific effects summaries in Appendix H of the BE.

Table 1. Species and critical habitats that the proposed spill response program may affect but is not likely to adversely affect.

Species Common Name	Scientific Name	Taxonomic Group
Decurrent false aster	*Boltonia decurrens*	*Plants*
Fassett's locoweed	*Oxytropis campestris var. chartacea*	*Plants*
Lakeside daisy	*Hymenoxys herbacea*	*Plants*
Leafy prairie-clover	*Dalea foliosa*	*Plants*
Mead's milkweed	*Asclepias meadii*	*Plants*
Michigan monkey flower	*Mimulus michiganensis*	*Plants*
Minnesota dwarf trout lily	*Erythronium propullans*	*Plants*
Prairie bush-clover	*Lespedeza leptostachya*	*Plants*
Short's goldenrod	*Solidago shortii*	*Plants*
Small whorled pogonia	*Isotria medeoloides*	*Plants*
Virginia sneezeweed	*Helenium virginicum*	*Plants*
Virginia spiraea	*Spirea virginiana*	*Plants*
American burying beetle	*Nicrophorus americanus*	*Insects*
Dakota skipper	*Hesperia dacotae*	*Insects*
Karner blue	*Lycaeides melissa samuelis*	*Insects*
Pallid sturgeon	*Scaphirhynchus albus*	*Fishes*
Canada lynx	*Lynx canadensis*	*Mammals*
Gray bat	*Myotis grisescens*	*Mammals*
Gray wolf	*Canis lupus*	*Mammals*
Indiana bat	*Myotis sodalis*	*Mammals*
Northern long-eared bat	*Myotis septentrionalis*	*Mammals*
Eastern massasauga	*Sistrurus catenatus*	*Reptiles*
Copperbelly watersnake, northern Distinct Population Segment	*Nerodia erythrogaster neglecta*	*Reptiles*
Eastern black rail	*Laterallus jamaicensis ssp. jamaicensis*	*Birds*
Piping plover, Great Lakes population	*Charadrius melodus*	*Birds*
Rufa red knot	*Calidiris canutus rufa*	*Birds*
Whooping crane, non-essential experimental population	*Grus americana*	*Birds*
Canada lynx Critical Habitat	*Lynx canadensis*	Critical Habitat
Dakota skipper Critical Habitat	*Hesperia dacotae*	Critical Habitat
Indiana bat Critical Habitat	*Myotis sodalist*	Critical Habitat
Piping plover Critical Habitat	*Charadrius melodus*	Critical Habitat

Species not likely to be adversely affected by the spill response program are highly mobile, inhabit upland or other areas with low vulnerability to spill response activities, or are likely to be easily detected when present. These characteristics will help to ensure that they are either not likely to be exposed to stressors generated by spill response or, if they are exposed, are unlikely to respond in an adverse manner. Likewise for the critical habitats listed above, the essential physical and biological features (PBF) of critical habitat – described as primary constituent elements (PCE) for some species – are either unlikely to be exposed to stressors generated by spill response activities or are unlikely to respond adversely when exposed.

The characteristics of these species and critical habitats, coupled with expected implementation of BMPs, conservation measures, and interagency coordination, will help to ensure that proposed spill response activities are only likely to result in insignificant or discountable effects to the species and critical habitats. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

BMPs and conservation measures built into the RRT5 spill response program are described below in the section Activity-Specific BMPs and Conservation Measures.

4 CONFERENCE ON PROPOSED SPECIES

4.1 SALAMANDER MUSSEL AND SALAMANDER MUSSEL CRITICAL HABITAT

To confer under section 7(a)(4) of the Endangered Species Act on the proposed species, the salamander mussel (*Simpsonaias ambigua*) and for its proposed critical habitat, we've incorporated into the text of the biological opinion the standard sections and information that follow the procedures of a formal consultation. This will allow us to adopt the conference on this species and critical habitat as a formal consultation if the listing and designation becomes final.

4.2 CONCURRENCE – TRICOLORED BAT

The action agencies determined that the proposed action may affect and is not likely to adversely affect the tricolored bat (*Perimyotis subflavus*) which is proposed for listing as endangered. We concur with this determination. Tricolored bat roosts in trees, are highly mobile, and unlikely to be highly vulnerable to spill response activities. In addition, USFWS field offices will be able to use data on locations of tricolored bat roosts and other occurrence records to help establish appropriate buffer zones and to implement other BMPs and conservation measures if a spill response is needed in or near its habitat. If the tricolored bat is listed, we recommend that the agencies coordinate with USFWS to confirm our concurrence on the determination for this species.

5 OTHER SPECIES ADDRESSED IN THE BIOLOGICAL EVALUATION

In addition to listed species, critical habitats, and proposed species, the action agencies also thoroughly evaluated effects of the spill response program on species that are under review by USFWS for potential listing. Although we do not address those species directly in this biological opinion, the analysis done for these species in collaboration with USFWS will help to avoid or minimize effects and will provide a basis to confer under section 7(a)(4) of the Endangered Species Act if any of the species are proposed for listing.

If any of the unlisted species are proposed for listing, we will work with the action agencies to evaluate the preferred approach to confer on effects to the species per section 7(a)(4) of the ESA and the implementing regulations for this section at 50 CFR 402.10. The inclusion of the species in the BE should facilitate those conferences. As appropriate, conferences may be adopted as formal consultations when species are listed as endangered or threatened or when a critical habitat proposal is finalized [see 50 CFR 402.10(d)].

6 BIOLOGICAL OPINION

6.1 DESCRIPTION OF THE PROPOSED ACTION

6.1.1 Overview of the Action

The action is the administration and oversight of Area Contingency Plans (ACP) and responses carried out under the direction of the National Oil and Hazardous Substances Pollution Contingency Plan (National Contingency Plan or NCP) and applicable laws – Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Oil Pollution Act, and the Emergency Planning and Community Right-to-Know Act – by the U.S. Environmental Protection Agency (EPA) Region 5 and the U.S. Coast Guard (USCG) Ninth District. The programmatic action does not include response actions whose effects are entirely terrestrial and overseen by states and responses for spills below a certain magnitude (see **Infrastructure used to Define the Action and Action Area**, below).

A detailed description of the proposed action can be found in the EPA and USCG biological evaluation (BE, *Biological Evaluation of the Response Activities Contained in the Region 5 Regional Contingency Plan/ Inland Zone Contingency Plan for the Response to Spills of Oil in Fresh Water Prepared for: The United States Coast Guard Ninth District and The United States Environmental Protection Agency Region 5*; September 20, 2022; prepared by EnviroScience, Inc.).

6.1.2 Legal Authority

The underlying authorities for spill response planning come from various acts, including the Federal Water Pollution Control Act (FWPCA) and the OPA 90, and are codified at 33 U.S.C. § 1321. This statute provides the President of the United States (President) the authority to respond to a discharge or substantial threat of discharge of oil or a hazardous substance.

6.1.3 Action Area

Areas likely to be affected by the program are within EPA Region 5 and include both coastal and inland operational areas of Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin, including tribal territories (Fig. 1). The coastal operational area consists of the open waters of the Great Lakes, including Lake St. Clair, the interconnecting rivers, major bays, ports, and harbors of the Region 5 states, and the land surface, land substrata, ground water, and ambient air proximal to those waters. The inland operational area includes all other land territories of the six states, including each state's inland ponds, lakes, and rivers.

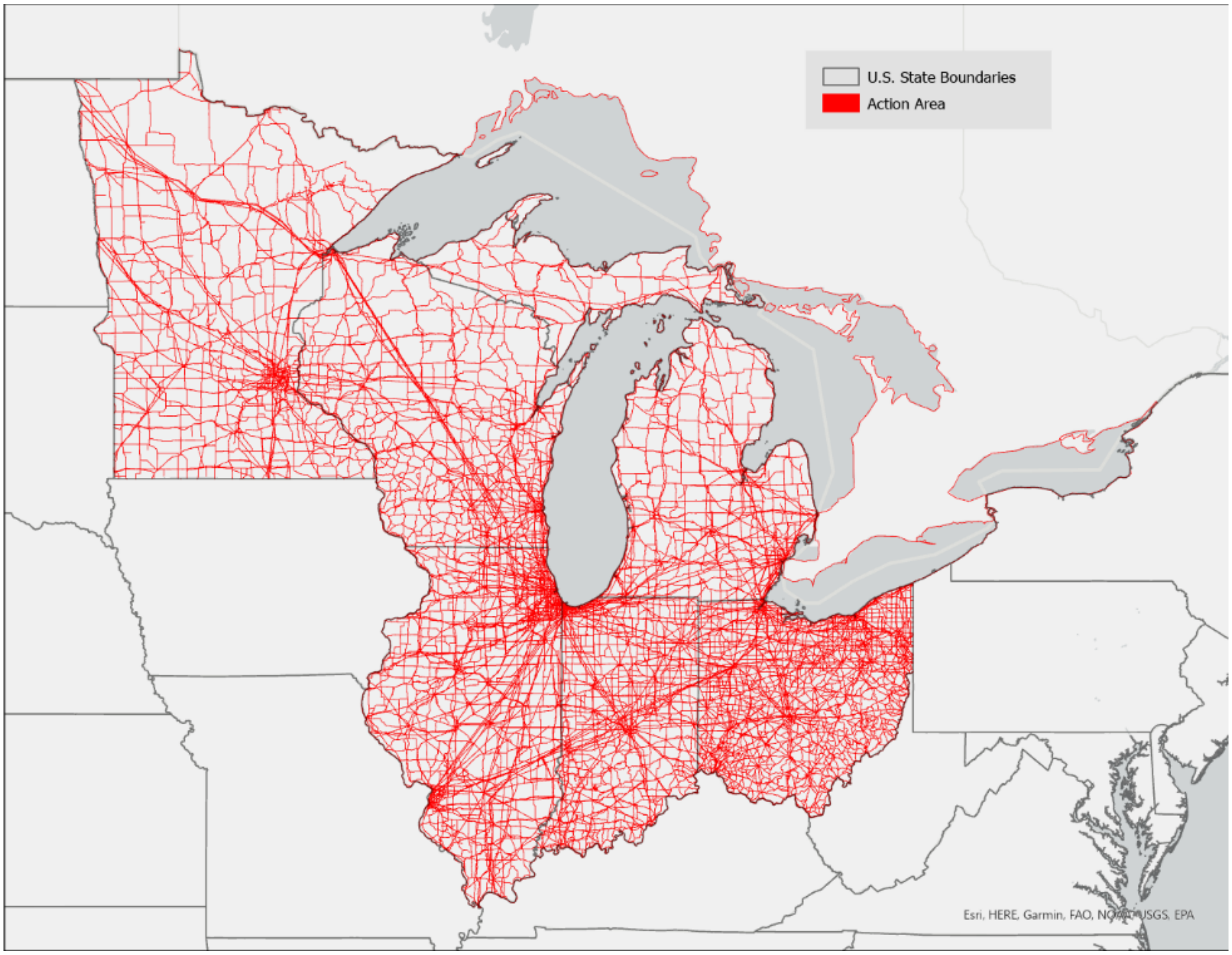

Figure 1. The action area (red) spread across the six states that comprise Environmental Protection Agency Region 5.

Within EPA Region 5, the action agencies restricted the action area for this consultation by including only spill responses that would be needed in areas "that have a higher risk of oil spills greater than 11,000 gallons" – the approximate amount carried by one large tanker truck (BE, p. 65). Spills of this magnitude are likely to occur along certain surface transportation infrastructure, waterways, and crude oil and petroleum facilities.

Therefore, varying proportions of each state overlap with the action area, depending on the extent of the following features:

- Major Roads
- Crude Oil Pipelines
- Crude Oil Rail
- Navigable Waterways
- Petroleum Pipelines
- Petroleum Refineries
- Petroleum Product Terminals
- Port Facilities
- Railroads

To fully define the location and extent of the action area, the action agencies extended a one-mile buffer on both sides of the high-volume transportation corridors and along railways carrying unit trains, and for one mile inland along coasts. The inclusion of one-mile buffers around these features was intended to ensure that potential effects of staging and associated ingress and egress activities and structures would be addressed and to ensure a range of siting options to reduce potential impacts on the species and designated or proposed critical habitat (BE, p. 66). In addition to the one-mile buffers, the action agencies also included waters downstream of intersections between waterways and high-risk spill areas.

See Figures 3-8 in the BE for a depiction of the action area in each of the six states.

6.1.4 Scope of Spill Response and Agency Roles

Under the National Contingency Plan, the action agencies provide Federal On-Scene Coordinators (FOSC) to respond to both oil spills and hazardous substance releases, including releases at hazardous waste sites requiring emergency removal actions. In the coastal zone, EPA performs remedial actions for releases originating from facilities and all response actions for releases originating from hazardous waste management facilities.

Two USCG districts overlap with EPA Region 5 – the Ninth District serves the Great Lakes draining basin; the Eighth District serves the drainage basins of the Upper Mississippi and Ohio Rivers. Within the Great Lakes coastal zone, the appropriate Captain of the Port functions as the predesignated FOSC for all oil and hazardous substance releases – subject to redelegation of certain Comprehensive Environmental Response (CERCLA) response authorities.

EPA is the predesignated FOSC for the entire inland zone, including the inland river system within the Eighth Coast Guard District. Per an MOA between EPA Region 5 and the Eighth Coast Guard District, USCG has agreed to respond to spills from commercial vessels only within the inland zone portion of the Eighth District. The National Oceanic and Atmospheric Administration provides scientific support to both agencies for oil and chemical spills.

In general, oil and hazardous substances under the umbrella of the programmatic action include crude oil and other petroleum derivatives. Oil as defined by Section 311(a)(1) of the CWA includes:

> "…oil of any kind or in any form, including, but not limited to, petroleum, fuel oil (including low sulfur [diesel] fuel), sludge, oil refuse, and oil mixed with wastes other than dredged spoil. Oil as defined by Section 1001 of the OPA means oil of any kind or in any form, including petroleum, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredged spoil, but does not include any substance which is specifically listed or designated as a hazardous substance under subparagraphs (A) through (F) of Section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. 9601) and which is subject to the provisions of that Act [42 U.S.C. 9601 et seq.]."

The size and complexity of spill response activities may correspond to the magnitude of spills, which are broadly broken down into three categories to provide context in ACPs – from low to high magnitude those categories are:

- average most probable discharge
- maximum most probable discharge
- worst-case discharge.

Average most probable discharge is one percent of the volume of the worst-case discharge. Maximum most probable discharge is the lesser of 1,200 barrels or 10% of the worst-case discharge. Worst-case discharge for onshore facilities and ports is the largest foreseeable discharge in adverse weather conditions, based on specific criteria as described in the BE (p. 17).

6.1.5 Primary and Secondary Response Actions

In the BE, USCG and the EPA describe the scope of primary response actions that may be taken during spills. For details on these actions, their intent, and response activities that commonly take place in conjunction with the actions, see p. 22-59 of the BE.

The full list of primary response actions that may be taken during spill responses include:

- Deflection and Containment Activities
  - Dikes or Berms
  - Construction Barriers, Dams, Pits, and Trenches
  - Culvert Blocking
  - Skimming
- Recovery Activities
  - Skimming
  - Vacuuming
  - Sorbents
- Removal-Cleanup Activities
  - Flooding
  - Flushing
  - Steam Cleaning
  - Sandblasting
  - Mechanical (Non-Chemical) Sand/Sediment/Mudflat Cleaning (surface, <1 inch)
  - Mechanical (Non-chemical) Sand/Sediment/Mudflat Cleaning and Excavation (>1 inch)
  - Manual Removal/Cleaning of Oil, Oiled Sediment, Debris, or Vegetation
- Submerged Oil Activities
  - Detection of Non-floating or Submerged Oil
  - Recovery of Non-Floating or Submerged Oil
  - Containment of Non-Floating or Submerged Oil
- Wildlife Protection Activities
  - Deterrence or Hazing
  - Capture and Care of Contaminated Species or Recovery of Contaminated Carcasses

- Locating, Tracking, and Support Activities
  - Aircraft Use
  - Use of Vessels
  - Use of Vehicles
  - Use of Machinery/Supporting Equipment
  - Creation/Use of New Access Points
  - Creation/Use of Staging Areas (Land-based)
  - Natural Attenuation
  - Deployment of Sampling/Monitoring Location Buoys
  - Locating, Sampling, and Monitoring: Air, Land, Water (includes Shoreline Cleanup Assessment Technique – SCAT)
  - Access by Foot Traffic

- Secondary Response Actions
  - Waste Handling
  - Temporary Storage (Land-based)
  - Temporary Storage (Water-based)
  - Decanting
  - Decontamination
  - Response Actions Specific to the Action Area and Not Included in the RAM

6.1.6 Information Sharing with USFWS during Emergency Spill Responses

The BE outlines specific questions that the action agencies will always consider ensuring that responders provide information sufficient in scope and detail to coordinate effectively with USFWS during spill responses. These questions are referred to as 'considerations for consultation' and are described on p. 22-59 of the BE under brief descriptions of each response activity. These are also listed in Appendix C.

For example, when the response includes booming activities: the action agencies will consider the following questions when providing information to USFWS:

- What type of boom will be used?
- Will the boom be anchored, and if so, what does the anchoring system include?
- Where will the boom be anchored?
- How is the boom being used, i.e., for containment, deflection, or protection?
- How long to deploy and recover the boom?
- Where is oil-contaminated boom disposed of?
- What machinery (vessels, trucks, etc.) are used to recover boom?
- What size is the boom?
- Why might the boom fail?
  - There are five basic types of boom failure: entrainment, drainage, splash over, submergence, and planning.
- Is there netting or skirting, and what is the size and material?
- How will equipment (e.g., vessels) be disinfected to prevent the spread of invasive species,
- particularly if the equipment is being transported to or from a different watershed?

6.1.7 Pre-Spill Planning – Endangered and Threatened Species and the Contingency Planning Process

6.1.7.1 Coordination with Area Committees and Regional Response Teams

Coordination between USFWS, Area Committees, or Regional Response Teams is essential to:

- determine which listed species or critical habitats are likely to be present in each planning area.
- evaluate potential effects of spill responses.
- develop measures to avoid or reduce impacts to listed species and critical habitats.

Coordination between Area Committees and USFWS when developing or modifying Area Contingency Plans and response strategies is considered essential per the 2001 ESA Memorandum of Agreement (MOA). USCG, EPA, and USFWS are each signatory to the MOA.

The descriptions of Area Contingency Plans, Area Committees, and Regional Response Teams are adapted below from the 2001 MOA.

Area Contingency Plans – Intent and Incorporation of Fish and Wildlife Information

Area Contingency Plans (ACP) are the plans prepared by an Area Committee (or the Regional Response Team acting as the Area Committee) to implement the NCP and Regional Contingency Plan (Fig. 2). They are designed in part to address removal of a worst-case discharge and to mitigate or prevent a substantial threat of such a discharge from a vessel, offshore facility, or onshore facility operating in or near an area designated by the President. A detailed annex containing a Fish and Wildlife and Sensitive Environments Plan prepared in consultation with the USFWS, NOAA, and other interested natural resource management agencies is to be incorporated into each ACP.

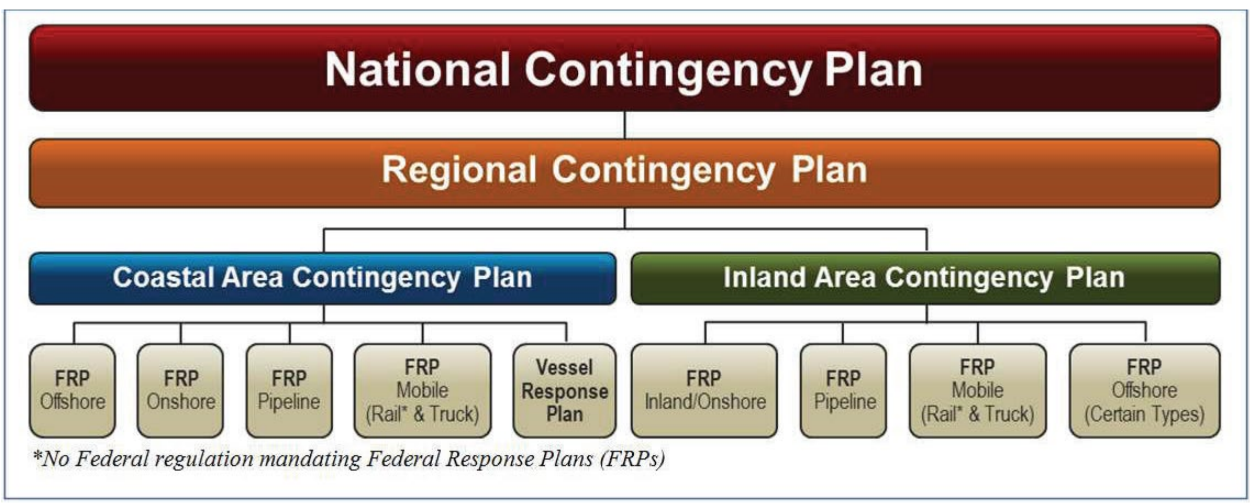

Figure 2. Multi-layer system for planning federal responses to discharges or substantial threats of discharges of oil or hazardous substances as authorized under the Federal Water Pollution Control Act. FRP = Facility Response Plan.

There are five main types of spill response plans: Regional Contingency Plans, Area Contingency Plans (ACP) and subsidiary Geographic Response Strategies, Facility Response Plans, and Vessel Response Plans (VRP). In the MOA, the term ACP also includes sub-area ACP's, sub-area contingency plans, geographic response plans and geographic response strategies as per 40 CFR 300.210. A key example of a sub-area contingency plan is the Inland Zone Sub-Area Contingency Plan (SACP) for Great Black

Swamp. One of the most imperiled species in the action area, a freshwater mussel – the white catspaw (*Epioblasma obliquata perobliqua*) – occurs in the area addressed by this plan.

As of January 2022, there were 16 active response plans in EPA Region 5 that operate under the coordinating structure provided by the regional contingency plan (see Fig. 2 and Table 1 in BE).

Figure 3. Overview of Planning Areas within EPA Region 5.

ACPs and Geographic Response Strategies provide guidance for spill response efforts that occur within defined planning areas. Geographic Response Strategies "include tactical response plans tailored to a particular shore or waterway" (BE, p. 7). Facility Response plans may address pipelines and certain vessels "that could reasonably cause substantial harm to the environment by discharging oil into or on the navigable waters of the United States and adjoining shorelines (BE, p. 7).

EPA Region 5 and the USCG have created several Sub-Area-Geographic Response Plans (GRPs) to help coordinate timely and effective response to minimize damage from releases of oil or hazardous materials (Fig. 3).

Area Committees

Area Committees are entities appointed by the President consisting of members from qualified personnel of federal, state, and local agencies with responsibilities that include preparing an area contingency plan. The chairs of the Area Committee are the USCG for coastal and Great Lakes plans, and the EPA for inland plans. In some instances, the Regional Response Team may act as the Area Committee.

Regional Response Teams

According to the MOA, Regional Response Teams (RRT) are comprised of agency representatives and act in two modes: the standing RRT and incident specific RRT. The co-chairs are the USCG and USEPA. The standing team is comprised of designated representatives from each participating federal agency, state government and local government as agreed upon by the states.

The role of the standing RRT includes establishing regional communications and procedures, planning, coordination, training, evaluation, preparedness, and related matters on a region-wide basis. It also includes assisting Area Committees in coordinating these functions in areas within their specific regions.

Incident-specific teams are formed from the standing team when activated for a response. The role and composition of the incident-specific team is determined by the operational requirements of the response. During an incident, it is chaired by the agency providing the FOSC.

6.1.7.2 RRT5 Coordination with USFWS

Within six months of completing this biological opinion, USFWS will convene a meeting with USCG and EPA to identify species or critical habitats for which development of spill response plans is a critical priority. The action agencies identified the development of spill response plans as a BMP for each species, but resources are not currently sufficient to develop spill response plans for every species at once. Therefore, coordination among the agencies is needed to ensure that the order in which these plans are completed corresponds to the potential for spill responses to significantly affect conservation of the species, designated critical habitat, or both. Highly imperiled and narrowly distributed species with clearly identifiable spill risks would be a higher priority for the development of geographic response plans than less imperiled and widespread species or species at low spill exposure.

When developing RCPs, the Planning Committee coordinates with USFWS ESFOs and with the FWS regional office spill response coordinator to ensure that plans incorporate information necessary to conserve listed species and critical habitat. For each planning effort, USFWS provides an endangered species point-of-contact and helps the planning committee to analyze potential effects of spills and spill responses on listed species and critical habitat.

USFWS also helps to ensure that key measures and important locations for listed species and critical habitat are appropriately incorporated into the plan. USFWS involvement in plan development includes section 7(a)(2) consultation on the contingency plan.

USFWS is expected to notify the planning committee when newly listed species or newly designated critical habitats overlap with the planning area. Likewise, the planning committee is expected to notify USFWS when substantive changes to spill response activities are made and to work with USFWS to determine whether revision of the 7(a)(2) consultation is necessary.

6.1.7.3 Poweshiek Skipperling Geographic Response Strategies

During consultation it became clear that development of site-specific strategies for two sites inhabited by the Poweshiek skipperling in Michigan was urgently needed due to the species' conservation status and the proximity of rail lines and a crude oil pipeline. EPA proposed to support the development of a site-specific strategy for each site as part of the RRT5 spill response program.

6.1.8 Conservation Measures and Best Management Practices

Mandatory conservation measures or BMPs that apply to the RRT5 spill response program are described in the BE and in ACPs. The BE includes a short list of general or standard BMPs as well as activity specific BMPs.

The action agencies make it clear that the conservation measures and best management practices (BMPs) included as part of the proposed action are mandatory and "non-negotiable" and will be implemented whether adverse effects to listed species or critical habitats are likely or not. They consider the BMPs, and conservation measures described in the BE to be "conditions" of the response actions.

6.1.8.1 General or Standard BMPs (BE, p. 62)

In the BE, the action agencies describe the following BMPs as "standard for spill response actions by EPA and USCG FOSCs and are generally part of spill response planning."

- **An endangered species protection, effects, and habitat monitoring plan** for the Action Area in place will provide information on the possible presence and impacts of ESA listed, proposed, and other species of concern or designated or proposed critical habitats. The need for wildlife hazing for a specific response activity will be assessed and implemented if necessary.
- **Buffer zones** for potentially affected wildlife or their habitat will be established and implemented (i.e., avian nesting areas, fish spawning areas, etc.) with the concurrence of USFWS. Buffer zones will be defined by the Environmental Unit in coordination with USFWS during spill response planning.
- **Spill Response Plans** prepared at the regional or sub-area level and Environmental Sensitivity Indices (ESIs) in the Action Area will have pre-identified staging areas for personnel and equipment that will avoid and minimize disturbance to threatened or endangered wildlife and their habitats. Local USFWS field offices will be consulted to obtain current geo-referenced information for listed species and proposed or designated critical habitat within the area of interest.
- **Before installing or placing temporary structures or material** (i.e., booms, berms, dikes, culvert blocks, or other oil collection equipment/material/structures), construction/deconstruction/removal plans are in place and are scheduled and implemented in a way to eliminate or minimize impacts to threatened and endangered species and their habitats, including any designated or proposed critical habitat.

These four BMPs are also listed in each species-specific summary in Appendix H (Fig. 4).

<table>
<tr><td colspan="2"><u>Topeka Shiner</u></td><td colspan="2">Status</td><td colspan="2">Endangered (1998)</td><td>63 FR 69008</td></tr>
<tr><td colspan="2">Scientific Name</td><td colspan="2">Notropis topeka</td><td>Critical Habitat</td><td colspan="2">Designated</td></tr>
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<tr><td colspan="7">High-Risk Response Actions and Activities</td></tr>
<tr><td colspan="7">May affect, not likely to adversely affect due to insignificant or discountable effects</td></tr>
<tr><td colspan="7">All Habitats of Occurrence</td></tr>
<tr><td colspan="7">• Waste Handling
• Temporary Storage (on water)</td></tr>
<tr><td colspan="7">May affect, likely to adversely affect – discuss possible BMPs with Services</td></tr>
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<tr><td colspan="3">• Booming
• Dikes or Berms
• Construction barriers, pits, and trenches
• Culvert Blocking
• Skimming
• Vacuuming
• Flooding
• Flushing
• Steam Cleaning
• Sandblasting
• Detection of non-floating or submerged oil
• Recovery of non-floating or submerged oil
• Containment of non-floating or submerged oil
• Deterrence or Hazing
• Use of Vessels
• Deployment of buoys
• Decanting</td><td colspan="4">1. Booming
2. Dikes or Berms
3. Construction barriers, pits, and trenches
4. Skimming
5. Vacuuming
6. Flooding
7. Flushing
8. Steam Cleaning
9. Sandblasting
10. Detection of non-floating or submerged oil
11. Recovery of non-floating or submerged oil
12. Containment of non-floating or submerged oil
13. Deterrence or Hazing
14. Use of Vessels
15. Deployment of buoys</td></tr>
<tr><td colspan="7">Special considerations needed, high level of concern</td></tr>
<tr><td colspan="7">All Habitats of Occurrence</td></tr>
<tr><td colspan="7">Natural attenuation: allow habitat to recover naturally while monitoring
Locating, sampling, and monitoring: air, land, water (includes SCAT)</td></tr>
<tr><td colspan="7">BMPs</td></tr>
<tr><td colspan="7">1. A wildlife monitoring plan
2. Buffer zones with the concurrence of USFWS.
3. Spill Response Plan that has pre-identified staging areas for personnel and equipment that minimize disturbance.
4. When installing or placing temporary structures or material (i.e., booms, berms, dikes, culvert blocks, or other oil collection equipment/material/structures), ensure that construction/deconstruction/removal plans are in place and are scheduled/implemented in a way to eliminate or minimize impacts to threatened and endangered species and their habitats.</td></tr>
<tr><td colspan="7">USFWS Lead Office Contact:</td></tr>
</table>

Figure 4. Example of a species account in the Biological Evaluation, Appendix H.

6.1.9 Activity-Specific BMPs and Conservation Measures

"At a minimum" USCG and EPA agree to implement the activity specific BMPs, or conservation measures listed below in this section. The agencies will implement these "where listed species occurrences or proposed or designated critical habitats overlap with the spill response area of interest" (BE, p. 62).

6.1.9.1 Deflection and Containment (BE, p. 62)

The standard BMPs and conservation measures listed in Section 2.5.1 in the BE apply to all deflection and containment activities – Booming; Dikes or Berms; Construction of Barriers, Dams, Pits, and Trenches; and Culvert Blocking.

6.1.9.1.1 Recovery Activities (BE, p. 62-63)

- Skimming in open water operations – Vessels will avoid transit through submerged aquatic vegetation. Where applicable, vessels will exclude larger water column species through use of restricted size intakes for skimming.
- Vacuuming in open water operations – Vessels will avoid transit through submerged aquatic vegetation. In non-open water operations, responders will closely monitor vegetated areas and develop a site-specific list of procedures and restrictions to minimize damage to vegetation.
- Use of Sorbent materials – Responders will monitor, maintain, and replace sorbents at regular intervals as necessary to avoid material breaking down. Particulate sorbent material will not be placed in open water (i.e., coconut husk, peat, etc.).

6.1.9.1.2 Removal and Cleanup Activities (BE, p. 63)

The BMPs below apply to the removal and cleanup activities, Flooding, Flushing, Steam Cleaning, and Sandblasting.

- Responders will monitor and maintain booms and oil collection methods at the application sites to prevent transport of oil and oiled sediments away from application site.
- Responders will employ careful use of the response equipment (i.e., hose, pressure wand) to prevent overuse.
- If at all possible, these techniques will not be used in sensitive areas such as soft substrates, aquatic vegetation, and spawning areas. If unavoidable, special restrictions will be established by the Environmental Unit in coordination with responders for areas where foot traffic and equipment operation may cause compaction or other damage.
- For Flooding applications – Responders will only use low pressure and ambient water temperatures where benthic organisms and vegetation are located to minimize stress or displacement.
- For Sandblasting operations – Responders will coordinate with the Environmental Unit to plan for and implement careful recovery and collection of oiled sand.

6.1.9.1.3 Additional Restriction in Mussel Beds and Vegetated Habitats (BE, p. 63)

The following activities are not permitted within mussel beds or vegetated habitats without incident-specific emergency consultation with USFWS: Mechanical Sand Cleaning (surface, <1 inch), Mechanical

Sand Cleaning (>1 inch) and/or Excavation, Removal of Non-floating or Submerged Oil, and/or Manual Removal.

6.1.9.2 Wildlife Protection Activities (BE, p. 63)
Actions must be conducted by authorized permitted personnel in the Wildlife Operations branch with USFWS oversight. Actions must be consistent with an existing Fish and Wildlife and Sensitive Environments Plan or Wildlife Response Plan if in place for the planning area or the EPA or USCG must ensure that one of these is created for the incident. Any such plan must meet the objectives set forth in 40 CFR 300.210 c(4i)(iiF).

6.1.9.3 Locating, Tracking, and Support Activities (BE, p. 63-64)
- All aircraft/vessel/vehicle traffic will be minimized as much as possible – particularly in environmentally sensitive areas identified in the Resources at Risk Summary form (Appendix D).
- Existing shore-based access/vehicular traffic routes and existing infrastructure or boat ramps will be utilized to the greatest extent possible.
- Creation of new access points, roads, ramps, or aircraft landing areas in order to deploy a response activity during a spill will need to be addressed under emergency consultation procedures.
- Deterrence and hazing may be considered for Natural Attenuation.
- For Deployment of Buoys; Locating, Sampling and Monitoring; and Access of Personnel by Foot Traffic, Responders will consult with the Environmental Unit or natural resource protection managers to determine if any additional restrictions or additional safety precautions are required in the proposed action area or if emergency consultation is necessary.

6.1.9.4 Waste Management and Temporary Storage Activities (BE, p. 64)
- Waste accumulation and storage locations will be pre-identified by responders in coordination with the Environmental Unit in a way that minimizes or eliminates potential for disturbance to threatened or endangered wildlife and their habitats.
- For waste accumulation and storage locations, responders will ensure that the following criteria will be in place: spill prevention, control, and countermeasures plans; storm water pollution prevention plans; severe weather contingency plans; ample storage for segregation of wastes; and an emergency response plan for waste accumulation/storage locations.
- To the maximum extent practicable, responders will conduct waste handling and staging operations in semi-developed or developed areas in order to minimize impact and to minimize the potential of new contamination in clean areas.

6.1.9.5 Decontamination (BE, p. 64)
- Responders will monitor wildlife and will take appropriate action to prevent harm (where not possible contact wildlife operations professionals, Environmental Unit, and SSC).
- Responders will remove oil as soon as possible to prevent contamination of non-oiled areas, insofar as is practical.
- Decontamination sites will be established by responders in non-sensitive or protected areas without listed species, for example: on a parking lot or at a boat ramp.

6.1.10 Area-Specific BMPs

ACPs also contain additional mandatory BMPs that may not be spelled out in the BE. In addition, the agencies may develop more detailed and prescriptive BMPs "as part of informal consultation between the action agencies and USFWS during the development of ACPs" (BE, p. 61). As with BMPs contained in the BE, the responding agencies would be expected to implement these additional BMPs as part of spill responses – i.e., "Conservation measures and BMPs are non-negotiable" (BE, p. 61).

6.1.11 Coordination with USFWS during Responses

EPA, USCG, or the Department of Interior Regional Environmental Officer will notify USFWS after a spill has occurred. Then, coordination with USFWS occurs as follows (BE, p. 20):

1. The FOSC provides initial information regarding spill response actions to USFWS within 24 hours of initiating emergency response activities.
2. USFWS acknowledges receipt of the notification and provides information to the FOSC on any species or habitats that may occur in the area and may be affected by the response activities, as well as recommended BMPs or other measures to avoid or minimize potential effects on those resources. USFWS should provide this information no more than 24 hours after receiving the FOSC's formal notification that a spill response has been initiated.
3. The FOSC continues to coordinate with USFWS as appropriate throughout the emergency response action. USFWS may join the incident management team to advise the FOSC. Staff from USFWS may be assigned to the Environmental Unit of the Planning Section to provide on-site technical assistance to avoid and minimize impacts from the response action on listed species and critical habitats.

Habitat Fact Sheets and Species Fact Sheets are developed to guide selection of response tactics. They are described in Sections 3.2 and 4.0 of the BE and are available on the RRT5 website (Figs. 5-6).

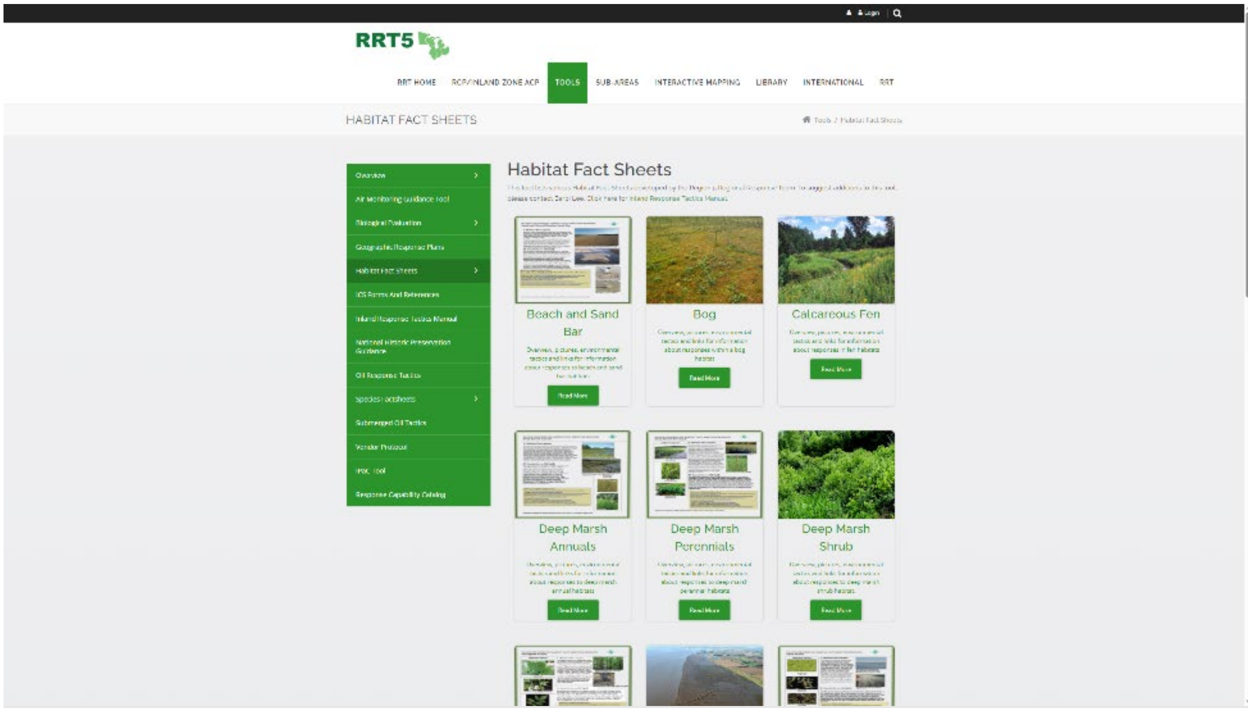

Figure 5. A view of the RRT5 website where habitat fact sheets can be obtained to guide spill responses.

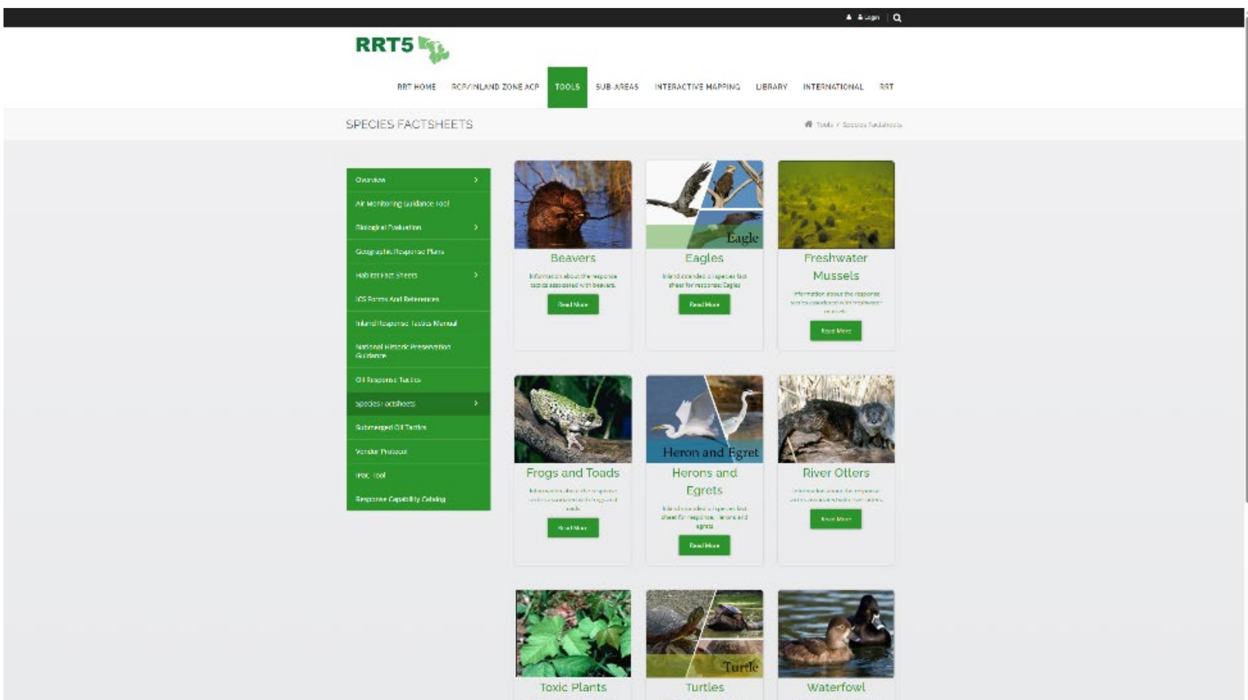

Figure 6. A view of the RRT5 webpage where spill species fact sheets are available to help guide spill responses.

6.1.12 USFWS and the Long-Term Cleanup Phase

USFWS may also be involved with the long-term cleanup phase to ensure that regulatory mandates are followed. Long-term response actions may include evaluation of cleanup-decontamination options;

implementation of cleanup alternatives; and long-term monitoring or remediation of the impacted area, if necessary.

6.1.13 Post-Emergency Consultations with USFWS on Individual Spills

Until the oil removal operations are completed, and the case is closed in accordance with 40 CFR 300.320(b), USCG and EPA considers the emergency status to remain in effect with respect to the section 7(a)(2) consultation process. 40 CFR 300.320(b) states that "Removal shall be considered complete when so determined by the On-Scene Coordinator (OSC) in consultation with the Governor or Governors of the affected states."

Once the case is closed, USCG, EPA, or both will initiate formal consultation or informal consultation with USFWS on the effects of the response activities. Formal consultation will be necessary whenever the response activities likely resulted in adverse effects to any listed species or critical habitat. If adverse effects likely occurred or were known to occur, USFWS will complete a biological opinion after USCG, EPA, or both provide the following:

1. A description of the emergency.
2. Justification for the expedited consultation.
3. An evaluation of the effects of the response to the emergency and of the emergency itself on affected species and their habitats, including documentation of how USFWS recommendations were implemented, and the results of implementation in minimizing adverse effects.

If adverse effects to listed species or critical habitats likely did not occur because of the emergency response, USCG or EPA will provide a rationale for that finding and request concurrence from USFWS. The action agencies make it clear in the BE that incorporation of area specific BMPs or conservation measures into the response may avoid adverse effects and the need for formal consultation post-response.

7 Status of the Species and Critical Habitat

For each species that may be present in the action area, we incorporate by reference the information that USCG and EPA included in the BE – specifically the information section 4.0 – Status of the Species and Critical Habitats in the Action Area – and in Appendix E – Species Status Descriptions. Below we briefly summarize key information from those sections and add any new or additional information that we think is essential to assess species-specific effects of the agencies' spill response actions.

7.1 Plants

7.1.1 American Hart's-tongue Fern (*Asplenium scolopendrium* var. *americanum*)

The following information is adapted from USFWS (2019*a*).

Most American hart's-tongue fern populations occur in discrete locations in central New York, south-central Ontario, and northern Michigan in areas of heavy lake-effect snowfall. Additional populations also occur in sinkhole environments in Tennessee, Alabama, and Mexico (U.S. Fish and Wildlife Service 2019*a*). The species inhabits open understories beneath tree canopies in areas that are typically buffered from temperature extremes. In the north insulating snow cover provides that buffer in the winter and in the south, it is provided via proximity to cave openings. Tree removal and invasive understory plant species both threaten the species where it occurs (U.S. Fish and Wildlife Service 2019*a*).

American hart's-tongue fern reproduces in a manner typical of ferns. The most prominent and visible life stage is the sporophyte, which produce spores that germinate and develop into gametophytes. Gametophytes are small and not routinely observed and contain both egg- and sperm-producing tissues. Eggs and sperm produced by gametophytes combine to form zygotes, which develop into sporophytes to complete the reproductive cycle. The gametophyte life stage is "particularly sensitive" and vulnerable to drought (U.S. Fish and Wildlife Service 2019*a*).

Since the American hart's-tongue fern was originally listed in 1989, the number of known extant populations increased in published reports from 16 to 144 – 32 in the United States (12 in Michigan, 18 in New York, one in Tennessee, and one in Alabama) and 112 in Canada (U.S. Fish and Wildlife Service 2019*a*). USFWS conservatively estimated the total population of the species to include approximately 122,000 plants (U.S. Fish and Wildlife Service 2019*a*).

7.1.2 Dwarf Lake Iris (*Iris lacustris*)

Dwarf lake iris (*Iris lacustris*) is endemic to the northern shores of Lakes Huron and Michigan, where it ranges from Brown County, Wisconsin to the Bruce Peninsula of Ontario (Fig. 7). Historical records indicate it once occurred as far south as Milwaukee County, Wisconsin and Sandwich, Ontario along the Detroit River.

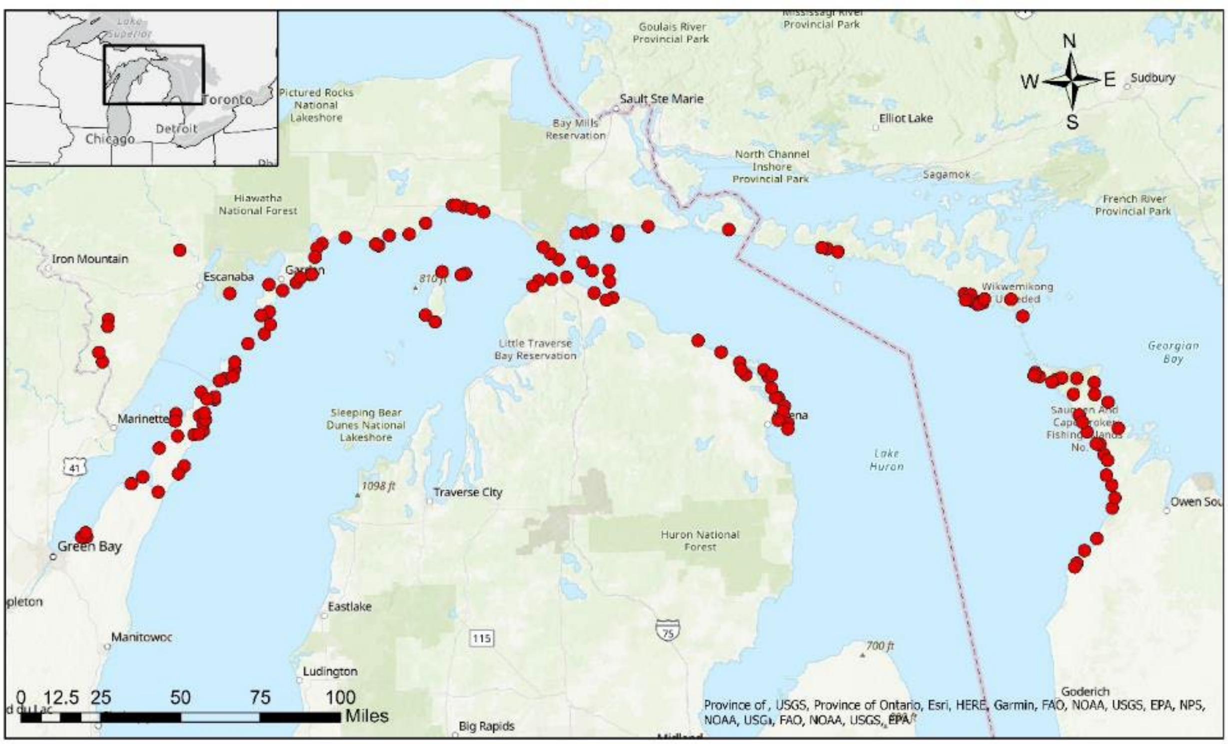

Figure 7. Current dwarf lake iris distribution.

Rangewide there are 167 extant occurrences (Fig. 7). Of the 80 known to be extant in Michigan, 24 are ranked A to B (excellent to good quality), with eight occurrences ranging across more than 500 acres each (Michigan Natural Features Inventory. 2022. Element occurrence records for dwarf lake iris, Houghton's goldenrod and Voss's goldenrod. Michigan Natural Features Inventory, Lansing, Michigan). Using a count of minimum estimates over the last 40 years, the species has a current estimate of over 60 million above-ground stems – dwarf lake iris is clonal and so the number of individual plants is less than 60 million.

Dwarf lake iris seems to allocate a much lower percentage of its resources to sexual reproduction than vegetative reproduction. Within populations, a low percentage of plants flower each year. Fruit set requires a pollen vector, and studies have shown that fruit set in some years may be very low (3%, Planisek 1983). Bees (Apoidea) and at least one species each of hawk moth (Sphingidae) and beetle (Coleoptera) are documented vectors of dwarf lake iris pollen (U.S. Fish and Wildlife Service 2022*a*). Fruit capsules contain, on average, 21–22 seeds (Planisek 1983, Morgan and Wolf 2008).

Dwarf lake iris populations are tied to fluctuations of Great Lakes levels and other factors such as wind, wave, and ice action. These shoreline disturbances cause erosion as well as deposition of sand and gravel, creating new storm berms and providing sites for dwarf lake iris to colonize. Natural disturbances also cause tree blowdowns, opening the tree canopy to create the partial shade that species prefers. In the absence of disturbances, natural forest succession increases the canopy cover, shading out the species. Thus, dwarf lake iris populations fluctuate over time and are tied to climatic events and changing local habitat conditions.

Soil moisture can be a limiting factor during drought years. At a site in Brown County, Wisconsin during the drought of 1988, 60% of dwarf lake irises growing in open areas that received three to four hours of direct sunlight per day died back and did not recover the following spring (Morgan and Wolf 2008). In contrast, those that received about one hour of sunlight a day suffered little die-back, and the density did not decline from 1988 to 1989.

Dwarf lake iris often occurs in association with coniferous forest dominated by northern white cedar (*Thuja occidentalis*). Other common trees may include balsam fir (*Abies balsamea*), white pine (*Pinus stobus*), red pine (*Pinus resinosa*), white spruce (*Picea glauca*), black spruce (*Picea mariana*), tamarack (*Larix laricina*), paper birch (*Betula papyrifera*), and trembling aspen (*Populus tremuloides*). The leaf litter from these trees also affects vegetative growth, sexual reproduction, seed germination, and seedling establishment. Increasing litter depth reduces the number of shoots and dwarf lake iris blooms; litter depth may work in conjunction with decrease light levels to cause this effect. In addition, greater litter thickness affected dwarf lake iris reproduction and seedling establishment. Roots of dwarf lake iris seedlings more readily penetrate the litter of conifers, such as *Thuja* and *Picea*, than the litter of broadleaf trees, such as *Betula* and *Populus*.

Light might be the most important limiting factor for sexual reproduction. Dwarf lake iris tolerates nearly full shade to open sun but tends to reproduce only vegetatively under such conditions; for optimal sexual reproduction, the species usually requires partial shade (Crispin 1981, Makholm 1986, Van Kley 1989). As light levels decline, flower and fruit production drops until sexual reproduction is absent under dense shade.

7.1.3 Eastern Prairie Fringed Orchid (*Platanthera leucophaea*)

The eastern prairie fringed orchid is a large and showy North American orchid species adapted to fire and drought (U.S. Fish and Wildlife Service 2020*a*). It occurs in Illinois, Indiana, Iowa, Maine, Michigan, Missouri, Ohio, Virginia, and Wisconsin. The main threats to the species are the lack of land management of high-quality wetland habitats on which this species depends, including increased development, spread of exotic species, and fire suppression.

The most recent rangewide population viability assessment of eastern prairie fringed orchid completed in 2019 indicated there were 95 extant populations of which 12 were highly viable, 29 moderately viable, and 51 of low viability. Viability ranks are based on population size and trend; habitat extent; protection status; successional status; and management needs (U.S. Fish and Wildlife Service 2016*a*, 2020*a*).

USFWS recovery criteria for the species calls for 22 populations distributed across the plant communities and physiographic regions inhabited by the species historically. The number of total populations exceeds the numeric criterion by 73, but highly viable populations currently exist in only five of the eight physiographic regions historically inhabited by the species. Continued progress towards recovery requires protection and appropriate management of populations that are highly viable and restoration and protection to increase the viability of populations that do not currently meet this standard.

Health of eastern prairie fringed orchid populations depends on appropriate management, including prescribed fire, which is associated with both increased plant survival and increased fecundity (seed production). During drought, however, prescribed fire may have a negative effect if plants are under "soil moisture stress" (Bell et al. 2021).

Pollination of eastern prairie fringed orchids by sphinx moths (Sphingidae) is significant in the growth and viability of eastern prairie fringed orchid populations. Flowering begins in late June to early July and lasts for 7 to 10 days. During this period, hawkmoths pollinate the nocturnally fragrant flowers. Flowers that are exposed above the canopy of surrounding vegetation are more likely to be visited by hawkmoths but may face increased threat of white-tailed deer (*Odocoileus virginianus*) herbivory.

Seed capsules mature over the growing season and contain about 4,500 seeds that are released in late August or September (U.S. Fish and Wildlife Service 2016*a*). Germination and development of orchid plants relies in part on mycorrhizal fungi that serve as a critical energy source while plants are subterranean early in development. The fungi then become a supplemental nutrient resource even after plants emerge aboveground and are able to photosynthesize (U.S. Fish and Wildlife Service 2016*a*).

The species occurs in both upland prairie and wetlands, including tamarack bogs and sedge meadows. In wetlands, Bell et al. (2021) found that eastern prairie fringed orchid population growth was more dependent on plant survival then fecundity whereas the opposite was true in upland prairie.

7.1.4 Houghton's Goldenrod (*Solidago houghtonii*)

Houghton's goldenrod mostly inhabits narrow and dynamic shoreline habitats along the Great Lakes, including beach flats, dunes, and interdunal wetlands (U.S. Fish and Wildlife Service 1997). Fluctuating water levels, waves, wind action, and movement of sand ensure that these habitats remain suitable to colonization by plants adapted to these naturally dynamic habitats.

In addition to shore and near-shore habitats, a few disjunct Houghton's goldenrod populations inhabit northern wet-prairie-like habitats in Michigan jack pine (*Pinus banksiana*) barrens. There the species inhabits seasonally inundated areas and old interdunal depressions in a sandy glacial outwash landscape (Penskar et al. 1996, U.S. Fish and Wildlife Service 1997).

In the US. there are 74 occurrences of Houghton's goldenrod in nine counties in Michigan and one occurrence in New York (Michigan Natural Features Inventory. 2022. Element occurrence records for dwarf lake iris, Houghton's goldenrod and Voss's goldenrod. Michigan Natural Features Inventory, Lansing, Michigan; Young 2008). Thirty-three populations have been documented in Ontario (Jones 2015).

Along northern shores of Lake Michigan and Lake Huron in Michigan – where almost all the U.S. populations occur – the species is vulnerable to a variety of activities, primarily residential development; recreational activity, including off-road vehicle use; dune stabilization; and foot traffic. These activities interfere with processes typical of the species' naturally dynamic habitats, artificially destabilize dune and beach flats, prevent, or inhibit dune formation, and further fragment remnant populations. Invasive plant species like *Phragmites australis* and cattail (*Typha* spp.) also disrupt the natural process that maintain Houghton goldenrod's early successional habitats.

The Houghton's Goldenrod Recovery Plan (U.S. Fish and Wildlife Service 1997) contains one delisting criterion: the species will be considered for delisting when 30 distinct, self-sustaining occurrences are protected (U.S. Fish and Wildlife Service 2020*b*). Protection, as defined in the recovery plan, consists of all actions necessary to conserve known occurrences, maintain ecosystem processes for the perpetuation of essential habitat, and enable each occurrence to be naturally self-sustaining.

Recent surveys to assess the status of U.S. populations found that 62% were stable or increasing and several locations had over 10,000 flowering individuals (Leopold and Weber 2019). About 40% of the populations were surveyed. High lake levels, shoreline development, invasive plant species, recreation, and deer browse, however, are stressors to the species that need further evaluation to conclusively assess the species' status (Leopold and Weber 2019).

7.1.5 Leedy's Roseroot (Rhodiola integrifolia ssp. leedyi)

The following is largely adapted from (U.S. Fish and Wildlife Service 2021*a*).

Leedy's roseroot populations occur in New York – two populations; Minnesota – four populations; and South Dakota – one population. Across its range, the seven discrete populations of Leedy's roseroot typically inhabit forested on cliffsides that receive groundwater seepage.

In New York, the largest population of Leedy's roseroot includes about 4,700 plants at Glenora Cliffs. This populations is stable although Japanese knotweed invasion is an ongoing threat and only a small portion of the habitat inhabited has been protected. The second New York population at Glenora Falls is small, consisting of only 40-50 plants that also inhabit unprotected habitat. Despite the lack of legal protection, development may pose little or no threat to the Glenora Falls populations due to its remoteness. A third population at Watkins Glen State Park had been extirpated because of trail construction in 2018, although out-planting efforts are underway to restore the population.

Well west of the New York populations, there are four populations of Leedy's roseroot in southeast Minnesota and one on the Black Hills National Forest in western South Dakota. In Minnesota, short-term population trends appear to be stable with small increases in numbers documented between 2018 and 2020. Longer term trends at Minnesota's largest population at Whitewater Wildlife Management Area (WMA), however, are indicative of a decline in numbers from 1997 to 2020.

In 2020, numbers of plants ranged from 198 to 642 among the four Minnesota populations, with a median of 447. Among the Minnesota populations, only the one at Whitewater WMA occurs on protected land. Protection of the sites inhabited by the other three populations is still an unmet criterion for recovery. The population in South Dakota consists of about 50-100 plants in the Black Hills National Forest. It was documented as Leedy's roseroot by genetic analysis after completion of the USFWS recovery plan for the taxon and this is not addressed in the current recovery criteria.

Among the six demographic stages identified by Olfelt et al. (2007), the proportion of seeds that germinate and become seedlings may have the greatest impact on population fluctuations. Olfelt (1998) found a seed germination rate for Leedy's roseroot of 77% and described this as high for a rare plant, but lower than that of related subspecies.

Except for the New York populations, Leedy's roseroot exists in largely separate populations dependent on insect pollination and successful establishment of new plants from seeds. Insects that likely pollinate Leedy's roseroot may move pollen less than 1,000 meters. The inability of insect pollen vectors to move pollen among occupied sites is consistent with the observed high amount of genetic differentiation among the four Minnesota populations (Ejupovic 2015). The two nearest populations in Minnesota are separated by about three kilometers whereas the New York populations are only 300-400 from one another.

7.1.6 Northern Wild Monkshood (*Aconitum noveboracense*)

The following was adapted from U.S. Fish and Wildlife Service (2023*a*).

Northern wild monkshood occurs in southeastern Wisconsin and eastern Ohio on a few of algific (cold air-producing) talus slopes characterized by cool soil, cold air drainage, and cold groundwater. Additional populations are found in Iowa and New York where it occurs on cold-water streambanks, high elevation headwater streambanks, cool cliff-faces, and cold talus ravines. Threats to the species relevant to the proposed action include habitat destruction or modification, invasive species, small population sizes, and cliff erosion.

Northern wild monkshood reproduces by seed and occasionally by vegetative propagation. Flowers are pollinated predominantly by bumble bees; self-pollination has not been confirmed for northern wild monkshood. Aside from water transport, it lacks a long-range seed dispersal mechanism, thereby limiting the species' ability to recolonize local extirpations or establish new sites.

In Ohio, two populations are known to occur, both on protected land. One population at Gorge Metro Park has grown from 11 in 2000 to an estimated 156 plants in 2020 due to proactive management. The other population at Crane Hollow is stable at approximately 75 plants, though the number of mature (flowering) plants has declined significantly. In Wisconsin, 14 populations have been identified, with population sizes ranging from 20-50 individuals to over 400 in larger populations. Of these, four populations appear to be declining, eight appear stable, and two have increased in size since the 1970s.

There are nine populations in New York, and all have experienced substantial declines in their abundance. Iowa currently supports 81 populations, but no estimate of population sizes has been made since the 1980s. However, population trends appear to be variable but relatively stable, likely due to their occurring in remote locations with minimal human disturbance.

7.1.7 Pitcher's Thistle (*Cirsium pitcheri*)

Pitcher's thistle is endemic to open beaches, grassland dunes and occasionally on lag gravel (residual gravel remaining after sand has been removed by wind) associated with shoreline dunes of Lakes Michigan, Superior, and Huron. It is found most frequently in near-shore plant communities, although it occurs in all non-forested habitats of the Great Lakes dune systems. Pitcher's thistle colonizes open, windblown patches and gradually declines locally as the vegetation density and ground litter increases. The species is dependent on continually colonizing the mosaic of open habitats within Great Lakes dunes, and it is patchily distributed with varying population sizes in all open zones of the dunes vegetation (U.S. Fish and Wildlife Service 2019*b*).

Most known sites of Pitcher's thistle occur along the shores of Lake Michigan (Fig. 8). The species ranges from the north shore of Lake Superior south to Indiana. It formerly occurred in northern Illinois, where it is has been experimentally reintroduced. Distribution of the species extends along the Lake Michigan shoreline in Wisconsin. In the east it ranges through northern Lake Huron to the Manitoulin Island archipelago and southern Georgian Bay in Ontario. Pitcher's thistle extends as far south as Lambton County, Ontario, Canada on Lake Huron (U.S. Fish and Wildlife Service 2019*b*).

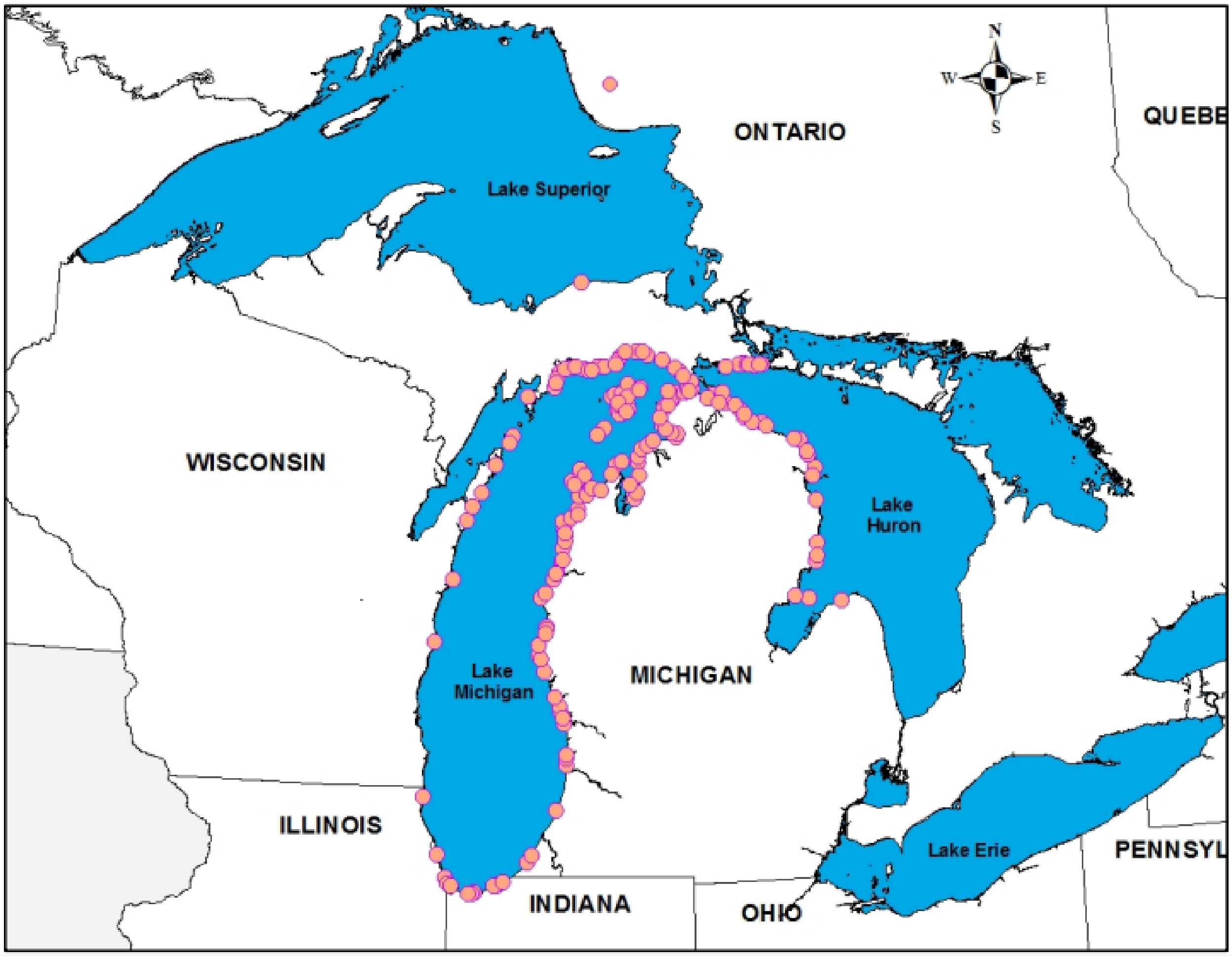

*Figure 8. Distribution of Pitcher's thistle throughout its range; includes reintroduced populations in Indiana, Illinois, and Wisconsin (U.S. Fish and Wildlife Service 2002*a*).*

Threats to the species relevant to the proposed action include habitat destruction and introduction of invasive plant species.

Pitcher's thistle reproduces only sexually. Pollination occurs through a variety of insects but primarily through bees. Seed dispersal occurs from June to August, depending on latitude. Seed is dispersed when individual seeds blow from the inflorescence head or when entire plants or seeds heads are blown across sand, snow, or water surfaces.

Within its U.S. range, there are 211 historic and extant element occurrences (U.S. Fish and Wildlife Service 2002*a*). Of these, 18 are extirpated (4 in Indiana and 14 in Illinois). Of the remaining 193 occurrences, 169 (88%) are in Michigan. The USFWS recovery plan defines priority occurrences as element occurrences that are: (1) on Federal or State-owned lands; (2) ranked excellent to fair; (3) in southern Lower Michigan, Indiana, or Wisconsin; and (4) part of complex perched dune systems. According to this definition, there are 139 priority occurrences in the U.S., with 118 in Michigan. The 21 remaining priority occurrences include nine in Wisconsin and 12 in Indiana. All naturally occurring Pitcher's thistle populations in Illinois are extirpated.

Of the priority occurrences, 83 (60%) are entirely in public ownership and eight (6%) are owned by land conservancies. The remaining 48 (35%) priority occurrences are on private lands. In Michigan, over two-thirds of occurrences are in the Lower Peninsula, mostly along Lake Michigan. The Upper Peninsula supports 28 priority occurrences located along the northern shores of Lake Michigan, mostly in Mackinac County. The one occurrence in Alger County is the only occurrence on the shore of Lake Superior.

7.1.8 Short's Bladderpod (*Physaria globosa*)

Short's bladderpod typically grows on steep, rocky, wooded slopes and talus areas on south- to west-facing slopes near rivers or streams. It also occurs along tops, bases, and ledges of bluffs and infrequently on sites with little topographic relief (U.S. Fish and Wildlife Service 2020*c*). It is known to occur in Posey County, Indiana; Clark, Franklin, and Woodford counties, Kentucky; and Cheatham, Davidson, Dickson, Jackson, Montgomery, Smith, and Trousdale counties, Tennessee (Fig. 9).

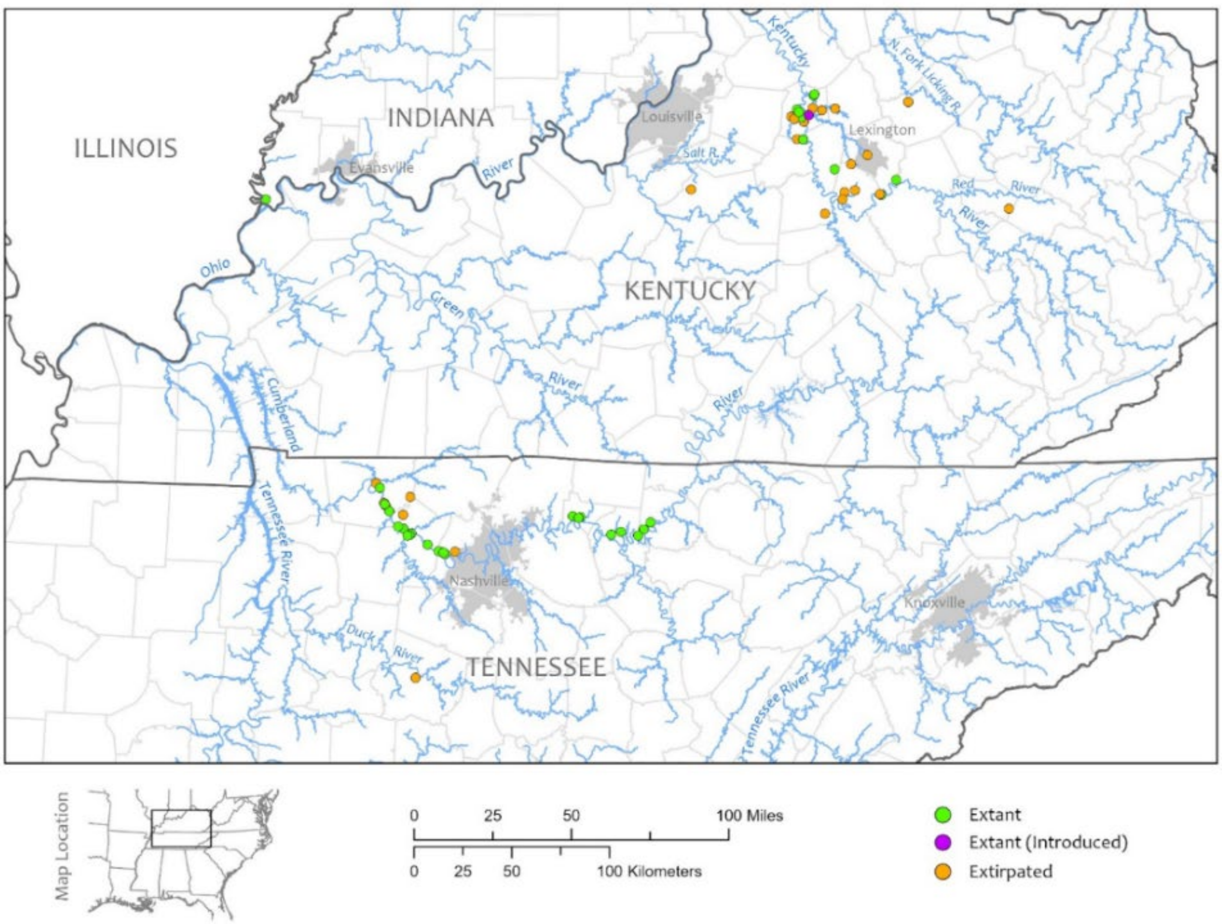

Figure 9. Short's bladderpod distribution map (U.S. Fish and Wildlife Service 2020c).

Populations of Short's bladderpod vary in size from two to about 1,500 individuals, with most populations including fewer than 50 plants. In a 1992 status survey for Short's bladderpod, Shea (1993) observed the species at only 26 of 50 historical sites: one in Indiana, 14 in Kentucky, and 11 in Tennessee. The remaining 24 records were from sites where the species had been extirpated or lacked sufficient location information to be relocated during the survey. Based on current mapping, state conservation agencies now recognize 24 element occurrences that correspond to populations that Shea (1993) found extant in 1992 (U.S. Fish and Wildlife Service 2019*c*). Of these 24 occurrences, 18 were extant in 2012.

Very little is known about the reproductive ecology of Short's bladderpod, although it is generally considered a biennial species. It flowers from March to June, seed maturation occurs throughout June, and plants begin to senesce by late June or early July. Pollination likely occurs from flies (Diptera) and bees, though information on pollinator diversity and effectiveness is limited. Although seed dispersal has not been studied in this species, the seeds' lack of morphological adaptations to wind, water, or any other dispersal mechanism suggest that dispersal only occurs across very short distances. Short's bladderpod appears to form seedbanks in natural populations, like other species in the genus. Although this species appears to be capable of persisting under variable light and moisture conditions, flowering is drastically increased in high-light conditions where canopy closure is minimized (U.S. Fish and Wildlife Service 2020*c*).

7.1.9 Western Prairie Fringed Orchid (*Platanthera praeclara*)

There are about 300 occurrences of western prairie fringed orchid in remnants of native tallgrass prairie that are distributed across six U.S. states – Iowa, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota – and southern Manitoba (U.S. Fish and Wildlife Service 2021*b*).

Progress has been made towards meeting recovery criteria, but continued work is needed to protect populations in some areas and to ensure protected populations are managed to ensure their long-term viability. The recovery criteria for the species includes objectives for each of nine ecoregions inhabited by the species. One criterion calls for the protection of areas that contain at least 90% of the plants in each ecoregion. In 2021, this criterion was met in three of the nine ecoregions and the minimum protection metric was nearly met in the region with the second highest total plant count – Lake Agassiz-Aspen Parklands with about 12,000 plants recorded and 88% of those on protected lands. In the region with the highest total plant count – the Red River Valley ecoregion with about 13,000 plants recorded – about 93% of plants were on protected sites.

Reproduction by western prairie fringed orchid depends on pollination by a small group of sphinx moth species whose anatomy is conducive to movement of pollen-containing structures (pollinia) between flowers. While nectaring on western prairie fringed orchid flowers, pollinia (pollen-containing structures) attach to the moths' eyes. Pollination takes place when the moths then fly to another flower to nectar. The sphinx moth species capable of pollinating western prairie fringed orchid are distributed widely compared to the western prairie fringed orchid and typically occur well outside the remnants of native prairie on which the orchid depends.

7.2 Insects

7.2.1 Hine's Emerald Dragonfly (*Somatochlora hineana*)

To guide recovery for Hine's emerald, USFWS has divided the species' twelve identified populations into two recovery units – Northern and Southern. These populations are comprised of 29 subpopulations that are spread across 81 discrete occupied sites.

The first recovery criterion for downlisting the species from endangered to threatened would be met if each of the recovery units contain a minimum of three populations composed of at least three subpopulations that each contain a minimum of 500 adults for ten straight years (U.S. Fish and Wildlife Service 2001). Intensive mark-recapture studies may be necessary to determine whether any subpopulation meets this criterion, but few such estimates are available. In 2013, estimated numbers of adults were available for only 2 of the 27 subpopulations – both part of the Lower Des Plaines River Valley Population (U.S. Fish and Wildlife Service 2013*a*). In 2019, USFWS reported an estimate of 176 adults at one site in the Missouri Population (U.S. Fish and Wildlife Service 2019*d*).

Protecting the hydrologic integrity of Hine's emerald habitats is an essential component of the species' recovery. The second recovery criterion for downlisting Hine's emerald requires that at least two breeding areas be present within each subpopulation, with each area fed by separate seeps or springs.

The third downlisting criterion requires that comprehensive protection measures to address a variety of threats be in place for at least two subpopulations within each population. In addition to protecting the hydrologic integrity of Hine's emerald habitats, contaminants, invasive plant, habitat fragmentation, and vehicle mortality are also major threats (U.S. Fish and Wildlife Service 2013*a*). Additional populations are threatened by all-terrain vehicle use, invasive animals, direct loss of habitat, and livestock grazing.

Hine's emerald's life cycle consists of aquatic egg, aquatic larval, and terrestrial-aerial adult stages (Corbet 1962, U.S. Fish and Wildlife Service 2001). The species spends most of its life as aquatic larvae in wetlands dominated by grasses or grass-like (graminoid) plants and fed in part by groundwater. Two characteristics common of these wetlands are shallow groundwater flowing slowly through vegetation and underlying dolomitic limestone bedrock or cobble and weathered bedrock. The flowing water can range from barely detectable sheet flow through vegetation or a small well-defined streamlets or rivulets (U.S. Fish and Wildlife Service 2001).

Hine's emeralds mate from early June to late August in Illinois (Vogt and Cashatt 1994, 1997, U.S. Fish and Wildlife Service 2001). Females can oviposit more than 500 eggs into shallow water in rivulets or shallow channels within marsh or sedge meadow or into soft mud. The eggs overwinter and hatch in the spring (Soluk and Satyshur 2005). Dragonfly larval mortality is high during the first few larval instars – a result of predation, cannibalism, and sometimes starvation.

7.3 Hungerford's Crawling Water Beetle (*Brychius hungerfordi*)

The current number and distribution of Hungerford's crawling water beetle populations in Michigan might be sufficient to meet the species' recovery criteria, but the status and viability of the populations is understood too poorly to consider downlisting or delisting. USFWS recovery criteria to downlist the species from endangered to threatened and to then delist the species focus on securing long-term viability of populations that are distributed across at least three watersheds. The species is known to occur in eleven streams across seven watersheds in north-central Michigan; there are three additional populations in Ontario (Fig. 10).

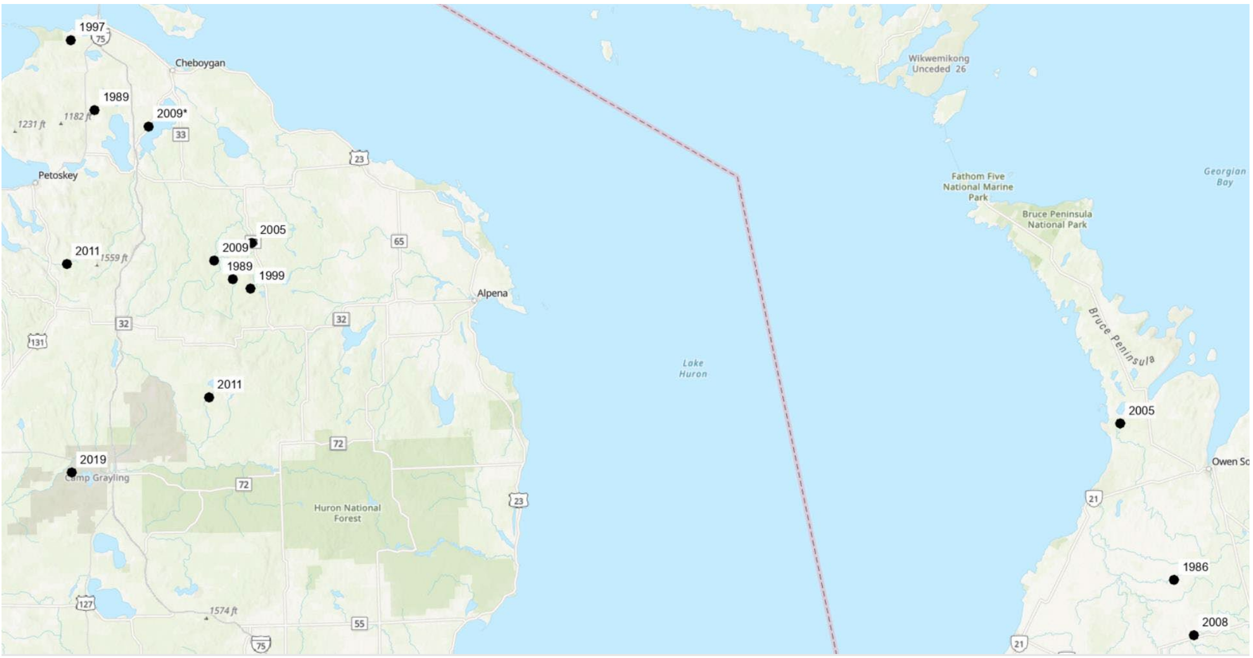

*Figure 10. Known rangewide distribution of HCWB in northern Michigan and Ontario labeled with the year of discovery. The locations known at the time of listing are circled. Adapted from USFWS (2021*c*).*

Despite having exceeded the minimum distribution as outlined by the recovery criteria – the number of inhabited watersheds – most populations of Hungerford’s crawling water beetle are of unknown viability and may include few individuals (U.S. Fish and Wildlife Service 2009, 2021*c*). The difficulty of finding and monitoring the species has precluded making reliable estimates of abundance or of trends in numbers for any population.

Good habitat for the Hungerford’s crawling water beetle is typified by groundwater inputs, moderate to fast stream flow, good stream aeration, and presence of the alga *Dichotomosiphon tuberosus* (U.S. Fish and Wildlife Service 2021*c*). The preferred food of Hungerford’s crawling water beetle, *Dichotomosiphon tuberosus* is widespread but uncommon. Hungerford crawling water beetle’s distribution within watersheds seems to be correlated with distribution of *Dichotomosiphon tuberosus* and the beetles lays eggs in mats of the alga (U.S. Fish and Wildlife Service 2021*c*).

Hungerford’s crawling water beetle habitats are dynamic and may change in time and place with variations in stream flow and water temperature. Water levels in occupied stream reaches sometimes drop to expose damp river sand habitats along stream edges that may be important for the pupation stage of the beetle’s life cycle (U.S. Fish and Wildlife Service 2021*c*). Some streams in the range of the species are currently too cold for the species and its algal food base (U.S. Fish and Wildlife Service 2021*c*). Climate change and shorter-term disturbances like beaver (*Castor canadensis*) dam construction may locally increase water temperatures to the extent that these areas become suitable for the beetle.

In general, threats to the species include any activities that degrade water quality or remove or disrupt pool and riffle habitats in streams (U.S. Fish and Wildlife Service 2021*c*). This can include natural disturbances like beaver activity or human-caused activities like culvert replacements. Both have the potential to improve and expand habitat for the Hungerford crawling water beetle (previous paragraph) but may also degrade the species habitat. Careful replacement of undersized culverts can improve water quality and reduce sedimentation.

Sea lamprey control is also a potential threat to the Hungerford crawling water beetle because the lampricide used is likely harmful to the species. Sea lamprey control, however, was not occurring in any streams known to be inhabited by the Hungerford crawling water beetles when USFWS conducted its most recent status review (U.S. Fish and Wildlife Service 2021*c*).

7.3.1 Mitchell's Satyr (Neonympha mitchellii mitchellii)

Mitchell's satyr was documented historically at 30 locations in Michigan, Indiana, and Ohio, with several disjunct populations in New Jersey, and possibly Maryland. After listing the species as endangered in 1992 and upon issuance of the USFWS recovery plan in 1998, known extant occurrences of the species had decreased by 50% with only 15 populations remaining extant – 13 in Michigan and two in Indiana. Since then the number of populations in the two states has declined to nine in Michigan and one in Indiana. Only six of the Michigan populations are either "likely" or "potentially" viable and no individuals have been observed in the last few years at the Indiana site (K. Kelly, USFWS, East Lansing, MI, pers. comm. 2023).

Recent genetic analyses of *Neonympha mitchellii* populations has enhanced our understanding of the species' status and clarified that the subspecies is not limited to Michigan and Indiana. These analyses thus far support including members of populations in Alabama and Mississippi in the listed subspecies (U.S. Fish and Wildlife Service 2021*d*). In Alabama the subspecies occurs at 28 sites and there are an additional 15 populations in Mississippi, adding significantly to the number of known populations (U.S. Fish and Wildlife Service 2021*d*).

In Michigan and Indiana, Mitchell's satyrs are found exclusively in prairie fens and open parts of rich tamarack swamps. These systems are comprised of mosaics of open, shrubby, and forested communities, with peat soils and alkaline groundwater seeps. Thin-leaved sedges usually dominate the ground layer in the fens (Kost and Steven 2000). Mitchell's satyr is usually found within 3 meters (10 feet) of woody vegetation (Barton and Bach 2005). In more open fens, the satyr occurs along the shrubby edges. In fens with more tamarack (*Larix lacina*) or other woody vegetation, it is found in open, grassy patches between lanes of trees and shrubs. Mitchell's satyr butterflies are rarely found in open fens without trees or in tamarack swamps without openings.

Mitchell's satyr is sensitive to changes in fen hydrology. Offsite activities that affect groundwater flowing into prairie fens could inadvertently impact Mitchell's satyr. For example, a prairie fen's recharge source may be located near or far from the fen, in a different watershed, county, or state. Regardless of the distance, altering the fen's groundwater source will affect the quality, quantity, or flow of groundwater into the fen (Abbas 2011). Groundwater alteration leads to, among other things, drying of the fen and encroachment of invasive species.

Adults are short-lived and usually do not feed; however, they have been observed nectaring on a few occasions (Darlow 2000) and accepted nectar daily during captive rearing (Tolson et al. 2006). Upon emergence, females mainly mate, disperse, and lay eggs. Most often, they lay eggs on wildflowers of very short stature, and after hatching, larvae move to food plants. In captivity, eggs are most often laid on clearweed (*Pilea pumila*) (Tolson and Ellsworth 2008). Larvae feed on a variety of sedges and grasses found in fens, sedge meadows, tamarack swamps, and other wetlands.

The Toledo Zoo conducted captive rearing studies on Mitchell's satyr and found that eggs were often laid on short-statured forbs or wildflowers (Tolson and Ellsworth 2008). In the field, oviposition (egg-laying) occurs close to the ground on a variety of small forbs and sedges during the afternoon (Darlow 2000). Larvae hatch from eggs after seven to eleven days then move onto neighboring food plants to begin feeding throughout the summer (U.S. Fish and Wildlife Service 1998, Tolson and Ellsworth 2007). During this period, larvae proceed through several phases of molts or instars (U.S. Fish and Wildlife Service 1998).

Invasive species, such as buckthorn (*Rhamnus* spp.), hybrid cattail (*Typha* ×*glauca*), narrowleaf cattail (*T. angustifolia*), multiflora rose (*Rosa multiflora*), purple loosestrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*) and others, represent additional threats and can be a significant management problem. Removal of these plants is required at many occupied sites.

7.3.2 Poweshiek Skipperling (*Oarisma poweshiek*)

The following is partly adapted from U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service 2020*d*, 2022*b*).

Historically, Poweshiek skipperling was common in Upper Midwestern prairies, documented at about 300 locations within the eight states of Illinois, Indiana, Iowa, Michigan, Minnesota, North Dakota, South Dakota, and Wisconsin, and Manitoba, Canada (U.S. Fish and Wildlife Service 2014, Belitz et al. 2020). The species now occurs only at a few sites throughout its range – at two isolated prairie fens in eastern Michigan and a tallgrass prairie and fen complex in southern Manitoba near the province's border with Minnesota. Captive propagation efforts in both the U.S. and Canada are underway in an attempt to help forestall the species' continued demise (Westphal et al. 2023).

Poweshiek skipperling habitat includes remnant prairie including prairie fens, grassy lake and stream margins, moist meadows, sedge meadows, and wet-to-dry prairie and appears to benefit from a diversity of soil moisture regimes and nectar sources within sites. The species relies on high-quality habitat conditions and on natural or appropriate human disturbances that maintain the integrity of the plant communities, while minimizing mortality to vulnerable life stages (Henault and Westwood 2023). Access to high quality native habitats across a moisture gradient may be essential for ensuring that optimal habitat conditions are available for each life history stage and sex. In Michigan, for example, males and females nectared most frequently on different species – males most frequently on black-eyed susan (*Rudbeckia hirta*) and females on shrubby cinquefoil (*Dasiphora fruticosa*) (Belitz et al. 2019). In Manitoba, Poweshiek skipperlings used areas "with different soil moistures to lay eggs, rest, bask and consume nectar" (Henault and Westwood 2023),

During the short 2–4-week period of adulthood in summer Poweshiek skipperlings need sufficient nectar sources for feeding and healthy and abundant native grasses for laying eggs. After hatching, larvae need native grasses to feed on throughout the summer and suitable temperature and humidity conditions. Larvae overwinter on the leaves or stems of the host grass and resume feeding and development in the spring. Thus, they also need habitat that provides a suitable microclimate for shelter during winter.

Relative abundance of the species at each of the remaining Michigan sites has declined since 2011 and the species may face a high risk of extinction in the state. Belitz et al. (2019) estimated the abundance of Poweshiek skipperlings in Michigan to 231 adults (95% confidence intervals, CI, 160-332) in 2017. Over 80% of detections were documented from a single site, confirming the imperiled status of this butterfly (Belitz et al. 2019). In 2018, Poweshiek abundance was estimated at 240 (CI 103-558). In 2019, despite conducting 3-5 surveys per site, only 47 Poweshiek skipperlings total were observed – about half of the number observed in 2018. Abundance was estimated at 93 for 2019 (CI 35-247), but with wider confidence intervals due to the low number of detections. In 2022, numbers observed were down to 26 at Long Lake and one Big Valley Fen (Michigan Natural Features Inventory, unpublished data, 2023).

It's unclear what led to the species' precipitous decline, but population persistence is influenced by several factors. These include degradation and destruction of habitat through conversion of native prairie to cropland or development; ecological succession to woody vegetation; encroachment of invasive species; past and present incompatible land management; flooding; and groundwater depletion, alteration, and contamination. Additionally, biocide use, including herbicides, insecticides, fungicides, and their associated additives, may have direct or indirect effects on Poweshiek skipperlings, compounding the effects of habitat curtailment.

Projections of increased variability in weather patterns and greater frequency of severe weather events, as well as warmer average temperatures, may affect the species' habitat, have direct effects on the survival of larvae, and cause asynchronous timing of adult emersion and plant resources. Finally, the remaining populations of the Poweshiek skipperling are small and isolated and, thus, are vulnerable to the effects of small population dynamics, further compounding the effects of other stressors.

7.3.3 Rusty Patched Bumble Bee (*Bombus affinis*)

To guide and to help assess progress towards recovery, USFWS tracks the number and distribution of populations of the rusty patched bumble bee based on a set of 10 x 10 kilometer grids spread across the species' range (U.S. Fish and Wildlife Service 2021*e*). Recovery of the rusty patched bumble bee is measured in part on the numbers of healthy populations present within each of five Conservation Units (CU), with specific numeric criteria for each CU (Fig. 11). For the purposes of recovery tracking, a population is equivalent to a known occupied grid and the recovery criteria set standards to ensure that populations are healthy and appropriately distributed.

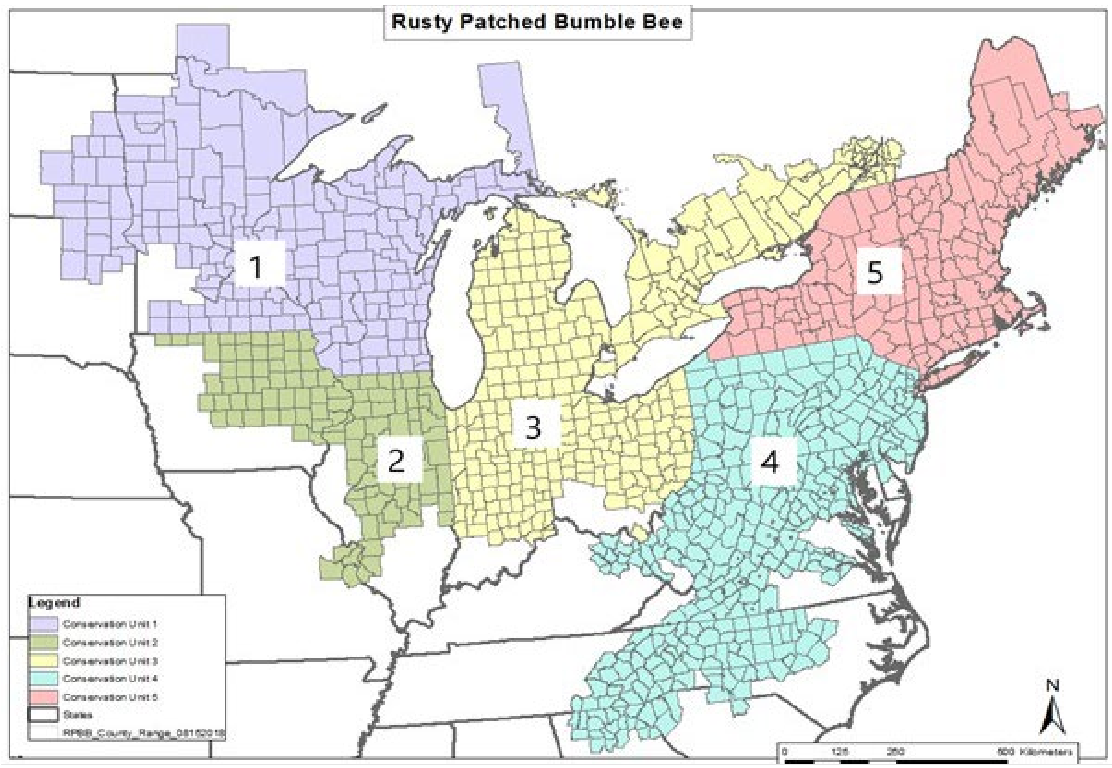

Figure 11. Rusty patched bumble bee conservation units from west to east: CU1 (Upper West), CU2 (Lower West), CU3 (Midwest), CU4 (Southeast), and CU5 (Northeast).

USFWS is working with its partners to develop standards to gauge health of populations, but we can at least describe the number of conceptual populations (occupied grids) within each CU. CU 1 contains the largest number of populations with 338 (U.S. Fish and Wildlife Service, unpublished data). In the remaining CUs there were 187 (CU2), 7 (CU3), 44 (CU4), and 2 (CU5) occupied grids.

Factors that USFWS will consider when developing standards on which to judge the health of populations will include:

- ability to successfully recruit (produces males and new queens) and to maintain positive rates of growth
- numbers of colonies needed to persist through unpredictable and adverse environmental conditions that are likely to vary in space and time (environmental stochasticity)
- genetic health
- resilience to multiple stressors, including climate change.

Another recovery criterion relies on the trends in percent occupancy as a discrete component of population health (U.S. Fish and Wildlife Service 2021*e*). For each CU, the USFWS will calculate percent occupancy by dividing the number of extant populations (occupied grids) by the number of *Bombus* grids. A *Bombus* grid is intended to reflect the likely historical range of the rusty patched bumble bee and includes each 10 × 10 km grid that contains at least one occurrence record of any bumble bee species (U.S. Fish and Wildlife Service 2016*b*). For this factor, the criterion is met if a CU has a stable or increasing trend in percent occupancy over a minimum of 5 to 10 years.

An additional recovery criterion introduces the concept of population clusters – “Ensure population clusters are distributed across a diversity of habitat, ecological, and climate types within each Conservation Unit” (U.S. Fish and Wildlife Service 2021*e*). Three or more healthy populations that are adjacent to each other would comprise a population cluster. USFWS did not specify a minimum number of population clusters needed to meet this criterion. The intent of maintaining population clusters is to ensure that gene flow is adequate among populations to reduce the likelihood of rapid extirpation due to genetic factors.

The recovery plan (U.S. Fish and Wildlife Service 2021*e*) cites the amount and quality of floral resources, nesting habitat, and overwintering habitat as influencers of population abundance and growth rate. Declines in the abundance of forage that have coincided with the RPBB’s decline may have left some portions of the species’ range with habitats unable to sustain healthy populations (e.g., Mola et al. 2021). In the recovery plan, USFWS also points to the importance of good physical body condition among the individuals in the colonies that make up each population. Pesticides, pathogen loads, and poor nutrition could degrade the body condition of individual RPBBs to the extent that colonies are not sufficiently productive to maintain healthy populations.

A RPBB colony can grow to include thousands of workers and hundreds of new queens but relies initially on one individual – the foundress queen (Macfarlane 1974, Macfarlane et al. 1994, Boone et al. 2022). The queen starts the colony in the spring after emerging from her overwintering chamber and finding a suitable nest site, typically a rodent burrow. The queen then makes workers by fertilizing eggs with sperm stored in her body from mating the previous year. Workers are all female. New colonies of the common eastern bumble bee (*Bombus impatiens*) include initially only the queen and about five workers; queens continue to collect food and to feed young until there are enough workers to take over those tasks (Fisher 2021). This may also be the case for new RPBB colonies. As colonies grow, they begin to produce males and new queens. Workers do not typically reproduce; reproduction relies almost exclusively on males and gynes (new queens) that are produced later in the season (Plath 1922, Macfarlane et al. 1994, Colla and Dumesh 2010). Before winter, the foundress queen, workers, and males all die; only the gynes, which overwinter a few inches below the soil surface, survive.

Continuous floral abundance from nest initiation to overwintering is important for RPBB colonies to ensure that resource bottlenecks do not exacerbate effects of other stressors. To establish and maintain productive colonies, RPBBs must have access to flowers in bloom from throughout the entire active season (Macfarlane 1974, Macfarlane et al. 1994). In the spring, queens must collect enough pollen to sustain developing larvae, or the new colony will fail (Goulson 2010). This may be the most delicate stage of the bumble bee life cycle, “when a shortage of forage in close proximity or inclement weather could cause the young queen and her colony to perish”

RPBB nests are typically 1 to 4 feet underground in abandoned rodent nests or other mammal burrows; they are also occasionally located at the soil surface or aboveground (Macfarlane 1974, Boone et al. 2022). The vast majority (95 percent) of the 43 RPBB nest records reviewed by Macfarlane (1974) were underground. Along with floral abundance and diversity, rodent holes were among the factors positively associated with bumble bee abundance and diversity in Southwestern Ontario (Purvis et al. 2019). At all three of the RPBB nests recently described by Boone et al. (2022), rodent activity was evident.

7.4 Snails

7.4.1 Iowa Pleistocene Snail (*Discus macclintocki*)

The Iowa Pleistocene snail (IPS) has been documented at 38 locations in Iowa, Illinois, and Wisconsin (Fig. 12). The most recent surveys, conducted in 2014-2015, detected live shells at 22 of these locations, relict shells at ten, and no shells at four (two sites were not surveyed due to landowner permissions) (U.S. Fish and Wildlife Service 2020*e*). The total extant population likely does not exceed 60,000 individuals (U.S. Fish and Wildlife Service 1984*a*), however, due to multiple complicating factors, determining accurate population numbers and trends is not feasible (U.S. Fish and Wildlife Service 2020*e*).

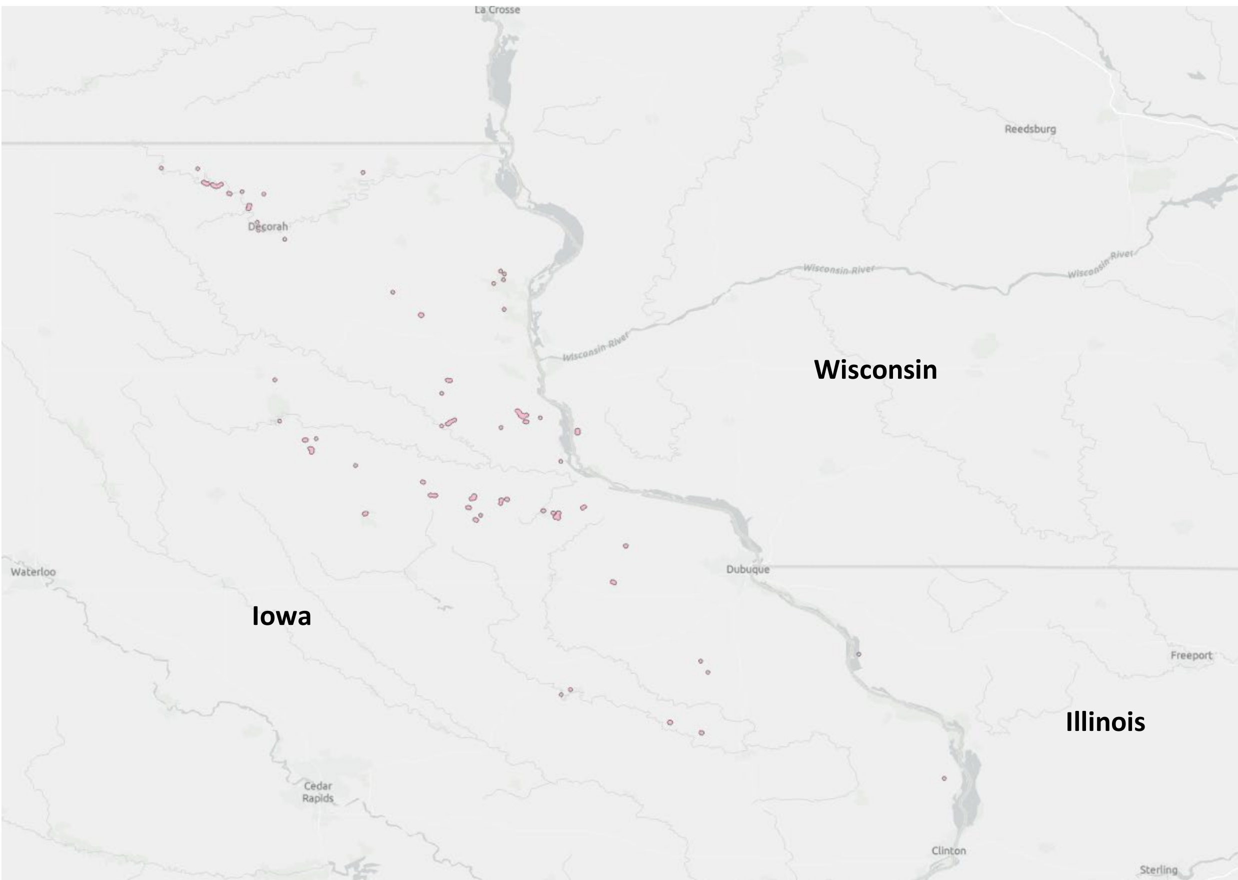

Figure 12. Current range of Iowa Pleistocene snail.

The IPS occurs on algific (cold producing) talus slopes that maintain a relatively stable source of moist cool air. Their preferred forage species (birch trees) may be in decline at many IPS sites (U.S. Fish and Wildlife Service 2020*e*).

Viable breeding populations appear to require a minimum of 50-150 individuals. IPS can remain active and breeding year-round in favorable conditions, though freezing temperatures in the winter will force the snails to cease activity, including breeding. IPS lay eggs under logs and bark, in rock crevices, and shallowly in soil. Due to the species' limiting temperature and moisture habitat requirements, migration and genetic exchange between populations does not occur (U.S. Fish and Wildlife Service 1984*a*). Despite this, genetic diversity remains relatively high throughout the population (Clark et al. 2008).

Threats to the species include trampling, habitat disturbance, invasive species – buckthorn and garlic mustard (*Alliaria petiolata*), pollution, and climate change.

7.5 CRUSTACEANS

7.5.1 Illinois Cave Amphipod (*Gammarus acherondytes*)

The following information is adapted from U.S. Fish and Wildlife Service (2002*b*).

The Illinois Cave Amphipod (ICA) is a small freshwater crustacean found in cave streams in Monroe and St. Clair Counties in southwest Illinois (Fig. 13). Historically, it has been reported from six cave systems, though recent surveys have identified additional cave systems where this species occurs, resulting in a total of 16 caves across ten groundwater basins (U.S. Fish and Wildlife Service 2011, 2020*f*). Of these populations, one is considered extirpated, while an additional eight are of unknown status. The known distribution of the ICA is about 89 square miles (230 square kilometer) in extent within the Salem Plateau karst region typified by many surface sinkholes in the limestone substrate that allow surface water to flow rapidly into subsurface waters.

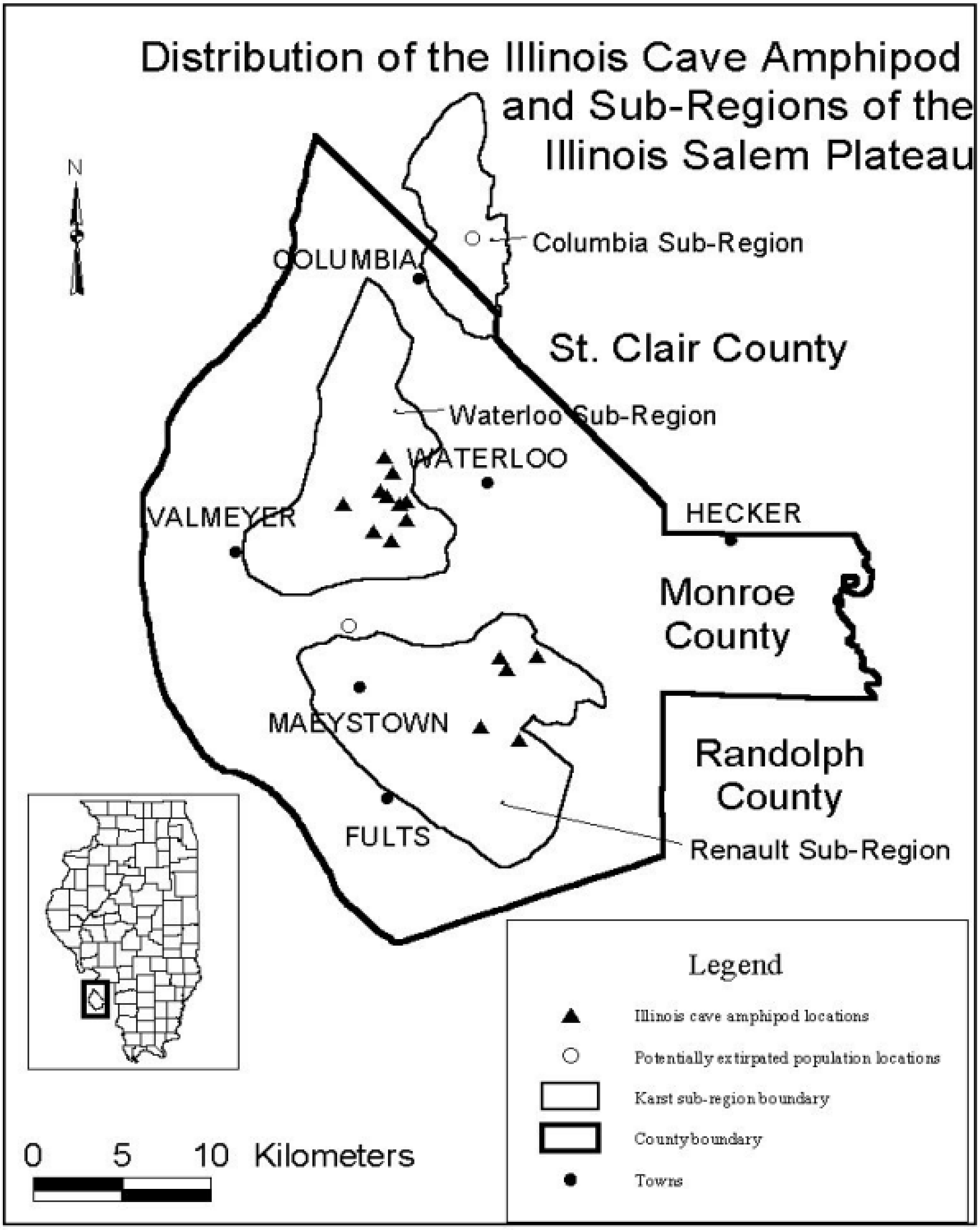

Figure 13. Distribution of the Illinois Cave Amphipod and sub-regions of the Salem Plateau (U.S. Fish and Wildlife Service 2002b).

Little is known about of the biology or life history of ICA. Much of what is assumed about this species is derived from related or similar species that inhabit similar environments. Reproduction appears to occur throughout the year, though young are generally more abundant in the spring. This species is most often found inhabiting shallow water (0-10 cm) in gravel or cobble riffles, and less frequently in rimstone pools, small tributaries, and silt overlying bedrock.

Factors that affect this shallow karst groundwater are the primary threats to ICA, including runoff that transports pesticides, fertilizers, sewage, sediment, and other contaminants from surface runoff. Solid waste dumping in sinkholes and groundwater flow disruption from quarry operations may also threaten this species. The rapid transport of water through the limestone substrate minimizes filtration potential and may lead to high amounts of contaminants into these subsurface habitats of the ICA.

7.6 FISHES

7.6.1 Topeka Shiner (*Notropis topeka*)

The following information is adapted from U.S. Fish and Wildlife Service (2018*a*).

The Topeka shiner is a small minnow that lives and breeds in graveled pools of low-order prairie streams in the Great Plains states of South Dakota, Minnesota, Nebraska, Iowa, Kansas, and Missouri (Fig. 14). Many populations and population complexes are separated by insurmountable distances, impassible structures, and/or unsuitable habitats and this is generally borne out by genetic differentiation among populations (U.S. Fish and Wildlife Service 2018*a*). Even adjacent populations existing without apparent barriers between them can exhibit differences indicative of long-term isolation, perhaps partly due to the species' typical association with small streams.

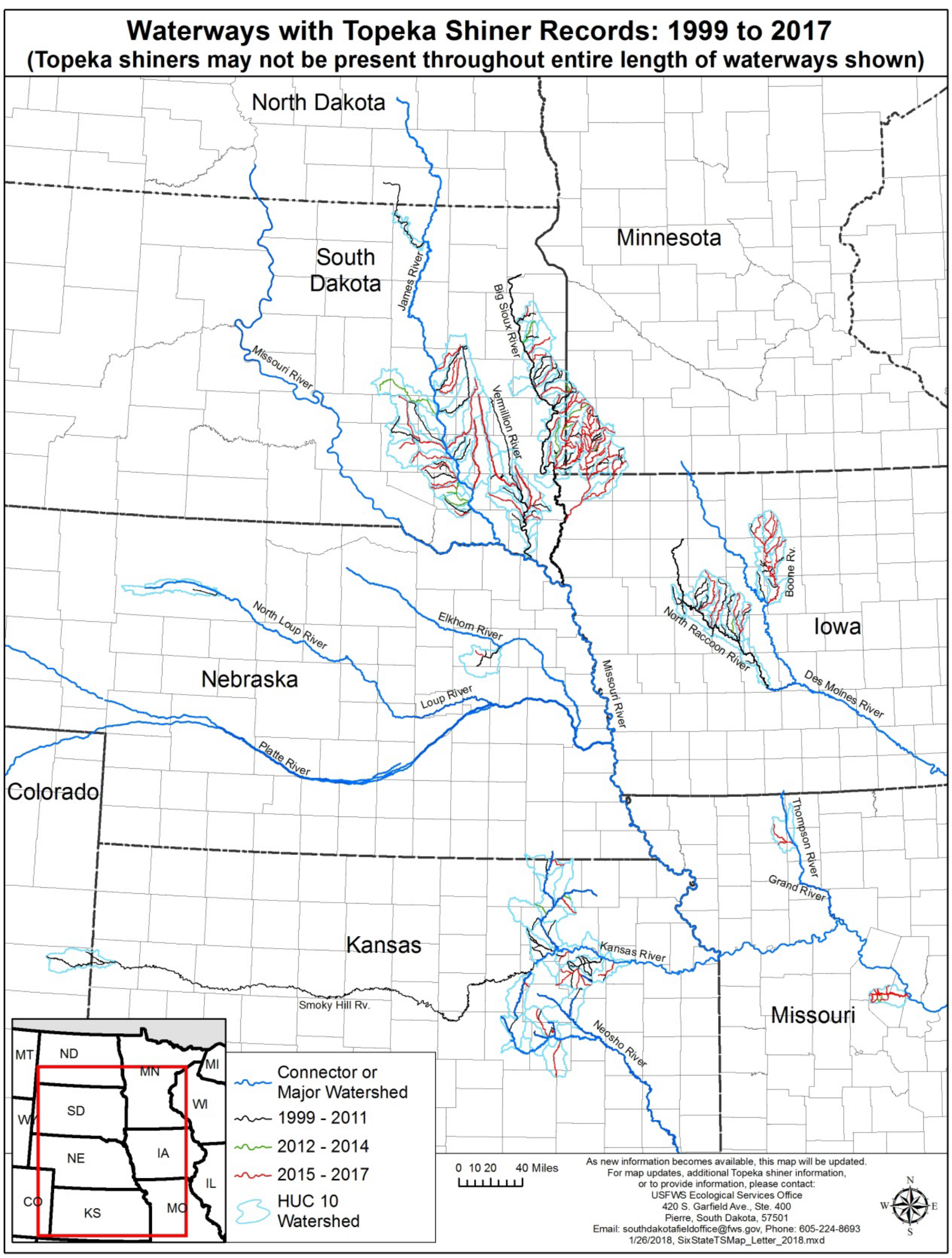

Figure 14. Streams with Topeka shiner collection records, 1999-2017.

Since 1999, the Topeka shiner has been documented within 223 small to mid-size streams, which encompass 87 populations (Hydrologic Unit Code (HUC) 10 watersheds), 13 population complexes (groups of hydrologically connected HUC10 watersheds), and 6 states (U.S. Fish and Wildlife Service 2018*a*). Most Topeka shiners are found within the northern populations in South Dakota, Minnesota, and Iowa, where the species has persisted despite a variety of persistent threats (U.S. Fish and Wildlife Service 2018*a*).

To survive and reproduce Topeka shiners typically need low-order prairie streams with pools, low flows, floodplain connectivity, gravel, and true sunfish (*Lepomis*) species. Females produce clutches at different times and can have various stages of mature/immature ova during a single breeding season (mid-May to early August). Topeka shiners often spawn in pools with little or no flow on the periphery of *Lepomis* sunfish nests. defend a small territory less than one-square meter, spawning with females that enter their territory, with fertilization occurring in the water column before eggs fall to the stream bottom. Egg mortality may be high, but Topeka shiners are multiple spawners. Females lay hundreds of eggs, with the largest and heaviest females laying the most eggs.

7.7 Freshwater Mussels

7.7.1 Clubshell (Pleurobema clava)

The following information is adapted from (U.S. Fish and Wildlife Service 2018*b*).

Current populations of clubshell are sparsely distributed within the Ohio River and tributaries (Wabash River, Green River, Licking River, Scioto River, Shenango River, Muskingum, Allegheny River, French Creek, Kanawha River, Monongahela River, Little Kanawha River, Middle Island Creek, and the Ohio River) and in the Lake Erie Basins (St. Joseph River). The species occurs typically in small to medium sized rivers, and often occupies the interstitial spaces below the substrate surface which make them highly susceptible to the effects of siltation. Impoundments and degraded habitat from instream activities physically separate most clubshell populations, decreasing the likelihood that recolonization could occur following stochastic events (e.g., toxic spill event, flood).

Clubshell are short term brooders, remaining gravid from May through July. There are no known host attracting behaviors associated with the clubshell (i.e., mantle lures, conglutinates, displays). Studies to determine suitable host fish for this species indicate cyprinids (minnows and shiners) may be suitable hosts for glochidia transformation.

The clubshell was historically widespread, occupying over 100 streams throughout the Ohio River basin and western Lake Erie tributaries. However, when listed in 1993, there were only 12 known streams with extant populations. As of 2019, 11 populations are known in 19 streams.

7.7.2 Fanshell (Cyprogenia stegaria)

The following information is adapted from (U.S. Fish and Wildlife Service 2019*e*).

Current populations of fanshell occur within the Ohio River basin including in the Tennessee River, Cumberland River, and Ohio River systems. The fanshell occurs in medium to large rivers in habitats of coarse gravel and sand (Jones and Neves 2002). They tend to co-occur with other riverine mussel species.

The fanshell is a long-term brooder, retaining glochidia from fall until the following summer. They release packets of glochidia (conglutinates) that resemble benthic invertebrates to attract sight-feeding host fish. Known host fish species from laboratory studies are primarily darters, sculpin and logperch (*Percina spp.*), including the mottled sculpin (*Cottus bairdi*), banded sculpin (*C. carolinae*), greenside darter (*Etheostoma blennioides*), snubnose darter (*E. simoterum*), banded darter (*E. zonale*), tangerine darter (*Percina aurantiaca*), blotchside logperch (*P. burtoni*), logperch (*P. caprodes*) and Roanoke darter (*P. roanoka)* (Jones and Neves 2002).

Currently, streams that support healthy and recruiting populations of fanshell occur in the Licking River, Green River, and Rolling Fork River in Kentucky and in the Clinch River in Tennessee and Virginia. All other populations in the species range appear to be small and restricted, with little evidence of recruitment. Augmentation efforts have occurred in the Ohio River to restore fanshell following a chemical spill that occurred in 1999 and are also being initiated in the East Fork of the White River in Indiana in response to a 2018 diesel pipeline break (W. Tucker, USFWS, Bloomington, IN, pers. comm. 2023).

7.7.3 Fat Pocketbook (*Potamilus capax*)

The following information is adapted from (U.S. Fish and Wildlife Service 2019*f*).

The fat pocketbook occurs in the St. Francis River, Ohio River, and Lower Mississippi River drainages and was historically widely distributed from the confluence of the Minnesota and St. Croix Rivers on the Minnesota-Wisconsin border down to the White River system. The species inhabits slow-flowing habitats of large rivers dominated by clay, mud, sand, or fine gravel substrates. They are known to inhabit river depths ranging from a few inches to areas with depths exceeding 20 feet. Typical of other freshwater mussels, the fat pocketbook usually co-occurs with other mussel species in diverse concentrations. Instream alterations (e.g., channel dredging) and localized spills or discharges threaten this species where it occurs.

Fat pocketbook is a long-term brooder with gravid observed from June to October. Freshwater drum (*Aplodinotus grunniens*) is the only known suitable host for fat pocketbook glochidia.

At the time of its listing in 1976, only two populations of fat pocketbook were known (St. Francis River and White River populations). However, range expansions and natural recruitment have occurred since 2012 including expansions into the lower Mississippi River, though they remain extirpated from the Upper Mississippi River.

7.7.4 Higgins Eye (Lampsilis higginsii)

The following information is adapted from (U.S. Fish and Wildlife Service 2020*g*)

Most Higgins eye populations occur in discrete locations in the Mississippi River, St. Croix River, Wisconsin River, and lower Rock Rivers. Higgins eye typically occur in large rivers and habitats with a variety of substrates ranging from hard clay to sand substrates. The Higgins eye is thought to have historically been a rare species that has been further affected by river impoundments and instream activities which have altered the hydrology and habitat most suitable for this species.

Higgins eye is a long-term brooder, retaining glochidia over winter and releasing them the following spring/summer. Suitable fish host species include sauger (*Sander canadensis*), walleye (*S. vitreus*), freshwater drum, largemouth bass (*Micropterus salmoides*), smallmouth bass (*M. dolomieu*), yellow perch (*Perca flavescens*), and black crappie (*Pomoxis nigromaculatus*).

The current range of this species is restricted to 50% of its historical range which included the Mississippi River near St. Louis, Missouri, to St. Paul, Minnesota, and rivers in Illinois, Iowa, Wisconsin, and Minnesota. At its listing in 1976, Higgins eye were limited to the Mississippi River upstream of Lock and Dam 19, the St. Croix River, the Wisconsin River, and the lower Rock River. Reintroduction efforts (2000-2019) have added over 555,000 individuals across several Mississippi River navigation pools, the lower Rock River, and the Iowa River, Cedar River, and Wapsipinicon River.

7.7.5 Longsolid (Fusconaia subrotunda)

The following information is adapted from (U.S. Fish and Wildlife Service 2022*d*).

Most longsolid populations occur across rivers in the Ohio River, Cumberland River, and Tennessee River basins. This species is considered extirpated from the Great Lakes basin. The longsolid occurs in small to large rivers in sand and gravel to coarse gravel and cobble substrates. Threats to the species include habitat degradation and fragmentation from the construction of impoundments and instream alterations, degraded water quality from pollutants (i.e., point source and non-point source inputs from agriculture, development, mining, timber operations, etc.), as well as invasive species.

The longsolid is a short-term brooder, typically gravid from May-July (Gordon and Layzer 1989). Like other species of *Pleurobemini*, longsolids release packets of glochidia (conglutinates) to attract sight-feeding fish. Specific fish hosts for the longsolid are unknown, but genera of minnows (Cyprinidae) and sculpins (Cottidae) are likely as they are suitable for other species of *Fusconaia*. The longsolid likely releases glochidia in conglutinates to target host species.

Currently 60 populations of longsolid are known across the Ohio River (39), Cumberland River (1) and Tennessee River (20) basins in Alabama, Kentucky, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia. Historically, over 160 populations extended across the species' range. The species is extirpated from Georgia, Illinois, and Indiana, including from the entire Great Lakes basin.

7.7.6 Northern Riffleshell (*Epioblasma rangiana*)

The following information is adapted from (U.S. Fish and Wildlife Service 2019*g*).

The northern riffleshell was historically a widespread species, occurring throughout Illinois, Indiana, Kentucky, Ohio, Pennsylvania, West Virginia, and portions of Canada. They are typically found in medium to large rivers in moderate to high water velocities. Impoundments, water quality degradation, land development activities and invasive species threaten the species where it occurs.

Northern riffleshell are sexually dimorphic, with males and females exhibiting differentiating characteristics on their posterior margins. Female northern riffleshell are long-term brooders, retaining glochidia through the winter and then releasing them in the summer. To attract host fish, females position themselves at the substrate surface and prominently gape their valves to display distinct white mantle tissue. They will then capture host fish between the shell valves and expel glochidia onto the fish's gills. Suitable host fish for northern riffleshell includes several darter (Etheostomatinae) and sculpin (Cottoidea) species.

At the time of its listing in 1993, there were six streams with extant northern riffleshell populations known – Green River (KY), Detroit River (MI) Big Darby Creek (OH), and French Creek, LeBoeuf Creek, and Allegheny River (PA). Allegheny River populations have been used in reintroduction efforts in Illinois, Indiana, Ohio, Kentucky, New York, Pennsylvania, and West Virginia. As of 2019, there are thought to be

23 streams with 13 known populations of northern riffleshell, four of which are considered stable and recruiting.

7.7.7 Orangefoot Pimpleback (*Plethobasus cooperianus*)

The following information is adapted from (U.S. Fish and Wildlife Service 2022*e*).

The orangefoot pimpleback is sparsely distributed throughout its restricted range. Currently, three populations are known, occurring in the Tennessee River, Cumberland, and Ohio Rivers. This species occurs in medium to large rivers with sand and gravel substrates and often co-occurs with other riverine mussel species. They are locally rare where they do occur, and remaining populations are likely genetically isolated. Limited spatial distribution of extant populations and genetic isolation make this species particularly susceptible to stochastic events (i.e., barge spills, dam failures).

Little is known about the specific life history of this species, but it is thought to be like other unionid mussels. The host fish for the orangefoot pimpleback is unknown.

At the time of listing, extant populations of the orangefoot pimpleback occurred in the Tennessee River, Cumberland River, and Ohio River. Currently, only three known populations remain; one in the lower Tennessee River below Kentucky Lake Lock & Dam and the Ohio River downstream of the Tennessee River confluence, one in the Tennessee River below Pickwick Landing Dam, and one on the Cumberland River, though the last individual documented in this river was in 2011-2012.

7.7.8 Pink Mucket (Lampsilis abrupta)

The following information is adapted from (U.S. Fish and Wildlife Service 2019*h*).

The pink mucket occurs in the Tennessee River, Cumberland River, Ohio River, White River, Red River, Missouri River, lower and upper Mississippi river basin. Extant populations tend to have few individuals with limited evidence of recruitment. This species is often found in stable sections of medium to large rivers with gravel/sand dominated substrates, but can occupy habitat with a wide range of substrates, water depths and currents (U.S. Fish and Wildlife Service 1985, Roberts and Bruenderman 2000). As is often typical of freshwater mussels, pink mucket usually co-occur with other mussel species in diverse concentrations. Limited spatial distribution of extant populations because of effects from impoundments and river alterations for navigations, make this species particularly susceptible to stochastic events (i.e., barge spills, dam failures).

The pink mucket is a long-term brooder, becoming gravid in summer months and overwintering to release glochidia in the spring. Females use modified mantle tissue as a “lure” to attract host fish and increase the likelihood that dispersed glochidia will successfully attach to host fish. Laboratory studies report a period of 12-14 days for pink mucket glochidia to transform to juvenile mussels. Fish hosts for pink mucket may include bass (*Micropterus* spp.), and walleye (Barnhart and Baird 1999).

It’s estimated that the pink mucket is extirpated from 80% of its historical range. Populations are currently known from 29 locations across Tennessee, Alabama, Kentucky, West Virginia, Ohio, Illinois, Arkansas, and Missouri, with one-third of those populations being represented by only a few individuals. Tennessee River and Cumberland River populations appear stable, but Osage River and Meramec River (Missouri) populations are thought to be declining. Recently, propagation efforts in the Osage River have helped augment this population.

7.7.9 Purple Cat's Paw (Epioblasma obliquata)

The following information is adapted from (U.S. Fish and Wildlife Service 2020*h*).

The purple cat's paw has an extremely limited distribution in Ohio, Tennessee, Kentucky, and West Virginia with only one extant and five reintroduced populations remaining. It's considered a medium and large river species, that occurs in swift to moderate currents with substrates ranging from sand to boulders. Due to their extremely limited distribution, the purple cat's paw is highly vulnerable to localized stochastic events which could threaten the species existence.

The life history needs of the purple cat's paw are well known and are similar to other unionid mussels. They live up to 25 years and can reach sexual maturity at age 3. Suitable host fish for this species includes bass (*Amploplites rupestris*), mottled sculpin (*Cottus bairdii*), stonecat (*Noturus flavus*), blackside darter (*Percina maculata*), and logperch (*P. caprodes*).

As of the species listing, there were only two known populations in the Green River (KY) and the Cumberland River (TN). An additional population was identified in Killbuck Creek (OH) in the 1990s. The species is likely extirpated from the Cumberland River and had also been extirpated in the Green River until reintroduced in 2017 (U.S. Fish and Wildlife Service 2020*h*). Purple cat's paw individuals have also been reintroduced into the Ohio River, Walhonding River, Green River, Licking River, and Duck River. Natural reproduction has not been documented in these populations. The purple cat's paw was historically distributed in the Ohio River, Cumberland River, and Tennessee River systems in Ohio, Illinois, Indiana, Kentucky, Tennessee, and Alabama.

7.7.10 Pink Pigtoe (Pleurobema pyramidatum)

The following information is adapted from (U.S. Fish and Wildlife Service 2021*f*).

The pink pigtoe occurs in discrete locations across the Ohio River, Tennessee River, Arkansas-White-Red River, and lower Mississippi River basins. It was historically a wide-ranging species found in the Upper Mississippi River, Ohio River, Missouri River, Tennessee River, Arkansas-White-Red River, and Lower Mississippi basins. Extant populations tend to have few individuals with low fecundity. This species has been found in larger rivers with sand and gravel to coarse sand substrates and can be found in a range of water depths up to 20 feet (6 meters) or greater. Threats to the species include habitat loss and degradation associated with impoundments, instream alterations, impaired water quality from pollution and land use changes and invasive species.

The pink pigtoe is a short-term brooder, retaining glochidia from May to approximately July. Like other species of Pleurobemini, the pink pigtoe releases packets of glochidia (conglutinates) which mimic the prey of sight-feeding fish. Minnows in the family Cyprinidae appear to be the primary host fish for this species.

It is estimated that the current range of the pink pigtoe includes 35 of the 151 historically documented populations. The pink pigtoe is considered extirpated from 69% of its historic range, including Pennsylvania, West Virginia, Indiana, Illinois, Minnesota, Wisconsin, Iowa, Kansas, and Missouri.

7.7.11 Rabbitsfoot (Quadrula cylindrica cylindrica)

The following information is adapted from (U.S. Fish and Wildlife Service 2020*i*).

The rabbitsfoot has a wide geographic extent, occurring in over 123 watersheds across its range. The species is typically found in shallow, stable sections of small to medium rivers with sand, gravel, and small cobble substrates. Adults are often found lying upon the substrate surface in areas of flow refugia, while juveniles tend to burrow in the substrate. Many of the extant populations with medium to high resiliency are no longer hydrologically connected because of artificial impoundments. In addition to loss of suitable habitat within the reservoir, this situation limits the genetic flow between populations, increasing their susceptibility to stochastic events (U.S. Fish and Wildlife Service 2021*g*).

The rabbitsfoot is a short-term brooder retaining glochidia from May to July. They use a small lure to attract fish hosts, and then release packets of glochidia (conglutinates) for some to encyst on the gills of suitable host fish (Barnhart et al. 2008). Known host fish species are primarily in the minnow family and include whitetail shiner (*Cyprinella galctura*), spotfin shiner (*C. spiloptera*), and bigeye chub (*Hybopsis amblops*).

It is estimated that 123 of 434 watersheds historically occupied by rabbitsfoot currently retain populations. Approximately 67% of remaining populations are considered to have low or poor condition. Populations in the lower Great Lakes sub-basin and Cumberland River basin have largely been extirpated. Known populations are considered improving in the Walhonding River (OH), stable in the Ohio River (IL, IN, KY, OH, PA, WV), Green River (KY), French Creek (PA), and Tippecanoe River (IN) and declining in the Eel River (IN) and Middle Branch of North Fork Vermilion River (IL).

7.7.12 Rayed Bean (Villosa fabalis)

The following information is adapted from (U.S. Fish and Wildlife Service 2022*f*).

The rayed bean occurs in the Great Lakes, Ohio River and Tennessee River basins and spans seven states. It historically occurred in at least 115 streams and lakes across Illinois, Indiana, Kentucky, Michigan, New York, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia. The species occurred in parts of the upper and lower Great Lakes systems, and throughout most of the Ohio River and Tennessee River systems where it was thought to be widespread and common where it occurred. The rayed bean is typically found in small, headwater streams in or near vegetation adjacent to shoal or riffle habitats. It is also found in shallow areas of glacial lakes including Lake Erie.

The rayed bean is a long-term brooder, with glochidia remaining in the gill chamber from May through October. The species attracts host fish with a modified mantle flap when gravid. Suitable host fish for the rayed bean are thought to be small predatory fish species including darters and sculpins. The Tippecanoe darter (*Etheostoma tippecanoe*) and spotted darter (*E. maculatum*) are the only known hosts of this species.

The rayed bean currently occupies 37 of 115 known rivers and 1 lake from which is historically occurred. There are 22 extant populations; 10 in the Great Lakes basin (IN, MI, OH); 11 in the Ohio River basin (Indiana, Pennsylvania, New York, Ohio, and West Virginia); and 1 in the Tennessee River basin (TN).

7.7.13 Rough Pigtoe (Pleurobema plenum)

The following information is adapted from (U.S. Fish and Wildlife Service 2021*h*).

The rough pigtoe is endemic to the Ohio River basin and occupies limited portions of the Clinch River, Tennessee River, Cumberland River, Green River, Barren River, and Licking River. The species is typically found in stable habitats composed of gravel, sand and silt substrate and typically co-occurs with other riverine mussel species. Effects from impoundments, river alteration, point and non-point source pollution continue to threaten this species where it occurs. The limited spatial distribution of extant populations makes this species particularly susceptible to stochastic events (i.e., barge spills, dam failures).

The rough pigtoe is a short-term brooder that produces packets of glochidia (conglutinates) which it releases between May-July. Minnow species in the family Leuciscidae have been suitable hosts for rough pigtoe in laboratory studies but may not represent its natural host fish.

The rough pigtoe historically had a widespread distribution throughout the Ozarks, Cumberland River, Mississippi River, and Ohio River basins. Currently, it is restricted to a few small populations, with evidence of reproduction in only the Clinch River and Green River (U.S. Fish and Wildlife Service 1984*b*).

7.7.14 Round Hickorynut (*Obovaria subrotunda*)

The following information is adapted from (U.S. Fish and Wildlife Service 2019*i*).

The round hickorynut is a wide-ranging species that occurs in the Great Lakes, Ohio River, Cumberland River, Tennessee River, and Lower Mississippi River basins and spans nine states. This species is most common in the Ohio River basin and least common in the Lower Mississippi River basin. They occur in small to large rivers in riffle, run, and pool habitats with sand and gravel or sandy mud substrates. Isolation of extant populations make the round hickorynut susceptible to stochastic events ((i.e., barge spills, dam failures). Continued threats to the species where they occur includes habitat and water degradation associated with contaminants, impoundments, and resource extraction.

The round hickorynut is a long-term brooder, retaining glochidia from fall through the following summer, or year-round in some southern populations. The round hickorynut releases packets of glochidia (conglutinates), which are targeted by sight-feeding darters. Primary host fish for the round hickorynut appear to be darters of the genera *Ammocrypta*, *Etheostoma*, and *Percina.*

Historically, the round hickorynut was a wide-ranging and abundant riverine mussel species. However, an estimated 77 percent populations have been lost. Currently, 69 populations of round hickorynut are known across the entirety of its range and 71% are considered in low condition. The largest populations of round hickorynut occur in the Duck River (TN), however this population they are isolated from other populations by the presence of mill dams.

7.7.15 Salamander Mussel (*Simpsonaias ambigua*) – Proposed Species

The following information was adapted from (U.S. Fish and Wildlife Service 2023*b*).

The salamander mussel is a wide-ranging species, occupying 66 watersheds across 14 states. Extant populations occur in the Upper Mississippi River (17), Tennessee River (2), Ohio River (35), Great Lakes (8), and Arkansas-White-Red River (1) basins. This species occupies rivers, streams, or lakes and occur under flat rocks in areas of moderate flow with varying substrates. Threats to the salamander mussel include degradation of habitat and water quality associated with contaminants, altered hydrology, and vulnerability of their host species.

The salamander mussel is a long-term brooder, remaining gravid over winter until spring or summer. Its primary host is the mudpuppy (*Necturus maculosus*). These species tend to co-occur in the spring and summer when salamander mussels release their glochidia and mudpuppies are more to occur in proximity to salamander mussels. This likely increases the chances for salamander mussel glochidia to encyst on mudpuppies. It is also thought glochidia infestation may occur when mudpuppies consume adult salamander mussels.

Currently, there are 66 extant populations of the 110 from which it historically occurred. There are minimal demographic data for extant salamander mussel populations, but at least 23 populations are only known from single records.

7.7.16 Scaleshell (Leptodea leptodon)

The following information was adapted from (U.S. Fish and Wildlife Service 2021*i*).

The scaleshell is a rare species that historically occurred in 60 streams representing 13 states. In the last 30 years it has only been observed from 15 rivers in Missouri, Arkansas, Oklahoma, South Dakota, and Illinois. It's typically found in stable riffle-run complexes of medium to large rivers with a preference toward gravel or mud substrates (U.S. Fish and Wildlife Service 2010). Threats to this species include habitat and water quality degradation associated with impoundments, contaminants, and sedimentation.

The scaleshell is a long-term brooder with spawning occurring in the fall and host infection the following spring. Freshwater drum, which eats mollusks, is thought to be the exclusive host fish for the scaleshell (U.S. Fish and Wildlife Service 2010). It is hypothesized that female scaleshell infest freshwater drum with glochidia when it is consumed by the host fish.

Currently, the only streams where scaleshell can be found consistently is the Meramec River, Bourbeuse River, and Gasconade River in Missouri. The species' distribution in these streams is spotty it is known only from discrete areas. All other listed streams from which the species has been documents within the last 30 years are based on the collection of one or a few individuals and they are not consistently found during surveys.

7.7.17 Sheepnose (Plethobasus cyphyus)

The following information was adapted from (U.S. Fish and Wildlife Service 2022*g*).

Sheepnose currently occurs in rivers of the Upper Mississippi River, Ohio River, Tennessee River, and Lower Mississippi River basins and spans 14 states. The species typically inhabits medium to large rivers with coarse sand, gravel, and clay substrates, and can be found in depths ranging from shallow to >20 feet (6 meters) in larger rivers. Impoundments and barriers may threaten the species' ability to repopulate extirpated locations, and effects of invasive species, contaminants, landscape and hydrological alterations threaten the species where it occurs.

Sheepnose is a short-term brooder, gravid from mid-May to early August. They release glochidia in narrow conglutinates which are targeted by sight-feeding host fish. The only known host fish for the sheepnose is the mimic shiner (*Notropis volucellus*), however, natural infestation of sauger (*Sander* *canadensis*) has been observed and other fish species have been successfully used as hosts for sheepnose in laboratory studies.

An estimated 71% of sheepnose populations are extirpated, with 37 extant populations remaining of the 126 which historically occurred (conservative estimate). There are 13 extant populations in the Upper Mississippi River basin (Minnesota, Wisconsin, Iowa, Illinois, and Missouri); 15 in the Ohio River basin (Illinois, Indiana, Ohio, Kentucky, Tennessee, Virginia, West Virginia, Pennsylvania, North Carolina, and New York); 8 in the Tennessee River basin (Kentucky, Tennessee, Mississippi, Alabama, Georgia, North Carolina, and Virginia); and one in the Lower Mississippi River basin.

7.7.18 Snuffbox (Epioblasma triquetra)

The following information is adapted from (U.S. Fish and Wildlife Service 2022*h*).

The snuffbox historically occurred in at least 211 streams and lakes across 18 States; Alabama, Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Mississippi, Missouri, New York, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Wisconsin. Snuffbox typically occur in high flow riffles or shoals of small to medium rivers. Reductions in suitable habitat is attributed as a primary contributor to the decline of this species and is largely associated with the construction of impoundments and instream modifications (i.e., dredging, channelization, sand/gravel mining and siltation).

Snuffbox are long-term brooders, retaining glochidia from September to May, and spawning in late summer. Like other mussels of the genus *Epioblasma*, female snuffbox “capture” host fish as part of their obligatory parasitic life stage. Gravid females at the substrate surface will gape their valves to display brightly colored mantle tissue to attract host fish. When fish come close, the female snaps her valves shut, and then expels glochidia onto the gills and tissues of the fish.

Logperch appears to be the primary host, though juveniles have successfully transformed on blackside darter, rainbow darter (*Etheostoma caeruleum*), Iowa darter (*E. exile*), blackspotted topminnow (*Fundulus olivaceous*), mottled sculpin, banded sculpin, Ozark sculpin (*C. hypselurus*), largemouth bass, and brook stickleback (*Culaea inconstans*) in laboratory settings. Logperch adults prefer relatively shallow, swift riffles with gravel substrate, which corresponds with habitat where snuffbox often occurs.

There are currently 55 extant snuffbox populations in 85 streams across Alabama, Arkansas, Illinois, Indiana, Kentucky, Michigan, Minnesota, Missouri, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and Wisconsin.).

7.7.19 Spectaclecase (Cumberlandia monodonta)

The following information is adapted from (U.S. Fish and Wildlife Service 2022*i*).

Spectaclecase is a wide-ranging species, with 40 extant populations occurring across the Ohio River, Tennessee River, Upper and Lower Mississippi River, and Missouri River basins. This species typically occurs in large rivers and is found in microhabitats sheltered from extremes in flow. Often, they are found in large aggregations, wedged between rocks in the interface between slow and swift currents.

Relatively little is known about the specific life history of this species, but it has been documented releasing glochidia twice per year (once in spring or early summer and once in the fall) in the Meramec

River in Missouri. The primary host fish for the spectaclecase are the goldeye (*Hiodon alosoides*) and mooneye (*H. tergisus*).

More than 60% of spectaclecase populations are extirpated from its historical range throughout the Mississippi River system, the upper Ohio River system, the Cumberland River and Tennessee River systems, and tributaries in the Mississippi Delta region of Mississippi and Louisiana. They are considered extirpated in Indiana, Nebraska, Kansas, and Ohio.

7.7.20 White Catspaw (Epioblasma perobliqua)

The following information is adapted from (U.S. Fish and Wildlife Service 2021*j*).

The white cat's paw is restricted to a 3-mile stretch of Fish Creek in northwest Ohio, where the last live individual was observed in 1999 (U.S. Fish and Wildlife Service 2013*b*). It is thought to have historically occurred in the Wabash River, White River, Tippecanoe River, Maumee River, and St. Joseph River (IN) and the Maumee River (OH), St. Joseph River (OH, MI), and Fish Creek (IN, OH). Habitat requirements for this species are not well known, though individuals observed have typically been found in riffle-run complexes of large rivers. Hazardous substance spills have previously impacted Fish Creek where the white catspaw occurs. With only one population potentially remaining, any impacts near or adjacent to Fish Creek could threaten the existence of this species.

Little is known about the life history characteristics of the white catspaw due to its extreme rarity; however, it is assumed to have similar characteristics to other Unionid mussels. Hosts for this species are unknown but may use similar hosts to other *Epioblasma* species which are typically riffle dwelling darters and sculpin.

In 1993 a pipeline rupture spilled over 30,000 gallons of diesel fuel into Fish Creek in northeastern Indiana, upstream of the last known remaining population of white catspaw. A concerted effort to restore key aspects of Fish Creek and its watershed using funds from a settlement that followed this spill have been completed (Simon et al. 2010). Follow-up surveys for white catspaw in 2009-2013 failed to locate any evidence of the species continued presence in the creek and it may be present only in numbers too low to detect (Simon et al. 2010, U.S. Fish and Wildlife Service 2013*b*).

7.7.21 Winged Mapleleaf (*Quadrula fragosa*)

The following information is adapted from (U.S. Fish and Wildlife Service 2015*a*).

Winged mapleleaf occur in discrete locations in Minnesota and Wisconsin (St. Croix River), Missouri (Bourbeuse River), Oklahoma (Little River), and Arkansas (Ouachita River, Saline River, and Little River. This species is typically found in medium to large rivers where depths exceed 1.5-2 ft and substrates are stable. Limited distribution and small population size of extant populations make this species particularly susceptible to stochastic events (i.e., barge spills, dam failures, flooding, etc.).

The winged mapleleaf is a short-term brooder releasing glochidia in early autumn. Females position themselves at the substrate surface and prominently gape their valves to release glochidia on potential host fish. Winged mapleleaf glochidia overwinter on their host fish, which could provide a competitive advantage over other mussels for resources during their initial growing years. Channel catfish (*Ictalurus punctatus*) and blue catfish (*I. furcatus*) are the only known hosts for the winged mapleleaf.

At the time of its listing in 1991, winged mapleleaf was thought to only occur in one population in the St. Croix River between Minnesota and Wisconsin, however live individuals have since been identified in the Ouachita and Saline Rivers (AR), Bourbeuse River (MO), and Little River (OK and AR). New populations have been established in the Chippewa River (WI) and the Mississippi River (MN).

7.8 Critical Habitats

7.8.1 Short's Bladderpod Critical Habitat

In 2014 USFWS designated 925.5 acres (ac) (373 hectares (ha)) in 20 units as critical habitat for the Short's bladderpod in Indiana, Kentucky, and Tennessee.

The primary constituent elements of critical habitat for the Short's bladderpod are:

i. Bedrock formations and outcrops of calcareous limestone, sometimes with interbedded shale or siltstone, in close proximity to the mainstem or tributaries of the Kentucky and Cumberland rivers. These outcrop sites or areas of suitable bedrock geology should be located on steeply sloped hillsides or bluffs, typically on south- to west-facing aspects.

ii. Shallow or rocky, well-drained soils formed from the weathering of underlying calcareous bedrock formations, which are undisturbed or subjected to minimal disturbance, so as to retain habitat for ground-nesting pollinators and potential for maintenance of a soil seed bank.

iii. Forest communities with low levels of canopy closure or openings in the canopy to provide adequate sunlight for individual and population growth. Invasive, nonnative plants must be absent or present in sufficiently low numbers not to inhibit growth or reproduction of Short's bladderpod.

USFWS does not monitor the status of the critical habitat, per se, but descriptions of the species' habitat, in general, threats to the habitat, and USFWS recommendations for recovery actions are likely indicative of the status and current conservation needs of the specific areas designated as critical habitat. See the Short's bladderpod section in **STATUS OF THE SPECIES AND CRITICAL HABITAT**, above.

Factors affecting the status of Short's bladderpod critical habitat include: 1) removal of soils; 2) altered water movement resulting in sediment deposition; 3) blasting or removal of hard rock and soil substrates; 4) dumping of trash and debris; 5) prolonged inundation; 6) indiscriminate maintenance of rights-of-way; and 7) shading and competition from forest canopy closure and encroachment of invasive plants.

7.8.2 Hine's Emerald Dragonfly Critical Habitat

In 2010, USFWS designated 26,531.8 acres (ac) (10,737 hectares (ha)) in 37 units as critical habitat for the Hine's emerald in Illinois, Michigan, Missouri, and Wisconsin.

The primary constituent elements of critical habitat for the Hine's emerald dragonfly are:

i. For egg deposition and larval growth and development: (A) Organic soils (histosols, or with organic surface horizon) overlying calcareous substrate (predominantly dolomite and limestone bedrock); (B) Calcareous water from intermittent seeps and springs and associated shallow, small, slow-flowing streamlet channels, rivulets, and/or sheet flow within fens; (C) Emergent herbaceous and woody vegetation for emergence facilitation and refugia; (D) Occupied burrows maintained by crayfish for refugia; and (E) Prey base of aquatic macroinvertebrates, including mayflies, aquatic isopods, caddisflies, midge larvae, and aquatic worms.

ii. For adult foraging, reproduction, dispersal, and refugia necessary for roosting, for resting, for adult females to escape from male harassment, and for predator avoidance (especially during the vulnerable teneral stage): (A) Natural plant communities near the breeding/larval habitat which may include fen, marsh, sedge meadow, dolomite prairie, and the fringe (up to 328 ft (100 m)) of bordering shrubby and forested areas with open corridors for movement and dispersal; and (B) Prey base of small, flying insect species (e.g., dipterans).

USFWS does not monitor the status of the critical habitat, per se, but descriptions of the species' habitat, in general, threats to the habitat, and USFWS recommendations for recovery actions are likely indicative of the status and current conservation needs of the specific areas designated as critical habitat. See the Hine's Emerald Dragonfly section in **STATUS OF THE SPECIES AND CRITICAL HABITAT**, above.

Factors affecting the status of Hine's emerald critical habitat include invasion and expansion of non-native plant species and native trees and shrubs, hydrologic alterations, and contamination. In its 2019, review of the species' status, USFWS recommended continued efforts to restore, protect, and manage Hine's emerald habitat and emphasized the need to protect groundwater resources and to restore and manage recharge areas (U.S. Fish and Wildlife Service 2019*d*). Identifying the location and extent of areas that recharge groundwater into Hine's emerald habitats is essential to maintaining seeps and springs that are important to the species. USFWS is working to identify those areas, but additional work is needed to ensure adequate protective steps may be taken.

7.8.3 Poweshiek Skipperling Critical Habitat

USFWS designated critical habitat for the Poweshiek skipperling on October 1, 2015. The designation included about 19,903 acres (8,054 hectares) in Iowa, Michigan, Minnesota, North Dakota, South Dakota, and Wisconsin.

Based on current knowledge of the physical or biological features and habitat characteristics required to sustain the species' life-history processes, USFWS identified four primary constituent elements of Poweshiek skipperling critical habitat.

Primary Constituent Element 1—Wet-mesic to dry tallgrass remnant untilled prairies or remnant moist meadows containing:

a. A predominance of native grasses and native flowering forbs;
b. Undisturbed (untilled) glacial soil types including, but not limited to, loam, sandy loam, loamy sand, gravel, organic soils (peat), or marl that provide the edaphic features conducive to Poweshiek skipperling larval survival and native prairie vegetation;
c. If present, depressional wetlands or low wet areas, within or adjacent to prairies that provide shelter from high summer temperatures and fire;
d. If present, trees or large shrub cover less than 5 percent of area in dry prairies and less than 25 percent in wet-mesic prairies and prairie fens; and

e. If present, nonnative invasive plant species occurring in less than 5 percent of the area.

Primary Constituent Element 2—Prairie fen habitats containing:

a. A predominance of native grasses and native flowering forbs;
b. Undisturbed (untilled) glacial soil types including, but not limited to, organic soils (peat), or marl that provide the edaphic features conducive to Poweshiek skipperling larval survival and native prairie vegetation;
c. Depressional wetlands or low wet areas, within or adjacent to prairies that provide shelter from high summer temperatures and fire;
d. Hydraulic features necessary to maintain prairie fen groundwater flow and prairie fen plant communities;
e. If present, trees or large shrub cover less than 25 percent of the unit; and
f. If present, nonnative invasive plant species occurring in less than 5 percent of area.

Primary Constituent Element 3—Native grasses and native flowering forbs for larval and adult food and shelter, specifically;

a. At least one of the following native grasses available to provide larval food and shelter sources during Poweshiek skipperling larval stages: Prairie dropseed *(Sporobolus heterolepis),* little bluestem *(Schizachyrium scoparium),* sideoats grama *(Bouteloua curtipendula),* or mat muhly *(Muhlenbergia richardsonis);* and
b. At least one of the following forbs in bloom to provide nectar and water sources during the Poweshiek skipperling flight period: purple coneflower *(Echinacea angustifolia),* black-eyed Susan *(Rudbeckia hirta),* smooth ox-eye *(Heliopsis helianthoides),* stiff tickseed *(Coreopsis palmata),* palespike lobelia *(Lobelia spicata),* sticky tofieldia *(Triantha glutinosa),* or shrubby cinquefoil *(Dasiphora fruticosa ssp. floribunda).*

(4) Primary Constituent Element 4—Dispersal grassland habitat that is within 1 km (0.6 mi) of native high-quality remnant prairie (as defined in Primary Constituent Element 1) that connects high quality wet-mesic to dry tallgrass prairies, moist meadows, or prairie fen habitats. Dispersal grassland habitat consists of the following physical characteristics appropriate for supporting Poweshiek skipperling dispersal: Undeveloped open areas dominated by perennial grassland with limited or no barriers to dispersal including tree or shrub cover less than 25 percent of the area and no row crops such as corn, beans, potatoes, or sunflowers.

Little information is readily available to directly inform the status of the primary constituent elements within the areas designated as critical habitat for the Poweshiek skipperling, but some new scientific information on some of the PCEs has been developed since the critical habitat designation.

New and recent information on the importance and status of the PCEs is restricted primarily to the few remaining known occupied sites in Manitoba and Michigan. Modeling in Michigan affirmed the importance of prairie fen habitat to the species with habitat suitability increasing in direct relationship to the extent of this habitat type on the landscape. Extent of suitable habitat was also an important predictor of habitat suitability in Manitoba as was the existence of a surface- or near-surface water table (U.S. Fish and Wildlife Service 2019*j*).

Observations in both Manitoba and Michigan suggested that larval food sources may include a few grass species in addition to those included as PCEs. Feeding trials conducted on these and on the previously known host species with captive larvae have had mixed and contradictory results. Native grass species spurned by larvae in one trial, for example, seemed to be preferred in another (U.S. Fish and Wildlife Service 2019*j*). Since 2016, larvae have been observed feeding on three of the four larval food plants identified in the PCEs in at least one study – sideoats grama was not involved with any of the studies.

Invasive species are an ongoing threat to the integrity of the PCEs at Poweshiek skipperling critical habitat sites. USFWS and its partners are monitoring and abating this threat, with a primary focus on the sites where the species remains extant in Michigan (U.S. Fish and Wildlife Service 2019*j*).

7.8.4 Topeka Shiner Critical Habitat

In 2004 USFWS designated 83 stream segments representing 1,356 kilometers (km) (836 miles) of stream in the States of Iowa, Minnesota, and Nebraska as critical habitat for the Topeka shiner. Due to the existence of state management plans for the species in Kansas, Missouri, and South Dakota USFWS excluded the areas inhabited by Topeka shiner in those states from the critical habitat designation.

The primary constituent elements of critical habitat for the Topeka shiner are:

i. Streams most often with permanent flow, but that can become intermittent during dry periods.
ii. Side-channel pools and oxbows either seasonally connected to a stream or maintained by groundwater inputs, at a surface elevation equal to or lower than the bank-full discharge stream elevation. The bankfull discharge is the flow at which water begins leaving the channel and flowing into the floodplain; this level is generally attained every 1 to 2 years. Bankfull discharge, while a function of the size of the stream, is a fairly constant feature related to the formation, maintenance, and dimensions of the stream channel.
iii. Streams and side-channel pools with water quality necessary for unimpaired behavior, growth, and viability of all life stages. (The water quality components include— temperature, turbidity, conductivity, salinity, dissolved oxygen, pH, chemical contaminants, and other chemical characteristics.);
iv. Living and spawning areas for adult Topeka shiner with pools or runs with water velocities less than 0.5 meters/second (approx. 20 inches/ second) and depths ranging from 0.1– 2.0 meters (approx. 4–80 inches);
v. Living areas for juvenile Topeka shiner with water velocities less than 0.5 meters/second (approx. 20 inches/ second) with depths less than 0.25 meters (approx. 10 inches) and moderate amounts of instream aquatic cover, such as woody debris, overhanging terrestrial vegetation, and aquatic plants;
vi. Sand, gravel, cobble, and silt substrates with amounts of fine sediment and substrate embeddedness that allow for nest building and maintenance of nests and eggs by native *Lepomis* sunfishes (green sunfish, orangespotted sunfish, longear sunfish) and Topeka shiner as necessary for reproduction, unimpaired behavior, growth, and viability of all life stages;
vii. An adequate terrestrial, semiaquatic, and aquatic invertebrate food base that allows for unimpaired growth, reproduction, and survival of all life stages;

viii. A hydrologic regime capable of forming, maintaining, or restoring the flow periodicity, channel morphology, fish community composition, off-channel habitats, and habitat components described in the other primary constituent elements; and
ix. Few or no nonnative predatory or nonnative competitive species present.

USFWS does not monitor the status of the critical habitat, per se, but does track the status of habitat for the species, in general. Descriptions of the status of Topeka shiner habitat in Iowa, Nebraska, and Minnesota in the Status of the Species and Critical Habitat section, above, apply to the status of the stream habitat designated as critical habitat for the species. Topeka shiner critical habitat exists in watersheds whose landscapes are altered compared to the conditions that prevailed prior to widespread development and intensive agriculture. Degradations of the essential features of Topeka shiner critical habitat reflect the impacts of that alteration. These impacts have affected the permanency of flows, the length of stream miles that support the essential habitat features, the quality and quantity of groundwater inputs to stream and off-channel habitats, and both seasonal and long-term connections among habitat areas. In turn, alterations to the habitat have facilitated introduction by nonnative fishes that compete with the Topeka shiners and prey on the species.

7.8.5 Rabbitsfoot Critical Habitat

On April 30, 2015, USFWS designated approximately 2,312 river km (1,437 river miles) as critical habitat for rabbitsfoot in Alabama, Arkansas, Illinois, Indiana, Kansas, Kentucky, Mississippi, Missouri, Ohio, Oklahoma, Pennsylvania, and Tennessee.

The primary constituent elements of critical habitat for the rabbitsfoot are:

i. Geomorphically stable river channels and banks (channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of freshwater mussel and native fish (such as stable riffles, sometimes with runs, and mid-channel island habitats that provide flow refuges consisting of gravel and sand substrates with low to moderate amounts of fine sediment and attached filamentous algae).
ii. A hydrologic flow regime (the severity, frequency, duration, and seasonality of discharge over time) necessary to maintain benthic habitats where the species are found and to maintain connectivity of rivers with the floodplain, allowing the exchange of nutrients and sediment for maintenance of the mussel's and fish host's habitat, food availability, spawning habitat for native fishes, and the ability for newly transformed juveniles to settle and become established in their habitats.
iii. Water and sediment quality (including, but not limited to, conductivity, hardness, turbidity, temperature, pH, ammonia, heavy metals, and chemical constituents) necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages.
iv. The occurrence of natural fish assemblages, reflected by fish species richness, relative abundance, and community composition, for each inhabited river or creek that will serve as an indication of appropriate presence and abundance of fish hosts necessary for recruitment of the rabbitsfoot. Suitable fish host for rabbitsfoot may include, but are not limited to, blacktail shiner (*Cyprinella venusta*) from the Black and Little River and cardinal shiner (*Luxilus cardinalis*), red shiner (*C. lutrensis*), spotfin shiner (*C. spiloptera*), bluntface shiner (*C. camura*), rainbow darter,

rosyface shiner (*Notropis rubellus*), striped shiner (*L. chrysocephalus*), and emerald shiner (*N. atherinoides*).

v. Competitive or predaceous invasive (nonnative) species in quantities low enough to have minimal effect on survival of freshwater mussels.

USFWS does not monitor the status of the critical habitat, but tracks the status of habitat for the species, in general. Descriptions of the status of rabbitsfoot habitat in Alabama, Arkansas, Illinois, Indiana, Kansas, Kentucky, Mississippi, Missouri, Ohio, Oklahoma, Pennsylvania, and Tennessee in the Status of the Species and Critical Habitat section, above, apply to the status of the stream habitat designated as critical habitat for the species. Degradation of the essential features of rabbitsfoot critical habitat reflect impacts of widespread stream alterations and land use changes prevalent throughout watersheds currently and historically occupied by the species. Impacts of the construction of impoundments and instream activities include changes in hydrology, geomorphology, and increased sediment deposition. Impoundments can also block or limit host fish movements, cutting off mussels from their fish hosts. Changes in land use practices surrounding streams occupied by rabbitsfoot include industrialization and agriculture, both of which are known contributors of point and non-point sources of contaminants which are identified as a major contributor to mussel declines.

7.8.6 Round Hickorynut Critical Habitat

On March 9, 2023, USFWS designated a total of 1,482 river kilometers (921 river miles) as critical habitat for round hickorynut in Pennsylvania, Ohio, Indiana, West Virginia, Kentucky, Alabama, Tennessee, and Mississippi.

The primary constituent elements of critical habitat for the round hickorynut are:

i. Adequate flows, or a hydrologic flow regime (magnitude, timing, frequency, duration, rate of change, and overall seasonality of discharge over time), necessary to maintain benthic habitats where the species are found and to maintain stream connectivity, specifically providing for the exchange of nutrients and sediment for maintenance of the mussels' and fish host's habitat and food availability, maintenance of spawning habitat for native fishes, and the ability for newly transformed juveniles to settle and become established in their habitats. Adequate flows ensure delivery of oxygen, enable reproduction, deliver food to filter-feeding mussels, and reduce contaminants and fine sediments from interstitial spaces. Stream velocity is not static over time, and variations may be attributed to seasonal changes (with higher flows in winter/spring and lower flows in summer/fall), extreme weather events (e.g., drought or floods), or anthropogenic influence (e.g., flow regulation via impoundments).

ii. Suitable substrates and connected instream habitats, characterized by geomorphically stable stream channels and banks (i.e., channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of freshwater mussel and native fish (such as, stable riffle-run pool habitats that provide flow refuges consisting of predominantly silt-free, stable sand, gravel, and cobble substrates);

iii. Water and sediment quality necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages, including (but not limited to): Dissolved oxygen (generally above 2 to 3 parts per million (ppm)), salinity (generally below 2 to 4 ppm), and temperature (generally below 86 °F (°F) (30 °Celsius (°C)). Additionally, water and sediment should be low in ammonia (generally below 0.5 ppm total ammonia-nitrogen) and heavy metal concentrations and lack excessive total suspended solids and other pollutants (see Threats Analysis, above).

iv. The presence and abundance of fish hosts necessary for recruitment of round hickorynut (i.e., eastern sand darter (*Ammocrypta pellucida*), emerald darter (*Etheostoma baileyi*), greenside darter (*E. blennioides*), Iowa darter, fantail darter (*E. flabellare*), Cumberland darter (*E. susanae),* spangled darter (*E. obama*), variegate darter (*E. variatum*), blackside darter, frecklebelly darter (*P. stictogaster*), and banded sculpin).

USFWS does not monitor the status of the critical habitat, but tracks the status of habitat for the species, in general. Descriptions of the status of round hickorynut habitat in Pennsylvania, Ohio, Indiana, West Virginia, Kentucky, Alabama, Tennessee, and Mississippi in the Status of the Species and Critical Habitat section, above, apply to the status of the stream habitat designated as critical habitat for the species. Degradation of the essential features of round hickorynut critical habitat reflect impacts of instream habitat alterations and widespread development/urbanization prevalent throughout watersheds currently and historically occupied by the species. Impacts of river channelization and the construction of impoundments include changes in hydrology, geomorphology, and increased sediment deposition. Impoundments can also block or limit host fish movements, cutting off mussels from their fish hosts. Development and urbanization within watersheds known to support the species contribute to point and non-point source inputs of contaminants which are identified as major contributors to mussel declines.

7.8.7 Salamander Mussel Proposed Critical Habitat

On August 22, 2023, USFWS proposed designating a total of 3,238 river kilometers (2,012 river miles) as critical habitat for the salamander mussel in Minnesota, Wisconsin, Indiana, Ohio, Michigan, New York, Pennsylvania, West Virginia, Kentucky, and Tennessee.

The primary constituent elements of critical habitat for the salamander mussel are:

i. Adequate flows, or a hydrologic flow regime (magnitude, timing, frequency, duration, rate of change, and overall seasonality of discharge over time), necessary to maintain benthic habitats where the salamander mussel and its host, the mudpuppy, are found and to maintain stream connectivity.

ii. Suitable substrates and connected instream habitats, characterized by geomorphologically stable stream channels and banks (i.e., channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support the salamander mussel and mudpuppy (e.g., large rock shelters, woody debris, and bedrock crevices within stable zones of swift current with low amounts of fine sediment silt).

iii. Water and sediment quality necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages, including (but not limited to) dissolved oxygen (generally above 2 to 3 parts per million (ppm)), salinity (generally below 2 to 4 ppm), and temperature (generally below 86 °F (°F) (30° Celsius (°C)). Additionally, concentrations of contaminants, including (but not limited to), nitrate, copper, and chloride, are below acute toxicity levels for mussels.

iv. The presence and abundance of the mud puppy host.

USFWS does not monitor the status of the critical habitat but does track the status of habitat for the species, in general. Descriptions of the status of the salamander mussel habitat in Minnesota, Wisconsin, Indiana, Ohio, Michigan, New York, Pennsylvania, West Virginia, Kentucky, and Tennessee in the Status of the Species and Critical Habitat section, above, apply to the status of the stream habitat designated as critical habitat for the species. Degradation of the essential features of salamander mussel critical habitat reflect impacts from widespread changes in land use and altered hydrology prevalent throughout watersheds currently and historically occupied by the species. Impacts of altered river hydrology resulting from instream alterations (i.e., dams, channelization, dredging) include decreased habitat heterogeneity, substrate stability, and lack of connectivity (blocking host fish passage or isolation of mussels from host fish). Changes in land use, including increased urbanization and agriculture is known to contribute to decreased water quality through sedimentation and point and non-point source inputs of contaminants, both of which are identified as major contributors to mussel declines.

7.9 ENVIRONMENTAL BASELINE

Regulations implementing the Act (50 CFR 402.02) define the environmental baseline as the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline.

7.9.1 Status of the Species and Critical Habitat within the Action Area

7.9.1.1 Plants

7.9.1.1.1 American hart's-tongue fern

In the action area, the American hart's-tongue fern occurs in the eastern part of Michigan's Upper Peninsula. Heavy lake-effect snowfall is typical in this area and its insulation during winter may be important as a buffer against winter extremes. Individual plants grow on the lower parts of moss-covered boulders in areas "with limestone pavement and in boulder fields under hardwood canopy" (U.S. Fish and Wildlife Service 2019*a*).

Six of the twelve American hart's-tongue fern populations in Michigan intersect with the action area and none are among the five populations in the state with "High" abundance ranks. (Chris Mensing, USFWS, East Lansing, MI, pers. comm. 2023). Some of the populations in the action area, however, contain "a few hundred individuals with good estimated viability" and one occurs near a pipeline right-of-way (U.S. Fish and Wildlife Service 2019*a*; C. Mensing, pers. comm. 2023).

7.9.1.1.2 Dwarf lake iris
In the action area, dwarf lake iris occurs in Wisconsin and Michigan. Of the 80 known occurrences in Michigan, 24 are ranked A to B (excellent to good quality), with eight occurrences ranging more than 500 acres in extent. Several of Michigan's most extensive and highest quality occurrences lie on state-owned land. The A-ranked occurrence on Snake Island, lies partly in a dedicated state natural area and has scattered colonies extending over hundreds of acres. A population at Thompson's Harbor State Park is the largest occurrence documented globally, is ranked excellent quality, and is estimated to contain 50,000,000 stems. Significant parts of other large, A-ranked occurrences, including sites in Delta County and Mackinac County, also occur on state-owned land.

7.9.1.1.3 Eastern Prairie Fringed Orchid
A high majority of the eastern prairie fringed orchid's most viable populations occur in the action area. Nine of the twelve populations that USFWS found to be highly viable in 2019 occur in the action area – in Illinois (4), Michigan (1), and Wisconsin (4) (U.S. Fish and Wildlife Service 2020*a*). All but one of them is under private or public ownership with legally binding protection – the highly viable population in Michigan is only partly covered by legally binding protection (U.S. Fish and Wildlife Service 2020*a*). About two-thirds of moderately viable populations also occur in the action area – in Illinois, Wisconsin, Michigan, and Ohio.

USFWS (2020*a*) listed lack of management of the high quality wetlands on which eastern prairie fringed orchid relies, increased development, and spread of exotic species as the primary threats to the species. Prescribed fire provides significant benefit to the species as explained above in the section, **Status of the Species and Critical Habitat**, except perhaps during droughts. A lack of sufficient and appropriate management to control the successional state of eastern prairie fringed orchid habitats and invasive species are threats at both publicly and privately owned sites. Inadequate staff or funding may be the primary cause for lack of management (U.S. Fish and Wildlife Service 2020*a*).

7.9.1.1.4 Houghton's Goldenrod
The status of the Houghton's goldenrod in the action area is very similar to the status as described above in the **Status of the Species and Critical Habitat** section except some populations are outside of the action area. Almost three-quarters of the known occurrences in Michigan intersect the action area, occupying near-shoreline habitats along Lake Huron and Lake Michigan. These populations occur on the southern shoreline of Michigan's Upper Peninsula, the northern shoreline of northern Michigan, and on islands in each lake. The populations in Ontario – about 33 – the single population in New York, and 21 occurrences in Michigan are outside of the action area.

7.9.1.1.5 Leedy's Roseroot
In the action area, the species occurs only in Minnesota at four locations that are genetically distinct and separated by distances that likely place them on "separate evolutionary trajectories" (Olfelt 1998). Each population occurs on cliffside habitats into which water from upslope areas discharges. Sources of groundwater are often evident in nearby uplands as sinkholes. See **Status of the Species and Critical Habitat – Leedy's Roseroot**, above, for further information on the status of the species in the action area.

7.9.1.1.6 Northern Wild Monkshood
The following is adapted from U.S. Fish and Wildlife Service (2023*a*).

In the action area, northern wild monkshood occurs in southeast Wisconsin and east Ohio. In Wisconsin, six populations occur on protected lands (Wisconsin DNR, Kickapoo Valley Reserve, and the Mississippi Valley Conservancy), four are on unprotected private lands, and four are a combination of both. Of these, four populations appear to be declining, eight appear stable, and two have increased in size since the 1970s. Population declines have largely been attributed to flooding or rainstorm events that have affected the species' cliffside habitats. Both populations in Ohio – Crane Hollow and George Metro Park – occur on protected lands. Two of three subpopulations in the George Metro Park population have been extirpated, but the remaining subpopulation has increased from 11 to 156 plants as of 2020. The other population at Crane Hollow is relatively stable at approximately 75 plants (half of the historical population size), though the number of mature plants has declined significantly.

7.9.1.1.7 Pitcher's Thistle

In the action area, the Pitcher's thistle occurs predominantly in Michigan, including the upper peninsula. Additional populations occur in Wisconsin, Indiana, and Illinois. 193 occurrences of Pitcher's thistle intersect the action area. See **Status of the Species and Critical Habitat** above for additional information regarding the status of the species in the action area

7.9.1.1.8 Short's Bladderpod

The only population of Short's bladderpod in the action area occurs in Posey County, Indiana. This population, located in the Wabash-Ohio Bottomlands ecoregion, has apparently decreased in number from an estimated hundreds-to-thousands of plants in 1992 to a few hundred recorded plants in 2020. No plants were observed during site visits in 2018 and 2019, due to prolonged inundation of the site from the Wabash River in both years. The observation of a few hundred plants in 2020 marked the first time that more than 100 plants have been observed at this site since 2012 (U.S. Fish and Wildlife Service 2020*c*). The population occurs on lands managed by the Indiana Department of Natural Resources.

The population's existence could be an artifact of the soil conditions in the gravelly margins of the adjacent roadbed and the relatively open canopy conditions generated by road and powerline right-of-way maintenance, in contrast to surrounding forested habitat. Although the population may not have existed prior to anthropogenic alteration of habitat via road and powerline construction, the population has persisted and has numbered in the hundreds to more than a thousand individuals in the past. In addition, the population may contain unique genotypes important for the species' conservation (U.S. Fish and Wildlife Service 2020*c*).

7.9.1.1.9 Western Prairie Fringed Orchid

In the action area, populations of western prairie fringed orchid occur in remnants of native prairie in western Minnesota, occurring in the state from near its border with Iowa to its northern boundary with Manitoba. There is also one small population in the action area in southeastern Minnesota. Most populations in Minnesota occur on lands owned and managed by conservation agencies or organizations, including Minnesota Department of Natural Resources, The Nature Conservancy, National Park Service, and USFWS. These populations are typically well surveyed, monitored, and mapped – about 80% of populations are monitored each year in Minnesota (U.S. Fish and Wildlife Service 2021*b*).

The largest populations occur in northwest Minnesota and seem to be stable although abundance is lower than has been recorded historically. At least one large population occurs in southwestern Minnesota, with almost 2,000 plants recorded in 2012 (U.S. Fish and Wildlife Service 2021*b*).

7.9.1.2 Insects

7.9.1.2.1 Hine's Emerald Dragonfly

Most extant Hine's emerald populations, subpopulations, and occupied sites occur in the action area – 5, 22, and 56, respectively. Only one recognized population – comprised of five subpopulations distributed across 20 sites – occurs in Missouri outside of the action area.

Threats to the hydrologic integrity of Hine's emerald habitats, habitat fragmentation, contaminants, and invasive plants are the primary threats to Hine's emerald in the action area (U.S. Fish and Wildlife Service 2013*a*).

USFWS initiated captive rearing of Hine's emerald in 2015 to try to save the Lower Des Plaines River Valley population in Illinois. This population may be at the highest current risk of extirpation among the six extant populations in the Southern Recovery Unit. It occurs in proximity to rapid urban development that poses numerous threats. Release of captively-reared adults began in 2016.

7.9.1.2.2 Hungerford's Crawling Water Beetle

Seven of the eleven stream segments inhabited by Hungerford's crawling water beetle in Michigan intersect with the action area (M. Kane, pers. comm., USFWS, East Lansing, MI, 2023). These are included in the action area due to their proximity to U.S. Highways, an interstate highway, other highways, railroads, and a crude oil pipeline. See **Status of the Species and Critical Habitat** above for additional information regarding the status of the species in the action area.

7.9.1.2.3 Mitchell's Satyr

Among the ten populations in EPA Region 5 states, only three in Michigan and the one in Indiana intersect with the action area (K. Kelly, pers. comm., 2023). Among the three sites in Michigan, one in Berrien County is currently one of the three healthiest populations in Michigan and Indiana. No Mitchell's satyrs have been located at the Indiana site in 2-3 years (K. Kelly, pers. comm. 2023). None of the relatively numerous populations in Alabama and Mississippi occur in the action area.

7.9.1.2.4 Poweshiek Skipperling

The Poweshiek skipperling occurs at two sites in the action area. Both sites are in Michigan and are the last known sites occupied by the species in the U.S. We've described the species' status at those sites above in the section **Status of the Species and Critical Habitat**.

7.9.1.2.5 Rusty Patched Bumble Bee

Roughly one-third of the rusty patched bumble bee's current known distribution overlaps with the action area. The status of the rusty patched bumble bee in the action area can be summarized by describing the number and distribution of species records from 2007 or later and by reviewing polygons that depict modelled movements of the species away from the observation points.[1] We refer to these polygons as High Potential Zones (HPZ). There are 462 HPZs rangewide in the United States. Among

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[1] Choy, S., "RPBB_HPZModel_Update"; USFWS, 21 June 2023, https://www.arcgis.com/home/item.html?id=15b68d967aab4737981d172e8e25f78f.

these, 352 intersect the action area (Fig. 15). Many overlap only partially with the action area – about 33% of the surface area of all HPZs rangewide overlaps with the action area.

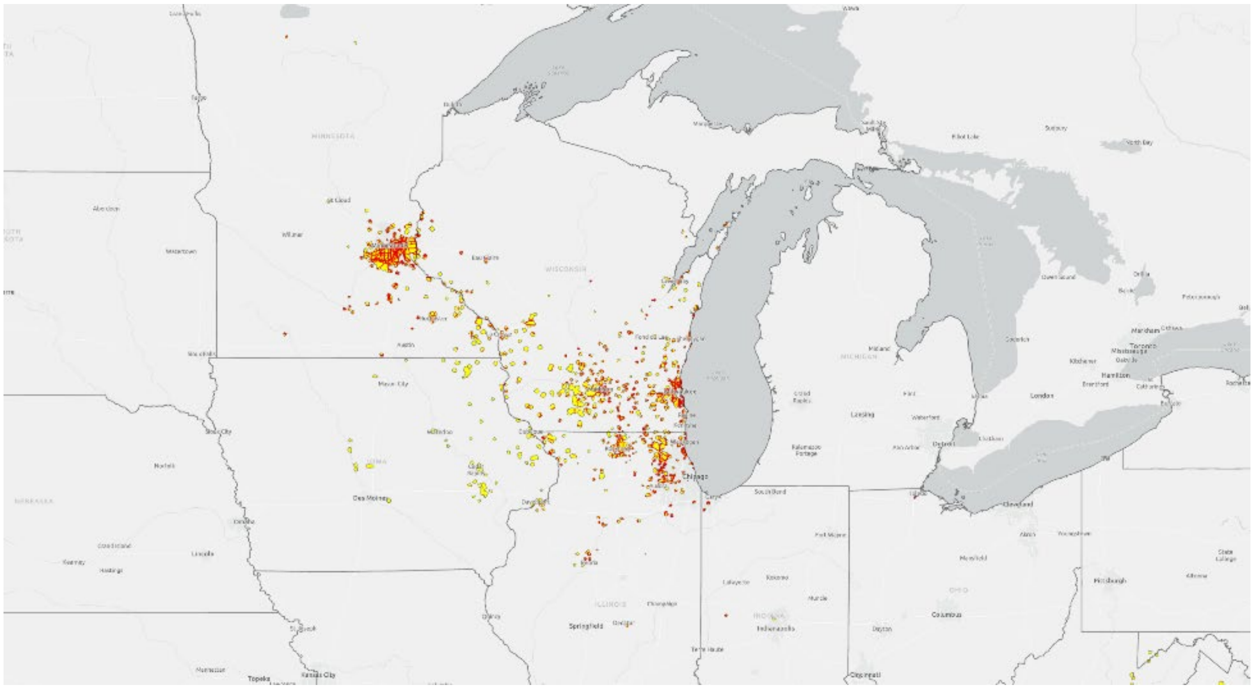

Figure 15. Rusty patched bumble bee High Potential Zones (yellow) and the areas where they overlap with the action area (red).

Rangewide threats to the rusty patched bumble bee described above in the section **Status of the Species and Critical Habitat** are also the predominant threats to the species survival and recovery in the action area. These include pathogens, pesticides, climate change, and non-native bees and managed bumble bees. In addition, the amount and quality of floral resources, nesting habitat, and overwintering habitat also influence population abundance and growth rate. Pesticides, pathogen loads, and poor nutrition could degrade the body condition of individual RPBBs to the extent that colonies are not sufficiently productive to maintain healthy populations.

7.9.1.3 Snails

7.9.1.3.1 Iowa Pleistocene Snail

The Iowa Pleistocene snail has been documented at 38 locations in Iowa and Illinois. However, most of these locations are outside of the action area, as only one is in Illinois (Jo Daviess County) (Fig. 12). Additionally, suitable IPS habitat (algific slopes) is found at an additional site in Illinois and nearby in Wisconsin, but evidence of IPS occupancy has not yet been established at these sites. The most recent survey effort for IPS (2014-2015) did not document any live IPS at the Illinois and Wisconsin sites, and relict IPS shells were found at the Illinois site with previous documentation of IPS presence (Yonkers Bluff) (U.S. Fish and Wildlife Service 2015*b*). However, IPS detection can vary widely temporally and spatially, and determining whether a site's IPS population is present or extirpated is very difficult (U.S. Fish and Wildlife Service 2020*e*). Both Illinois sites are protected by private easements.

7.9.1.4 Crustaceans

7.9.1.4.1 Illinois Cave Amphipod

The Illinois Cave Amphipod is known to be present in seven cave systems, extirpated in one, and unknown in the remaining eight (Table 2) (U.S. Fish and Wildlife Service 2020*f*). All sites are located within the action area.

Table 2. Illinois cave amphipod status and observations from monitoring between 1938 and 2014.

Sub-region	Groundwater Basin	Cave	Last Record	Last Survey	Status
Columbia	Stemler	Stemler	1965	2006	Extirpated
Renault	Fogelpole	Fogelpole	2008	2014	Unknown
Renault	Illinois Caverns	Illinois Caverns (Morrison's Cave)	2014	2014	Present
Renault	Krueger-Dry Run	Krueger-Dry Run	1999	2000	Unknown
Renault	Krueger-Dry Run	Spider	2014	2014	Present
Waterloo	Annbriar	Cedar Ridge	1998	1998	Unknown
Waterloo	Annbriar	Reverse Stream	2014	2014	Present
Waterloo	Annbriar	Triple Delight	2007	2007	Unknown
Waterloo	Annbriar	Wednesday	2011	2014	Unknown
Waterloo	Dual Spring	Snow White	2014	2014	Present
Waterloo	Frog Cave	Frog	2014	2014	Present
Waterloo	Luhr Spring	Pump House (Rick's Pit)	2014	2014	Present
Waterloo	Madonnaville	Madonnaville	1986	1998	Unknown
Waterloo	Pautler	Danes	2008	2008	Unknown
Waterloo	Pautler	Pautler (KCI)	2014	2014	Present
Waterloo	Pautler	Rose Hole	1999	1999	Unknown

7.9.1.5 Fishes

7.9.1.5.1 Topeka Shiner

The Topeka shiner inhabits 66 streams in Minnesota, some of which cross state boundaries into Iowa or South Dakota (Fig. 16, U.S. Fish and Wildlife Service 2018*a*). The occupied streams that interest the action area support Topeka shiners that are part of two distinct population complexes in the northern part of the species' range where the species has persisted despite threats occurring on the landscape.

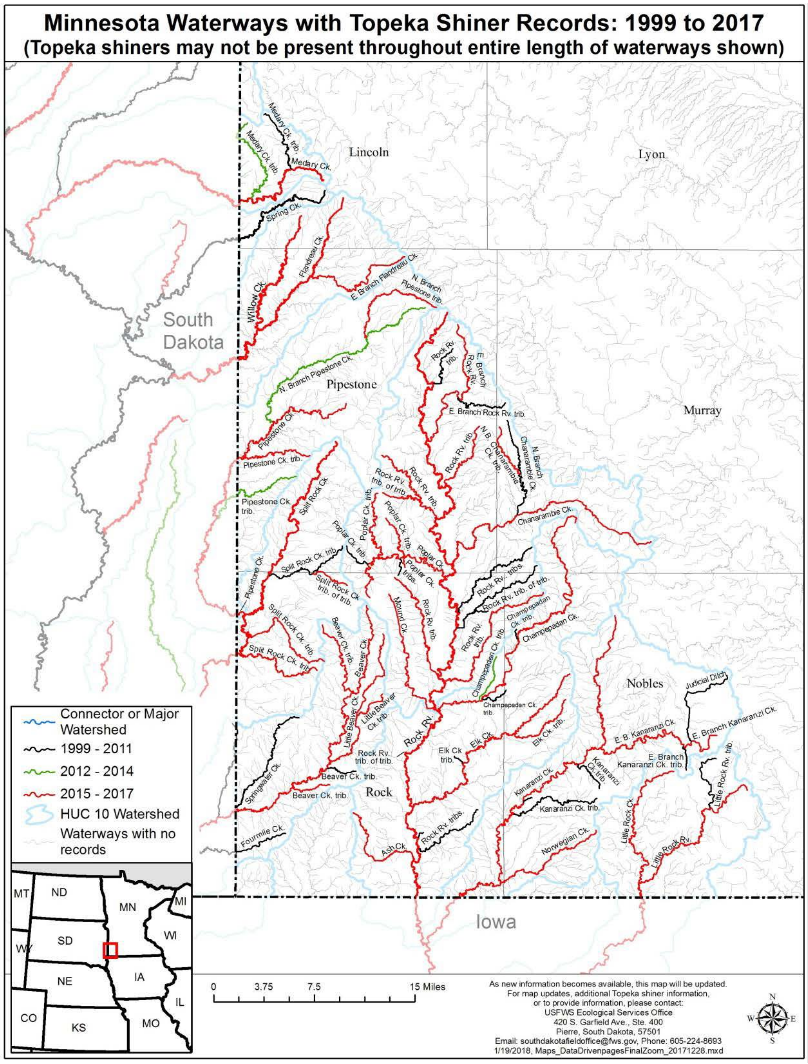

Figure 16. Minnesota streams with Topeka shiner records, 1999-2017.

The species frequently uses off-channel habitats associated with streams in the action area. These habitats remain suitable for the species if fine sediments are not too deep, *Lepomis* sunfish are present, groundwater input occurs, and predators are sparse absent.

Sampling conducted in Minnesota suggests that distribution and abundance of the Topeka shiner can fluctuate markedly over the span of 10-11 years. The proportion of sample sites at which the species was found declined from 90% in 2006 to a low of 30% in 2013. It increased again to 90% in 2016 before falling slightly to 60% in 2017. Similarly, the proportion of sites where the species' numbers was described as abundant or common fell sharply between 2010 and 2016 but increased in 2017 to resemble pre-2010 levels.

7.9.1.6 Freshwater Mussels

7.9.1.6.1 Clubshell

The status of the species in the action area is very similar to the status as described above except some populations are outside of the action area. The occupied streams that intersect the action area support populations in the Middle and Salt Fork Vermillion Rivers (IL), Tippecanoe River, Fish Creek (IN), W. Branch St. Joseph River (MI), Walhonding River, Big Darby and Little Darby Creeks (OH). Evidence of recent successful recruitment has been reported in the Tippecanoe River, Middle Branch of the North Fork Vermilion River, and Little Darby Creek. Populations in the East Fork of the West Branch St. Joseph River, Fish Creek, and Walhonding River appear to be comprised of adults and are considered in decline or possibly extirpated (U.S. Fish and Wildlife Service 2018*b*).

7.9.1.6.2 Fanshell

In the action area, small populations of the fanshell occur in discrete reaches of the Wabash River (IL, IN) White River, E. Fork White River (IN), Muskingum River, Walhonding River and Killbuck Creek (OH). The species is considered rare in the mainstem Wabash River with few live individuals observed since 1988. An extant reproducing population in the Tippecanoe River, however, may contribute individuals to the mainstem Wabash River. An additional, a small population occurs in the East Fork White River from Williams Dam to the confluence of the east and west forks of the White River and there are plans to augment this population beginning in 2024 (W. Tucker, pers. comm.).

Extant populations of the fanshell occur in the lower Muskingum River (Morgan County and Washington County, OH), where adults and juveniles have been observed. Additionally, in 2010 adult fanshells were stocked in this area, between Devola Dam and the confluence with the Ohio River.

The mainstem Ohio River has extant fanshell populations, including at the Belleville and Racine pools where stocking efforts have occurred following a chemical spill in 1999 that significantly impacted mussels (U.S. Fish and Wildlife Service 2019*e*).

7.9.1.6.3 Fat Pocketbook

In the action area, the fat pocketbook occurs in the Ohio River (IL, IN), Wabash River (IL, IN), Little Wabash River (IL), White River (IN) and East Fork White River (IN). The species' range has expanded over time to include nearly 160 miles of the Ohio River and 150 miles of the Wabash River. In these reaches the fat pocketbook has demonstrated viability and recruitment and is considered locally abundant where it occurs (U.S. Fish and Wildlife Service 2019*f*).

7.9.1.6.4 Higgins Eye

In the action area, the Higgins eye occurs in the upper Mississippi River between St. Paul, Minnesota, down to Iowa; in the St. Croix River between Wisconsin and Minnesota; the lower portions of the Wisconsin River, and the lower Rock River in Illinois. Historically, one of the most productive Higgins eye populations occurred at Prairie du Chien, Wisconsin, however, increases in zebra mussels at this location has resulted in declines of the species at this site. Reintroductions of the species have recently been conducted in the Chippewa River (WI) (U.S. Fish and Wildlife Service 2020*g*).

7.9.1.6.5 Longsolid
In the action area, remaining populations of the longsolid occur in the Ohio River (Gallapolis Pool, upper Greenup Pool), Tuscarawas River, Muskingum River, and the Walhonding River in Ohio. Historically, the longsolid occurred throughout a greater portion of the action area but is now considered extirpated in Indiana and Illinois and the Great Lakes. All populations in the action area are small with low overall viability (U.S. Fish and Wildlife Service 2022*d*).

7.9.1.6.6 Northern Riffleshell
The status of the northern riffleshell in the action area is similar to the status as described above in the section **Status of the Species and Critical Habitat** except some populations are outside of the action area. Occupied streams that intersect the action area are the Vermillion River (IL), Tippecanoe River (IN), Great Lakes (MI), Big Darby Creek, Scioto River, and Maumee River (OH). Several of these populations have been augmented by reintroductions from the Allegheny River in Pennsylvania (U.S. Fish and Wildlife Service 2019*g*).

7.9.1.6.7 Orangefoot Pimpleback
In the action area, one known population of the orangefoot pimpleback occurs in the Ohio River in the 34-mile stretch downstream of the Tennessee River confluence. It is considered extirpated in the lower Ohio river upstream of the Tennessee River confluence (U.S. Fish and Wildlife Service 2022*e*).

7.9.1.6.8 Pink Mucket
In the action area, two sub-populations of the pink mucket occur in the Ohio River. The upstream sub-population occurs between Ohio and West Virginia, and the downstream population occurs between Illinois and Kentucky near the confluence with the Mississippi River. The upstream population is known to occur in three lock and dam pools in the tailwaters where habitat is more consistent with free-flowing rivers. In the downstream population, the species is limited to the free-flowing stretch of the Ohio River below Smithland Lock and Dam (RM 918.7) to the confluence with the Mississippi River. These populations are highly susceptible to spills associated with industrial facilities or barges. Two major spills in the vicinity of the upstream sub-population of pink mucket in the action area have occurred within the past 20 years (U.S. Fish and Wildlife Service 2019*h*).

7.9.1.6.9 Purple Cat's Paw
In the action area, two populations of purple cat's paw occur in discrete locations: one in Killbuck Creek (OH) and a reintroduced population in the Walhonding River (OH). Due to the small size and restricted range of the Killbuck Creek and Walhonding River populations, this species is highly susceptible to stochastic events such as spills or releases from oil and gas wells which are prevalent in the Killbuck watershed (U.S. Fish and Wildlife Service 2020*h*).

7.9.1.6.10 Pyramid (Pink) Pigtoe
In the action area, the pink pigtoe is restricted to a two-mile river reach in the Muskingum River below Devola Dam, where only one individual has been observed since 2000. Historically, the species had a broader range within the action area, historically occurring in portions of Indiana, Illinois, Minnesota and Wisconsin. It is now considered extirpated from those states (U.S. Fish and Wildlife Service 2021*f*).

7.9.1.6.11 Rabbitsfoot

The status of the rabbitsfoot in the action area is like that described above in the section **Status of the Species and Critical Habitat** minus those populations outside of the action area. Extant populations that intersect the action area occur in the Ohio River (IL, IN, OH), the Wabash River (IL, IN), North Fork Vermilion River (IL), Tippecanoe River (IN), Eel River (IN), Fish Creek (IN, OH), Muskingum River (OH), Walhonding River (OH), Big and Little Darby Creeks (OH). Populations in the mainstem Ohio and the Tippecanoe rivers are considered stable. All other populations in the action area are in decline (U.S. Fish and Wildlife Service 2021*g*).

7.9.1.6.12 Rayed Bean

Of the 37 known rivers occupied by the rayed bean, 21 intersect the action area. These include the Black River, Mill Creek, Pine River, Belle River, Clinton River, and River Raisin in Michigan; the Auglaize River, Swan Creek, St. Joseph River, Fish Creek, Blanchard River, Tymochtee Creek, Olentangy River, Big Walnut Creek, Mill Creek, Big Darby Creek, Little Darby Creek, Great Miami River, and Stillwater River, L in Ohio; St. Joseph River, Fish Creek, Tippecanoe River, Lake Maxinkuckee, and Sugar Creek in Indiana.

The population in Swan Creek (OH) is considered robust, though it is restricted to a 5-mile stream reach. The rayed bean occurrence in the Blanchard River (OH) is considered one of the largest remaining populations range wide. Several populations of rayed bean within the action area have been detected by surveys that were part of pipeline repair or installation (U.S. Fish and Wildlife Service 2018*c*).

7.9.1.6.13 Rough Pigtoe

Only one recorded occurrence of the rough pigtoe intersects with the action area. A live individual was found in the East Fork of the White River during a dive survey in 1992. Subsequent surveys have not produced any new records and it is unknown whether the rough pigtoe still persists in Indiana (U.S. Fish and Wildlife Service 2021*h*).

7.9.1.6.14 Round Hickorynut

The round hickorynut occurs in 28 streams that intersect the action area across Indiana, Michigan, and Ohio, but is considered extirpated throughout Illinois. Occupied rivers that intersect the action area are; Pine, Belle, and Black Rivers (MI); Grand River, Mill Creek, Black River, Fish Creek, Ohio River (Willow Island Pool), Little Muskingum River, Killbuck Creek, Walhonding River, Mill Creek (Walhonding), Muskingum River, Wakatomika Creek, Symmes Creek, Federal Creek, Middle and East Branch Shade River, Alum Creek, Big Darby Creek, Walnut Creek, Big Walnut Creek, Middle Fork Salt Creek, Scioto River, and Rocky Fork Little Scioto River (OH); Tippecanoe River, Eel River, and Richland Creek (IN) (U.S. Fish and Wildlife Service 2019*i*).

7.9.1.6.15 Salamander Mussel

The status of the salamander mussel in the action area is like that described above except some populations are outside of the action area. There are 43 extant or presumed extant populations of salamander mussel that occur in the action area (nine in the Great Lakes Basin, 19 in the Ohio basin, and 15 in the upper Mississippi River basin) (U.S. Fish and Wildlife Service 2023*b*).

7.9.1.6.16 Scaleshell

There is only one record of a live scaleshell within the action area. The species was detected in the Illinois River in 2013 when the river was drawn down and mussels were easily observed. No additional records have resulted from subsequent surveys. Prior to 2013, it had not been observed in the Illinois River since the 1800's and was considered extirpated from all states east of the Mississippi River (U.S. Fish and Wildlife Service 2021*i*).

7.9.1.6.17 Sheepnose

In the action area, the sheepnose occur in streams across portions of Minnesota, Wisconsin, Illinois, Ohio, and Indiana. It occurs in discrete locations in the Mississippi River (IL, WI, MN), including in Pools 4-5, 7, 11, and 14-17. It also occurs in the Kankakee, Rock, and Ohio Rivers (IL, IN, OH). Records within the Rock River are limited to the collection of one individual in 2007, approximately two miles southwest of Como, Illinois (J. Tiemann, pers. comm. 2011; J. Kath, pers. comm. 2019). This is the only known collection of sheepnose from the Rock River in approximately 60 years. It is assumed this population may be approaching extirpation. The Kankakee River populations is thought to be restricted to the reach downstream of Kankakee, Illinois (Will County) and upstream of the dam in Wilmington Illinois.

Populations in Ohio occur in the Ohio, Muskingum, and Walhonding Rivers. The Muskingum population is limited to the 10-20 miles between the Ohio River confluence and the Beverly Dam. The Walhonding populations is restricted to a 5-10 mile reach near Six Mile Dam.

Wisconsin populations occur in the Chippewa, Flambeau, and Wisconsin Rivers. The Flambeau River population is located below the lowest dam near the river confluence. Chippewa River populations occur from the Mississippi River confluence to Eau Claire, WI and upstream of Holcombe Flowage. There are two extant populations in the Wisconsin River which occur downstream of RM 133.7. The Castle Rock population occurs downstream of Portage, WI where sheepnose was last collected in 2017. The Lower Wisconsin population extends downstream from Portage, WI to the confluence with the Mississippi River. Sheepnose were last collected from the Lower Wisconsin population in 2016. In Indiana, sheepnose occur in two segments of the Tippecanoe River, upstream and downstream of the Lake Freeman impoundment. The species historically occurred in the lower mainstem of Eel River (IN), but individuals have not been observed in over 20 years (U.S. Fish and Wildlife Service 2022*g*).

7.9.1.6.18 Snuffbox

The status of the snuffbox in the action area is like that described above in the section **Status of the Species and Critical Habitat** except some populations are outside of the action area. Occupied streams within the action area occur in one stream in Illinois, six streams in Indiana, fourteen streams in Michigan, two in Minnesota, 10 in Ohio, and three in Wisconsin (U.S. Fish and Wildlife Service 2022*h*).

7.9.1.6.19 Spectaclecase

In the action area, the spectaclecase occur in the Mississippi River (IL, MN, WI), the St. Croix River (MN, WI) and the Ohio River (IL). Extant populations that intersect the action area include the St. Croix River, Rush-Vermilion River, Buffalo-Whitewater River, Lower Chippewa River, Flint Henderson River, Rock River, Sny River, Peruque-Piasa, lower Illinois – Lake Chautauqua, and Cahokia-Joachim in the Upper Mississippi River Basin and the Muskingum River and the lower Ohio River in the Ohio River basin (U.S. Fish and Wildlife Service 2022*i*).

7.9.1.6.20 White Catspaw

The only potentially remaining populations of white catspaw occurs with the action area. The last live individual observed was in a 3-mile stretch of Fish Creek in northwest Ohio in 1999 (U.S. Fish and Wildlife Service 2021*j*).

7.9.1.6.21 Winged Mapleleaf

In the action area, the winged mapleleaf occurs in a discrete location within a 6-mile reach of the St. Croix River between Interstate State Park and Franconia, Minnesota. Survey data and use of this population in programs to headstart juvenile mussels for reintroduction toother rivers indicate this population is recruiting. In addition, an estimated 400 individuals were discovered near Hudson, Wisconsin where individuals from a propagation study were inadvertently released (U.S. Fish and Wildlife Service 2015*a*). Winged mapleleaf were introduced in the Chippewa River near Meridean, WI and in the Mississippi River near Ft. Snelling, MN in 2017.

7.9.1.7 Critical Habitat

7.9.1.7.1 Short's Bladderpod Critical Habitat

Only one of the 20 units designated as critical habitat for Short's bladderpod occurs in the action area. Unit 20 (Bonebank Road) consists of 4.3 ac (1.7 ha) in Posey County, Indiana, and is owned and managed by the Indiana Department of Natural Resources. This unit parallels a local road for approximately 0.45 miles (0.73 kilometers) and supports the PCE of forest vegetation with canopy openings. The soils in this unit are much different than those from other units. The primary threats in this unit are shading and competition due to encroachment of native and invasive, nonnative plants. This unit is managed to maintain the population by removing vegetation competition through mechanical scraping (Indiana Department of Natural Resources 2022).

7.9.1.7.2 Hine's Emerald Dragonfly Critical Habitat

Of the 37 units designated as critical habitat for the Hine's emerald, 19 intersect with the action area – seven in Illinois, five in Michigan, and seven in Wisconsin. We are not aware of data collected with the primary intent of assessing the status of the critical habitat, but threats to Hine's emerald habitat, in general, are also relevant to the critical habitat in the action area. Those include threats to hydrologic integrity, habitat fragmentation, contaminants, and invasive plants (U.S. Fish and Wildlife Service 2013*a*). As mentioned above in the discussion of the Lower Des Plaines River Valley population in Illinois, Hine's emerald habitats in this area may be among the most threatened by urban development. Among the 19 critical habitat units that intersect the action area, six are along the Des Plaines River.

7.9.1.7.3 Topeka Shiner Critical Habitat

Only a small portion of Topeka shiner critical habitat overlaps with the action area. Although critical habitat includes off-channel pools, its extent is measured in stream miles. As stated above, all the critical habitat together includes 1,356 stream km (836 steam miles). Of that, only about 9% intersects with the action area – all in Minnesota.

The status of the Topeka shiner critical habitat in the action area is like its status rangewide, as described in section 5.2.1 **Status of the Species and Critical Habitat within the Action Area**, above. The same historical watershed alterations described in that section have affected the critical habitat in Minnesota.

7.9.1.7.4 Poweshiek Skipperling Critical Habitat

Twelve of the 58 Poweshiek skipperling critical habitat units intersect the action area. This includes one in northwestern Iowa; four in southeastern Michigan six in western Minnesota; and one in southeastern Wisconsin (Table 3). These sites are widespread, with about 1,000 miles separating the sites in northwestern Minnesota from the sites in Michigan. Whereas the sites in Iowa and Minnesota consist primarily of tallgrass prairie, the sites in Michigan are prairie fens.

Table 3. Poweshiek skipperling critical habitat units that overlap with the action area.

State	State Unit Number	Total Extent of Unit (Acres)	Extent of Unit in Action Area (Acres)	Percentage of Unit in Action Area	Infrastructure Near Unit
Iowa	5	75	9	12	Rail
Michigan	2	66	42	64	Interstate highway
Michigan	3	394	388	98	Rail, crude oil pipeline
Michigan	4	256	222	87	Rail, crude oil pipeline
Michigan	5	23	1	4	State highway
Minnesota	4	2351	46	2	Rail, U.S. highway
Minnesota	7	1330	851	64	Rail, U.S. highway
Minnesota	8	321	321	100	Rail, state highway
Minnesota	13	765	100	13	U.S. highway
Minnesota	17	431	216	50	State highway
Minnesota	20	2751	33	1	State highway
Wisconsin	1	1535	288	19	State highway

In Michigan, prairie fens designated as critical habitat provide the last known refugia for the Poweshiek skipperling in the U.S. and face a variety of significant threats. These include invasive plants, loss and degradations of key disturbance regimes like fire and essential hydrological conditions, loss of connectivity, salt and agricultural runoff, leaking septic fields, groundwater pollution, and climate change (Derosier et al. 2015).

All critical habitat units are likely to support all or most of the PCEs and include a predominance of high-quality remnant tallgrass prairie or prairie fen habitat. The final critical habitat rule contains only scant information on the status of the individual units. Minnesota Unit 13 also contains some “lesser quality” habitat intended to support dispersal of Poweshiek skipperlings (U.S. Fish and Wildlife Service 2015*c*). This unit is partly owned by The Nature Conservancy and partly under private ownership. TNC is also owns land in Minnesota Unit 4, which also includes state-owned land. Minnesota Unit 7 also includes a mix of state- and TNC ownership. Iowa Unit 5 is entirely contained within a railroad right-of-way and is included in the action area due to its extension a short distance into Iowa across its border with Minnesota along the rail line.

Prairie and prairie fen habitats are disturbance-dependent systems that require fire or careful grazing or haying to maintain the features essential to their role in supporting the conservation of the Poweshiek skipperling. These habitats are generally threatened by invasive species and require human intervention to ensure that the abundance and diversity of native plant communities remain intact or are restored.

Minnesota Department of Natural Resources cites several significant threats to prairie in its state, including climate change – warmer temperatures, increased evapotranspiration rates, and periods of drought – invasive species, agricultural expansion, and altered hydrology (Minnesota Department of Natural Resources 2016).

7.9.1.7.5 Rabbitsfoot Critical Habitat

Portions of several streams designated as critical habitat for rabbitsfoot overlap with the action area. In Illinois, this includes portions of the North Fork and Middle Branch North Fork Vermillion Rivers; in Indiana this includes portions of the Tippecanoe River; and in Ohio, this includes portions of Fish Creek, Little Darby Creek and the Walhonding River. Threats to rabbitsfoot critical habitat in the action area are assumed to be the same as threats to its habitat throughout its range. These include impoundments, channelization, sedimentation, chemical contaminants, mining, oil and natural gas development, invasive species, as well as altered temperature regimes.

7.9.1.7.6 Round Hickorynut Critical Habitat

Two streams designated as critical habitat for round hickorynut overlap with the action area: the Tippecanoe River in Indiana and the Grand River in Ohio. Threats to round hickorynut critical habitat in the action area are assumed to be the same as threats to its habitat throughout its range. Threats include habitat degradation (i.e., land use and development, water quality/quantity, sedimentation, contaminants, impoundments, resource extraction), invasive and nonnative species (i.e., Asian clam (*Corbicula fluminea*), zebra mussels (*Dreissena polymorpha*), quagga mussels (*Dreissena bugensis*), black carp (*Mylopharyngodon piceus*), didymo (*Didymosphenia geminata*), and hydrilla (*Hydrilla verticillata*), and effects associated with small population size, impoundments, channelization, sedimentation, chemical contaminants, mining, oil and natural gas development, and invasive species.

7.9.1.7.7 Salamander Mussel Critical Habitat

Twenty-six of the 37 of the proposed salamander mussel critical habitat units intersect the action area (Table 4). Critical habitat units in West Virginia and Kentucky only overlap at the downstream most portion of the stream where they overlap at the confluence of the Ohio River. Threats to salamander mussel critical habitat in the action area are assumed to be the same as threats to its habitat throughout its range. Threats include contaminants, hydrological regime, landscape alteration, lack of connectivity, invasive species, and host vulnerability.

Table 4. Proposed salamander mussel critical habitat units in the action area. Note that only small portions of critical habitat units that are outside of the six EPA Region 5 states overlap with the action area where they abut those states.

State	State Unit Number	Stream/River Name
Minnesota, Wisconsin	1	St. Croix River
Wisconsin	2	Chippewa River
Wisconsin	3	Eau Claire River
Wisconsin	4	Black River
Wisconsin	5	Wisconsin River North
Wisconsin	6	North Branch Pensaukee River
Wisconsin	7	Lemonweir River
Wisconsin	8	Wisconsin River South
Indiana	9	Big Pine Creek
Indiana	10	Middle Fork Wildcat Creek
Indiana	11	Tippecanoe River
Indiana, Ohio	12	Fish Creek
Ohio	13	Blanchard River
Michigan	14	Clinton River
Michigan	15	Mill Creek
Ohio	17	Conneaut Creek
West Virginia	20, 21, 22,23	Fish Creek, Fishing Creek, Middle Island Creek, Little Kanawha River
Kentucky	25, 27	Kinniconick Creek, Licking River
Indiana	30	Laughery Creek
Indiana	31	Otter Creek
Indiana	32	Graham Creek
Indiana	33	East Fork White River

8 EFFECTS OF THE ACTION

8.1 WHAT ARE EFFECTS OF THE ACTION?

In accordance with 50 CFR 402.02, effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of all other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see §402.17).

8.2 CONSERVATION MEASURES, BEST MANAGEMENT PRACTICES, AND EFFECTS OF RESPONSE ACTIVITIES

The development and application of conservation measures (CM) and BMPs are critical in determining how spill responses may affect listed species and critical habitats. Development of effective CMs and BMPs relies on a thorough and up-to-date understanding of where each species and critical habitat occurs, an analysis of how species and critical habitats could be exposed to stressors generated by response activities, and how they are likely to respond to those stressors when exposed.

The action agencies worked to ensure that USFWS staff were involved closely in the development of the BE. With USFWS involvement, the agencies strove to analyze the spill response activities thoroughly and to identify and articulate CMs and BMPs that would "ensure that FOSCs, regional responders, and planners appropriately account for significant sensitivities of the species and critical habitats" (BE, p. 65).

8.3 WILL RESPONDERS KNOW WHEN LISTED SPECIES OR CRITICAL HABITAT ARE PRESENT?

Our analysis assumes that responders will know when whether listed or proposed species or critical habitat are likely to be present in areas affected by spill responses. When a spill occurs, USFWS is notified directly and is given information regarding response actions within 24 hours of their initiation (BE, p. 20). It's then incumbent on USFWS to provide information regarding presence of listed species and any critical habitats in the action area and to provide or confirm CMs and BMPs needed to avoid or minimize effects.

USFWS involvement early in the response process is essential to ensure conservation of the species and critical habitats. Without it, spill responders may not be aware of CMs and BMPs that could be incorporated into spill responses. Clear communication of appropriate measures to avoid or minimize adverse effects to listed species and critical habitats is critical.

Whether responders are aware of the presence of species and critical habitat seems to rely on multiple factors –

1. Are listed species and critical habitat locations completely and accurately reflected in ACPs?

2. In the absence of an ACP for the response area, are the locations of listed species and critical habitats provided to the FOSCs and responders quickly enough for them to identify and implement appropriate BMPs to avoid or minimize adverse effects?

USCG and EPA describe the general ways in which each specific response action could affect listed species or critical habitats in section 2.2 of the BE ("Primary Response Actions"). In that section, the agencies also list the habitats in the action area where each activity is most likely to occur and other "Vulnerable Habitats" that may be affected be each activity.

8.4 Importance of Interagency Cooperation to Prioritize and Develop Spill Response Plans

The development of species-specific or site-specific spill response plans may be critical to ensure that spill response activities do not have a significant or irreversible impact on the status of listed species and critical habitat. The action agencies recognized this by adding spill response planning as a BMP in each species account in Appendix H of the BE.

Site- or geography-specific response plans cannot be developed for all species and critical habitats at once and so prioritization is needed. This analysis of effects has been helpful in suggesting a prioritization of species for such plans. Additional coordination will be necessary between the action agencies and USFWS to identify the specific areas where these geographic response plans should be conducted.

8.5 Effects to Species and Critical Habitats

Effects of spill responses on species and critical habitats will rely largely on the ability of spill responders, USFWS, and other conservation agencies to communicate the precise locations of listed species or critical habitat features promptly and effectively in or near the response area. Preparation to ensure that this coordination and communication takes place is reflected in various stages and aspects of the RRT spill response program.

8.5.1 Plants

As described above for species and critical habitats, in general, effects of spill responses on listed plant species will rely largely on the ability of spill responders, USFWS, and other conservation agencies to coordinate quickly and effectively to ensure that responders understand where the species is – or may be – present in the response area.

8.5.1.1 American Hart's-tongue Fern

Adverse effects to American Hart's-tongue fern could occur if response activities are carried out in or near one of the six locations where the species inhabits upland forest in the action area (U.S. Fish and Wildlife Service 2019*a*). During informal consultation, the action agencies and USFWS found that mechanical removal and cleaning, including sand blasting, might be needed to remove spilled material in or near areas inhabited by the species.

In addition to direct exposure to the cleaning activities, adverse effects could occur if the activities modified the species' cool-moist habitats by reducing tree coverage or by facilitating invasion of open understories. In Michigan, invasive plant species may only threaten American Hart's-tongue fern populations when they “originate from disturbances in or immediately adjacent to the populations” (U.S. Fish and Wildlife Service 2019*a*).

Effective implementation of the general BMPs listed on p. 62 of the BE rely on the accurate placement of protective buffer zones that would avoid or minimize effects to the species. This in turn would rely on timely communication with the USFWS field office in Michigan. When notified of a spill response that may affect American Hart’s-tongue fern, USFWS will review the species’ known locations and as needed, coordinate with Michigan Natural Features Inventory, the U.S. Forest Service, and other landowners to ensure accuracy of information about species’ locations in the action area and to help ensure appropriate and effective siting of buffer areas for spill responders.

Although spill responses could cause adverse effects locally to American Hart’s-tongue fern, appreciable effects on the species’ numbers, reproduction, or distribution rangewide are not likely. We expect that interagency coordination will help to avoid or minimize effects if a spill response is needed in or near one of the six populations in the action area. In addition, all the populations with the highest occurrence ranks in Michigan occur outside of the action area and there are additional populations in the U.S. in New York, Tennessee, and Alabama – and 112 populations in Canada.

8.5.1.2 Dwarf Lake Iris

Adverse effects are likely to occur if dikes or berms are constructed in response to a spill in a shoreline area where dwarf lake iris is present. Plants could be crushed or buried, and the species’ habitat could be altered. Populations of dwarf lake iris that occur in upland areas away from current shorelines are unlikely to be adversely affected.

If a spill response were needed where dwarf lake iris may be present, the USFWS Michigan ESFO would refer to Michigan Natural Features Inventory data to determine the locations of any vulnerable populations to help with site-specific conservation measures as needed.

We do not anticipate that the spill response program is likely to appreciably reduce the dwarf lake iris’s numbers, reproduction, or distribution. Although present predominantly in Great Lakes shoreline areas where spills are possible, the species is distributed broadly enough that adverse effects would likely affect the species only locally. Moreover, we anticipate that coordination between USFWS and spill responders will be instrumental in avoiding or minimizing any effects to the species. Agencies of the State of Michigan are also likely to play an instrumental role in ensuring protective measures during responses, especially if any of the populations on state lands may be affected. As stated above, several of Michigan’s most extensive and highest quality occurrences lie on state land.

8.5.1.3 *Eastern Prairie Fringed Orchid*

Construction and deconstruction of dikes or berms would be likely to adversely affect eastern prairie fringed orchid if carried out in or near the species’ habitat. Effects would depend on the type of equipment used, the ramifications of any necessary excavation, the details of the construction, and the location and extent of access needed for equipment and machinery. Effects could occur after spill response has ended if the activities introduce seeds or other propagules of invasive species or exacerbate threats from any invasive species already present.

If a spill occurs in or near occupied eastern prairie fringed orchid habitat adverse effects may be difficult to avoid but interagency coordination is likely to minimize effects. As spill responses are planned and carried out, USFWS and other resource agencies will work to ensure responders are aware of any eastern prairie fringed orchid habitats in the area. In addition, the action agencies would consider the types of equipment that will be used, potential ramifications of digging, building, and access activities, and procedures to minimize the spread of invasive species and establish buffer zones with concurrence of USFWS. In addition, the action agencies have committed to ensuring that construction, deconstruction, and removal plans are in place and are scheduled and implemented in a way to eliminate or minimize impacts to eastern prairie fringed orchid.

Coordination will be especially important if a spill occurs at or near a site inhabited by one of the highly viable populations. There currently appear to be eight highly viable populations that overlap with the action area. USFWS will work with the action agencies to prioritize these sites for the development of site-specific spill response plans. The agencies may also identify other sites ranked as moderately viable for development of spill response plans. Absent these site-specific spill response plans, establishment of appropriate and effective buffer zones will depend on prompt and effective coordination with USFWS, state or local conservation agencies, or landowners.

Effective coordination is likely be most effective at sites that are protected and managed by public conservation agencies or private conservation organizations. For the highly viable populations that intersect with the action area this is typical and may decrease the odds that ineffective coordination with spill responders or knowledge of species locations would exacerbate effects to the species. Site-specific spill response plans for these sites are still necessary to further ensure spill responders have access to critical information regarding the species before implementing potentially harmful response activities.

The action agencies' spill response program in EPA Region 5 is not likely to reduce appreciably the numbers, reproduction, or distribution of the eastern prairie fringed orchid rangewide. The likelihood of spills affecting any eastern prairie fringed orchid is not precisely understood, but the proposal to develop site-specific spill response plans, the agency and organization resources that would likely come be bear in the event of a spill at highly viable sites, and the number of populations outside of the action area help to minimize potential for effects to the species. The greatest risk to the species would be if one or more spills occurred where response activities could adversely affect one of the eight highly viable populations that intersect with the action area. There are also about 19 moderately viable populations that intersect the action area. Protection of these populations is paramount due to their importance to the species' recovery and due to their potential to become highly viable, respectively.

8.5.1.4 Houghton's goldenrod

Adverse effects are likely to occur to Houghton's goldenrod if dikes or berms are constructed in response to a spill in beach flats, dunes, and interdunal wetlands where the species is present. Plants could be crushed or buried, and the species' habitat could be altered.

If a spill response was needed in or near a Houghton's goldenrod occurrence, the USFWS Michigan ESFO would likely refer to Michigan Natural Features Inventory data to determine the locations of any vulnerable populations to help with site-specific conservation measures as needed. To the extent feasible during the response, the action agencies would then consider the following to help identify potential impacts of dikes and berms to the species and potential conservation measures.

- What types of equipment will be used to build the dikes or berms?
- What are the digging and building and access ramifications?
- How will equipment (e.g., heavy machinery) be disinfected to prevent the spread of invasive species, particularly if the equipment is being transported to or from a different watershed?

The action agencies' spill response program is not likely to appreciably reduce the rangewide numbers, reproduction, or distribution of the Houghton's goldenrod. The action agencies will coordinate with USFWS before and during any spill response, consider certain key aspects of each activity that could affect the species, and put in place BMPs to avoid or minimize effects to the species. Spill responses are unlikely to be widespread in the action area. Although present predominantly near and along Great Lakes shorelines, the Houghton goldenrod is distributed broadly enough that adverse effects would likely affect only a small proportion of the species' known occurrences.

8.5.1.5 Leedy's Roseroot

Like American Hart's-tongue fern, adverse effects could occur to Leedy's roseroot if responders carried out mechanical cleaning or removal of oil, oiled sediment, debris, or vegetation in, near, or upslope of where the species is present. Potential effects of response activities would depend on the degree of oiling, equipment used for cleaning or removal, access to the site and whether access would need to be constructed, and measures taken to prevent spread of invasive species. Adverse effects to Leedy's roseroot may also occur if spill response upslope of the species affects groundwater discharge along the species' cliffside habitats. Activities that pollute or alter the pattern of groundwater discharge into Leedy's roseroot habitats could adversely affect the species due to its apparent affinity for seepage areas along cliffs.

The species typically occurs along cliffs in the action area and extant populations are well mapped. Therefore, we anticipate that adverse effects will be avoided or minimized by the coordination that we anticipate between the Minnesota-Wisconsin ESFO and spill responders. Minnesota Department of Natural Resources (DNR) will likely also play a key role in helping to ensure that response activities would appropriately consider locations and potential threats of response activities to the species, especially at the state-owned Whitewater Wildlife Management Area.

The spill response program is not likely to appreciably reduce Leedy's roseroot numbers, reproduction, or distribution. In the unlikely event of a spill response that could affect one of the four populations in the action area, adverse effects are likely to be avoided or minimized by effective interagency coordination and buffered by the occurrence of significant numbers of the species outside of the action area, especially in New York. Leedy's roseroot populations in the action area are not typically near roads, railroads, or other infrastructure. The greatest concern may be the potential for effects to the quantity or quality of groundwater inputs if, for example, response activities affected sinkholes that may be more likely to be affected directly. Coordination between USFWS, Minnesota DNR, and responding agencies, however, will likely help to avoid or minimize those effects.

8.5.1.6 Northern Wild Monkshood

Adverse effects may occur to northern wild monkshood if responders carry out mechanical cleaning or removal of oil, oiled sediment, debris, or vegetation in upland areas where the species is present. In upland areas, this species typically occurs on partially to wholly shaded cliffs and algific (cold air producing) talus slopes characterized by cool air, soil, and groundwater temperatures. In addition to direct exposure to the cleaning or removal activities, adverse effects could also occur indirectly if the activities modify the species' cool-moist habitats by negatively affecting the ice vents in algific slopes, or if the activities result in increased erosion of cliffs by tree removal.

Adverse effects to northern wild monkshood may be avoided or minimized by implementing the proposed BMPs. Locations of populations are well known due to extensive surveys on the scarce habitat types where northern wild monkshood occurs. Coordination with the Minnesota-Wisconsin or Ohio ESFO will facilitate the placement of appropriate buffer zones and equipment or material siting locations such that known occurrences are avoided.

As a result, we find that the spill response program is not likely to appreciably reduce the northern wild monkshood's numbers, reproduction, or distribution. In addition to the BMPs, the disjunct distribution of northern wild monkshood affords the species some resilience to the effects of individual spills. Should a population be adversely affected by a spill, most other populations would remain unaffected in the action area. Additional populations exist outside of the action area as well. Interagency coordination to implement BMPs will minimize adverse effects if a spill response does affect the species in the action area. Although the species would be vulnerable in some areas to the effects of a spill response, it is unlikely that response efforts would be extensive enough to have an appreciable effect on the species' overall numbers, reproduction, or distribution.

8.5.1.7 Pitcher's Thistle

Adverse effects are likely to occur if dikes or berms are constructed in response to a spill in a shoreline area where Pitcher's thistle is present. Plants could be crushed, uprooted, or buried and the species' habitat could be altered. Populations of Pitcher's thistle that occur in upland areas away from current shorelines are unlikely to be adversely affected.

If a spill response were needed where Pitcher's thistle may be present, the USFWS ESFO (Michigan, Indiana, Minnesota-Wisconsin, or Illinois-Iowa) would refer to state natural heritage databases (such as the Michigan Natural Features Inventory) to determine the locations of any vulnerable populations to help with site-specific conservation measures as needed.

We do not anticipate that the spill response program is likely to appreciably reduce the Pitcher's thistle's reproduction, numbers, or distribution. Although present predominantly in Great Lakes shoreline areas where spills are possible, the species is distributed broadly enough that adverse effects would likely have only local effects to the species. Moreover, we anticipate that coordination between USFWS and spill responders will be instrumental in avoiding or minimizing any local effects to the species. State agencies are also likely to play an instrumental role in ensuring protective measures are implemented during responses, especially if any of the populations on state lands may be affected.

8.5.1.8 Short's bladderpod

Adverse effects may occur to Short's bladderpod if responders carry out sandblasting, and mechanical and manual cleaning or removal of oil, oiled sediment, debris, or vegetation in upland areas where the species is present. This species typically occurs on steep, rocky, wooded slopes and talus areas on south- to west-facing slopes near rivers or streams, and along tops, bases, and ledges of bluffs. In the action area, however, this species occurs within forested habitat alongside a road right-of-way near the confluence of the Wabash and Ohio rivers. In addition to direct exposure to the cleaning or removal activities, adverse effects could also occur if the activities disrupt the seedbank within the occupied area.

Adverse effects to Short's bladderpod may be avoided or minimized by implementing the proposed BMPs. The population location is well established due to its singular occurrence and ease of access. Coordination with the Indiana ESFO will facilitate the placement of appropriate buffer zones and equipment or material siting locations so that the known occurrence can be avoided.

The spill response program is not likely to appreciably reduce the Short's bladderpod's numbers, reproduction, or distribution. In addition to the BMPs, the broad distribution of populations outside of the action area affords the species some resilience to the effects of individual spills and related response activities. The population in Indiana likely contains unique genotypes that are important to the conservation of the species. As such, adverse effects to the Indiana population could have long-term impacts to the overall recovery of the species. Despite this, it is unlikely that response efforts would be extensive enough to have an appreciable effect on the species' overall numbers, reproduction, or distribution. Interagency coordination to implement BMPs will minimize adverse effects if a spill response does affect the species in the action area. Indiana state agencies are also likely to play an instrumental role in ensuring protective measures are implemented during responses, as the lone population in the action area occurs on Indiana DNR lands.

8.5.1.9 Western Prairie Fringed Orchid

The placement and removal of dikes or berms in wetlands could adversely affect western prairie fringed orchids by crushing or burying plants or by degrading habitat conditions, but these effects may be avoided or minimized by implementation of BMPs. Most populations in the action area occur in low-lying areas that sometimes contain standing water where they could be especially vulnerable to the effects of response activities. Impacts to the species may depend primarily on the types of equipment that would be used to build dikes or berms, their location relative to western prairie fringed orchid plants, effects to surface and subsurface hydrology, the extent of any excavation or access construction, and efforts to mitigate the potential for spread of invasive species by equipment.

Spill responders may avoid or minimize adverse effects to western prairie fringed orchid by implementing the proposed BMPs, which includes coordination with USFWS. We expect spill responders to have ready access to key personnel to provide up-to-date and accurate information on species occurrences in or near the spill area. This is likely to occur via coordination with USFWS and other land management agencies such as Minnesota DNR, and The Nature Conservancy (TNC). Access to key information and coordination with agency or TNC staff is likely to facilitate the establishment of appropriate buffer zones when placing dikes or berms near known occurrences and when removing the structures.

We do not anticipate that the spill response program is likely to appreciably reduce the western prairie fringed orchid's numbers, reproduction, or distribution. In addition to interagency coordination during responses and implementation of buffers and other BMPs, the wide distribution of western prairie fringed orchid populations and of its pollinators affords the species some resilience from local effects of one or a few individual spills. A substantial number of populations occur outside of the action area and would be unaffected by the spill response program.

8.5.2 Insects

8.5.2.1 Hine's Emerald Dragonfly

In the event of a spill in or near one of the approximately 56 sites occupied by Hine's emerald in the action area, adverse effects to the species would be likely if the response included construction of barriers, pits, and trenches or manual removal or cleaning of oil, sediment, debris, or vegetation. In addition to the potential for direct impacts, like crushing, these activities could affect the species indirectly by changing hydrology of Hine's emerald habitats or by destroying rivulets, small channels, or sheet flow within wetlands that the species inhabits (E. Karecki, USFWS, Chicago, IL, pers. comm. 2023). The nature of the effects would rely in part on the timing of the spill, the intensity of the response, and the degree to which essential information regarding Hine's emerald and its habitat is communicated to spill responders.

If barriers, pits, or trenches were required to minimize environmental effects of a spill in or near Hine's emerald habitats, the action agencies would likely consider numerous factors. These are likely to include the equipment, material, tools, and number of personnel that would be used during construction; how construction material will be disposed of; and what means should be used to disinfect equipment to prevent spread of invasive species into Hine's emerald habitats.

Detection and recovery of non-floating or submerged oil, and manual removal or cleaning of oil sediment, debris, or vegetation could also result in adverse effects to the Hine's emerald. If any of these activities are needed in or near Hine's emerald habitats, the responding agencies will consider numerous factors that could affect whether and to what degree Hine's emerald may be affected and how those effects may be mitigated. These include the type of detection equipment used; whether oil is likely to refloat; water depth and depth of penetration of submerged oil; whether dragging of sorbent material will occur; whether sediment will be disturbed; whether removal activities will be concentrated or dispersed; degree of oiling; substrate type; what is oiled and what cleaning methods are required; whether oil may be left in place; equipment used to remove oiled material; how oiled material will be collected and transported; number of personnel; access impacts; necessary logistical support (e.g., facilities or utilities); use of ground cover; method of securing containment barriers or structures; disinfection of equipment to prevent spread of invasive species.

The action agencies may avoid or reduce adverse effects to Hine's emerald by implementing BMPs described in the BE. These include use of a wildlife monitoring plan; use of buffer zones with the concurrence of USFWS; spill response plans with pre-identified staging areas for personnel and equipment that minimize disturbance; and by ensuring "that construction/deconstruction/removal plans are in place and are scheduled/implemented in a way to eliminate or minimize impacts to" the species and its habitat when installing or placing temporary structures or material (BE, Appendix H).

Hine's emerald is already addressed in at least the following plans (RRT 5 Website - https://rrt5.org/Sub-Areas.aspx; accessed 18 Dec 2023):

- EPA Region 5 Will County, Illinois Initial Incident Action Plan (IAP)
- Inland Zone Sub-Area Contingency Plan (SACP) for Southeast Wisconsin May 2022/Version 1
- Sub‐Area Contingency Plan (SACP) for Northeast Wisconsin 2022/Version 1

The considerations and BMPs proposed by the action agencies, the likelihood that USFWS will be involved in an advisory role during spill responses, and the distribution of occupied sites across four states will be sufficient to ensure that the spill response program in the action area is not likely to appreciably reduce Hine’s emerald’s numbers, reproduction, or distribution rangewide. We anticipate interagency coordination, including the close involvement of USFWS, to avoid or minimize adverse effects of spill responses by helping to ensure that critical aspects of the species’ habitats are considered during spill responses. Development of site-specific spill response plans (BE, App. H) should also help to ensure that the agencies are especially well prepared for any necessary spill responses.

8.5.2.2 Hungerford’s Crawling Water Beetle

Several response activities could be used in or near Hungerford's crawling water beetle habitats where they would likely result in adverse effects to the species (Table 5).

Table 5. Response activities that would be likely to adversely affect Hungerford's crawling water beetle if implemented in or near stream reaches inhabited by the species, potential effects, and some factors that will influence effects to the species. We based the latter on the "Considerations for consultation" for each activity described in the biological evaluation. Potential effects were provided by M. Kane (USFWS, East Lansing, MI, pers. comm. 2023).

Response Activity	Potential Effects	Factors action agencies will consider during spill response
Booming	Crushing and habitat disturbance	Type of boom used; whether boom will be anchored; type of anchoring system; location of boom relative to species and its key habitat features; whether the boom will be used for containment, deflection, or protection; how long the boom will be deployed; disposal of oil-contaminated boom; use of machinery to recover boom; size of boom; potential for boom failure.
Dikes or berms	Crushing, habitat disturbance, limitations to movement, and interference with pupation.	Types of equipment used to build dikes or berms; ramifications of digging, construction, and access; disinfection of equipment to prevent spread of invasive species.
Construction of barriers, pits, and trenches	Crushing, habitat disturbance, and limitation of movement	Disposal of construction material; the tools, material, personnel, and equipment that would be used during construction; disinfection of equipment to prevent spread of invasive species.
Culvert blocking	Habitat disturbance and limitation of movement. Dewatering of occupied pools could harm or kill individuals by drying them out.	Water levels; weather; duration of culvert blocking; whether deflection booming will be used; potential effects to water chemistry; equipment disinfection to prevent spread of invasive species.
Skimming and vacuuming	Habitat disturbance, entrapment of individuals. Adverse effects caused by habitat disturbance could occur if either of these activities reduced availability of the species' algal food base.	Type of equipment used and support-storage and access needs; the availability, size, quantity, and mobility of storage devices for recovered oil; access for support equipment; disinfection of equipment to prevent spread of invasive species; whether traffic to and from sites could harm the species directly or damage its habitat; where and how will oil be disposed of.
Flooding, flushing, steam cleaning and sandblasting	Sedimentation or erosion; burial from transported sediment, harm to pupating beetles; physical displacement and exposure to oil; habitat degradation through water temperature changes.	Type of ancillary equipment (pumps, hoses, and trucks); method and equipment used to collect freed oil; access; number of personnel; duration of activity; flow rates, temperature, volume, chemicals; potential for water used to contain invasive species; increase in turbidity; disinfection of equipment to prevent spread of invasive species.
Detection and recovery of non-floating or submerged oil, and manual removal or cleaning of oil sediment, debris, or vegetation	Trampling, crushing and habitat removal and alteration; destruction of pupal chambers buried in damp sand; movement limitation	Type of detection equipment used; water depth; nature of the oil (will it refloat?); depth of penetration of submerged oil; use of divers; whether dragging of sorbent material will occur; whether sediment will be disturbed; whether removal activities will be concentrated or dispersed; degree of oiling; substrate type; what is oiled and what cleaning methods are required; whether oil may be left in place; equipment used to remove oiled material; how oiled material will be collected and transported; number of personnel; access impacts; necessary logistical support (e.g., facilities or utilities); use of ground cover; method of securing containment barriers or structures; disinfection of equipment to prevent spread of invasive species.
Deployment of buoys	if used, anchoring materials could crush individuals.	Static or drifting buoys? How will buoys be deployed; will they be anchored? During of use; effects of rope or chain drags or anchors on benthic habitat; disinfection of equipment to prevent spread of invasive species.

To the extent feasible during spill responses, the action agencies would consider numerous factors while planning and implementing responses in areas where they could affect Hungerford's crawling water beetle (Table 5). Due to the small size of Hungerford's crawling water beetle streams, we assume that response activities would be shore-based and that vessels would not be used, and that the activity Mechanical (Non-Chemical) Sand/Sediment/Mudflat Cleaning – an activity typically carried out on beaches – would not be carried out in or near the species' habitat.

As with other species, BMPs implemented by the responding agencies may avoid or reduce adverse effects to the species. These include use of a wildlife monitoring plan; use of buffer zones with the concurrence of USFWS; spill response plans with pre-identified staging areas for personnel and equipment that minimize disturbance; and, when installing or placing temporary structures or material they will "ensure that construction/deconstruction/removal plans are in place and are scheduled/implemented in a way to eliminate or minimize impacts to" the species and its habitat (BE, Appendix H).

Although the risk of spills to the species is significant as evidenced by the high proportion of known populations that overlap with the action area, we do not think that response activities are likely to reduce appreciably numbers, reproduction, or distribution of the species' rangewide. The BMPs that the action agencies have proposed, including development of site-specific response plans, are sufficient to ensure that responders will consider factors necessary to avoid or minimize effects to the species. In addition, we anticipate that USFWS and other resource agency personnel will be able to transmit information on the species' locations, critical and relevant aspects of their life-history, and important habitat features in a manner that will further minimize any adverse effects of spill response activities.

8.5.2.3 Mitchell's Satyr Butterfly

Adverse effects would likely occur to Mitchell's satyr if mechanical (non-chemical) sand cleaning or excavation up to 10 inches deep were carried out in the species' wetlands habitats. Excavation equipment could crush butterflies present in any life stage in the affected area and excavation could cause temporary or permanent degradation of important habitat features. Excavation could also destroy or make larval host plants and nectar plants temporarily unavailable to the species.

The proposed spill response activities could affect the Mitchell's satyr at three sites in Michigan and at one site in Indiana. The species has not been observed at the Indiana site for a few years and the status of that population may already be in doubt. A crude oil pipeline occurs within about 2.4 km (1.5 miles) of one of the Michigan populations in the action area. This population is not one of the populations that is currently healthy, but USFWS and its partners have been undertaking land management actions to improve its status (K. Kelly, pers. comm. 2023). Six populations in Michigan inhabit areas that do not intersect with the action area. In addition, there are about 43 populations of the subspecies in Alabama and Mississippi that are also outside of the action area.

If implementing mechanical cleaning of sediment during spill responses in or near Mitchell's satyr sites, the actions agencies would consider multiple factors when considering ways in which this activity could affect the subspecies. These factors including:

- The degree of oiling.
- Type of equipment to be used.

- Substrate type.
- The potential need to construct access.
- Whether oil is in the form of tar balls and whether it could remain in the area without causing problems.
- Disinfection needed to prevent the spread of invasive species.

Coordination with USFWS on these factors when the activity could affect the Mitchell's satyr will help to avoid or minimize effects to the subspecies. Likewise implementation of the standard BMPs will help to further minimize the likelihood, extent, and severity of adverse effects to Mitchell's satyr. These include, for example – development of buffer zones in coordination with USFWS, site-specific spill response plans, and plans for construction, deconstruction, and removal of any required temporary structures or materials.

Considering the conservation measure and BMPs built into the program, including those that help to ensure effective coordination with USFWS, we do not anticipate that the proposed action will significantly reduce the rangewide numbers, reproduction, or distribution of the Mitchell's satyr. Mitchell's satyr is one of the few species that USFWS recommends as a high priority for the development of one or more site-specific spill response plans in the action area. Development of site-specific plans for the Mitchell's satyr if and where warranted, would increase the likelihood that spill responses would be carried out with no or minimized adverse effects. This in combination with other BMPs and conservation measures and the occurrence of about 50 populations of the subspecies outside of the action area will help to buffer the Mitchell's satyr against any adverse effects caused by spill responses in the action area.

8.5.2.4 Poweshiek Skipperling

The highly imperiled status of the Poweshiek skipperling and the proximity of the last two inhabited U.S. sites to a railroad and an oil pipeline place this species at high risk to spill responses. Development of site-specific spill response plans for both remaining inhabited sites in Michigan is critical to minimize the chances that any spill response could further imperil the species. Survival and recovery of the species relies heavily on the persistence of these populations, which already face high degrees of threat from other sources.

Activities to remove oiled or other contaminants by excavation were identified as being the most likely to not be adequately avoided or minimized by proposed BMPs, but any potential spill response action poses a risk to the Poweshiek skipperling. The species and these populations are so imperiled that even excessive foot traffic in the two occupied Michigan sites is a significant concern. Mechanical (non-chemical) sand cleaning or excavation up to 10 inches deep could crush butterflies present in any life stage and could cause temporary or permanent degradation of essential habitat features.

As with Mitchell's satyr, if implementing mechanical cleaning of sediment during spill responses in or near Poweshiek skipperling sites, the actions agencies would consider multiple factors when considering ways in which this activity could affect the subspecies. These factors including:

- The degree of oiling.
- Type of equipment to be used.
- Substrate type.

- The potential need to construct access.
- Whether oil is in the form of tar balls and whether it could remain in the area without causing problems.
- Disinfection needed to prevent the spread of invasive species.

These and any additional necessary considerations would likely be incorporated into site-specific response plans developed for the Poweshiek skipperling.

Development of site-specific response plans for the two remaining sites inhabited by the Poweshiek skipperling in Michigan is essential to ensure that the potential need for spill response activities in these areas is not likely to further imperil the species. As stated above under **Description of the Action – Poweshiek Skipperling Site Specific Strategies**, EPA has proposed as part of the RRT5 spill response program to coordinate with USFWS and other partners to develop a site-specific response strategy for each of these sites. We anticipate that these plans will facilitate a significant reduction in the likelihood that spill response activities, if needed, will result in adverse effects to the Poweshiek skipperling at these sites.

8.5.2.5 Rusty Patched Bumble Bee

Adverse effects to rusty patched bumble bee could occur when the activities "Mechanical (non-chemical) sand cleaning and excavation" affects sedge meadow or upland habitats where the species may be present. Sedge meadow habitat "includes lowland areas around lakes, ponds, backwaters, and along seasonally flooded shorelines" (BE, p. 75). Rusty patched bumble bees use sedge meadows for foraging but are not likely to use them for nesting or overwintering due to flooding or soil saturation.

There may be a small chance of one or more rusty patched bumble bees being crushed by heavy equipment in sedge meadows, but many or most may be likely to escape from direct interactions with this activity. Indirect effects could result from the temporary or permanent loss of sedge meadow foraging habitats if more than a few acres are affected.

Mechanical sand cleaning and excavation could destroy nests if conducted in upland habitats within High Potential Zones, but we anticipate interagency coordination during responses will avoid or minimize nest destruction. Rusty patched bumble bees nest in grassy and shrubby upland areas and along forest edges. The likelihood of direct impacts to a rusty patched bumble bee nest may be more than discountable if the extent of nesting habitat affected by excavation exceeds about 0.25 acre (U.S. Fish and Wildlife Service 2021*k*). The action agencies will consider the same factors as described above for both Mitchell's satyr and Poweshiek skipperling when considering mechanical cleaning or excavation of substrates. Those considerations as part of the action agencies' coordination with USFWS during responses are likely to help to avoid or minimize effects.

We do not expect the proposed spill response activities to significantly impact reproduction, numbers, and distribution of the rusty patched bumble bee rangewide. Based on the extent of overlap between the action area and the species' High Potential Zones, a substantial proportion of the species' current range overlaps with the action area – about 33%. We anticipate, however, that spill responses will affect only a small proportion of that area. In addition, USFWS and other conservation agencies would likely be involved early in spill responses to inform spill responders regarding the likely presence of the species and of the life stages and important habitat features that occur in the response area. This will help responders to minimize impacts by appropriately positioning staging areas, carefully constructing and removing any needed structures, and to otherwise avoid or minimize any adverse effects that could occur due to spill responses. The rusty patched bumble bee's habit of nesting and overwintering predominantly in upland areas may further reduce the likelihood and severity of adverse effects from spill response activities.

8.5.3 Snails

8.5.3.1 Iowa Pleistocene Snail

Adverse effects to the Iowa Pleistocene Snail (IPS) may occur if the following response activities are carried out in or near one of the two locations where the species occurs in the action area:

- Booming
- Manual removal / Cleaning of oil sediment, debris, or vegetation
- Creation/Use of New Access Points
- Creation/Use of Staging Area (on land)
- Access of personnel by foot traffic
- Temporary Storage (on land)
- Decontamination

Equipment and foot traffic may result in crushing or other physical trauma of IPS or its eggs. Any form of ground disturbance may temporarily or permanently degrade the specific habitat conditions on which the IPS relies to carry out its life history. The preferred forage species of IPS – decaying birch – may be reduced by removal of trees and vegetation, as well as the introduction of invasive garlic mustard and buckthorn. Decontamination activities may introduce contaminants to IPS habitat and directly to IPS if containment measures are breached or oil is remobilized.

In addition to direct exposure to the cleaning or removal activities, adverse indirect effects could also occur if the activities modify the species' cool-moist habitats by negatively affecting the ice vents in algific slopes, or if the activities result in increased erosion of cliffs by tree removal.

As with other species, BMPs implemented by the responding agencies may avoid or reduce adverse effects to the species. These include use of a wildlife monitoring plan; use of buffer zones with the concurrence of USFWS; spill response plans with pre-identified staging areas for personnel and equipment that minimize disturbance; and, when installing or placing temporary structures or material they will "ensure that construction/deconstruction/removal plans are in place and are scheduled/implemented in a way to eliminate or minimize impacts to" the species and its habitat (BE, Appendix H).

We do not anticipate that the spill response program is likely to appreciably reduce the IPS's numbers, reproduction, and distribution rangewide. In addition to the BMPs, the disjunct distribution and high genetic diversity affords the species some resilience to the effects of any individual spill response. The broad distribution of and limited IPS movement between sites likely means that adverse effects would have only localized effects to the species at individual IPS sites. Moreover, interagency coordination to implement BMPs will minimize adverse effects if a spill response does affect the species in the action area.

8.5.4 Crustaceans

8.5.4.1 Illinois Cave Amphipod

Adverse effects to the Illinois cave amphipod (ICA) may occur if the following response activities are carried out within the groundwater basins where the species occurs:

- Booming
- Dikes or Berms
- Construction barriers, pits, and trenches
- Culvert Blocking
- Skimming
- Vacuuming
- Flooding
- Flushing
- Steam Cleaning
- Sandblasting
- Manual removal / Cleaning of oil sediment, debris, or vegetation
- Recovery of non-floating or submerged oil
- Containment of non-floating or submerged oil
- Deployment of buoys

Any of these activities could result in contaminants or sediment being transported from the surface and into the subsurface habitat of the ICA. Contaminants are thought to contribute to a decline in population sizes and species diversity in ICA and other groundwater-adapted species (U.S. Fish and Wildlife Service 2020*f*). Additionally, introduction of non-native honeysuckle (*Lonicera* spp.) could lead to an increase in soil erosion and siltation around cave entrances and alter the gravel habitat sufficiently to threaten the persistence of ICA in occupied caves (Lewis and Lewis 2015).

As with other species, BMPs implemented by the responding agencies may avoid or reduce adverse effects to the species. These include use of a wildlife monitoring plan; use of buffer zones with the concurrence of USFWS; spill response plans with pre-identified staging areas for personnel and equipment that minimize disturbance; and, when installing or placing temporary structures or material they will "ensure that construction/deconstruction/removal plans are in place and are scheduled/implemented in a way to eliminate or minimize impacts to" the species and its habitat (BE, Appendix H).

We do not anticipate that the spill response program is likely to appreciably reduce the ICA's numbers, reproduction, and distribution rangewide. In addition to the BMPs, the isolated nature of each cave system likely means that adverse effects would have only localized effects to the species at individual cave. Moreover, interagency coordination to implement BMPs will minimize adverse effects if a spill response does affect the species in the action area.

8.5.5 Fishes

8.5.5.1 Topeka Shiner

The following spill response activities could adversely affect the Topeka shiner (*Notropis topeka*):

- Booming
- Dikes or berms
- Construction of barriers, pits, and trenches
- Culvert blocking
- Skimming and vacuuming
- Flooding and flushing
- Steam cleaning
- Sandblasting
- Detection, recovery, and containment of non-floating or submerged oil
- Deterrence or hazing
- Use of vessels
- Deployment of buoys
- Decanting

These activities could adversely affect the Topeka shiner if carried out in or upstream of a stream or off-channel habitat where the species occurs in southwestern Minnesota. Adverse effects could occur by crushing or other physical trauma; impeding movement; dewatering habitat; entrainment; stranding; and oiling. The factors that will (1) influence how these activities may affect Topeka shiners and (2) be considered by the action agencies are the same as for Hungerford's crawling water beetle, another small stream species (Table 5).

In addition to the activities shown in Table 5, however, the agencies may implement a few additional activities in or near Topeka shiner habitats that would likely cause adverse effects (Table 6).

Table 6. Activities, effects, and key factors associated with some response activities that would be likely to adversely affect the Topeka shiner if implemented in occupied habitats.

Response Activity	Potential Effects	Factors action agencies will consider during spill response
Deterrence or hazing	crushing or other physical trauma, impeding movement, entrainment, stranding	Potential effects on the species' habitat; duration of activity; animal targets of hazing; disinfection of equipment
Use of vessels	crushing or other physical trauma; contamination	Type and number of vessels; fueling locations; launching locations; disinfection

Potential effects and mitigating measures for the Topeka shiner should consider the importance of healthy riparian areas for the species and off-channel habitats. Topeka shiner relies on a food base of aquatic invertebrates and prey that falls into its habitat from overhanging terrestrial vegetation. Response activities that degrade riparian or instream benthic habitats or remove overhanging terrestrial vegetation along stream or off-channel habitats could adversely affect Topeka shiners in the affected area. The species' frequent use of off-stream pools and abandoned stream channels also makes them vulnerable to constructions of dikes, berms, barriers, pits, and trenches that could disrupt surface water connections between these habitats and the associated stream.

In addition to the potential for indirect effects to Topeka shiners, instream activities could affect the species directly by crushing eggs and larvae or by entraining larvae or adults. The Topeka shiner's *Lepomis* sunfish associates could be similarly affected. These activities include skimming, vacuuming, flooding, flushing, and detection, recovery, and containment of non-floating or submerged oil (Table 5).

Interagency coordination is likely to avoid or minimize at least some of the potential adverse effects if a spill response occurs in watershed inhabited by the Topeka shiner in southwestern Minnesota. When notified of a spill response that may affect Topeka shiner in Minnesota, USFWS would review information of the species' known locations and designated critical habitat, coordinate with the Minnesota Department of Natural Resources and other landowners to ensure that accurate information is communicated regarding the species' presence in the action area and to help ensure appropriate buffer areas are established (N. Utrup, USFWS, Bloomington, MN, pers. comm. 2023). There is already a sub-area contingency plan that explicitly addresses Topeka shiner critical habitat in the action area – EPA's Siouxland Subarea Contingency Plan (RRT5 website, https://rrt5.org/Portals/0/docs/SiouxlandSACP_PublicAccess_Sept2020.pdf; accessed 18 Dec 2023). This plan covers a substantial portion of the Topeka shiner critical habitat in the action area and explicitly addresses USFWS involvement in responses to help avoid or minimize adverse effects to the Topeka shiner.

Due to the anticipated interagency coordination to implement BMPs to avoid or minimize effects of any spill responses in the portion of the species range that overlaps with the action area, and the likelihood that only a small proportion of the species' occupied habitat is likely to be affected, we do not anticipate that the spill response program is likely to appreciably reduce the Topeka shiner's numbers, reproduction, or distribution rangewide. In addition anticipated efforts to minimize any local adverse effects, effects to the rangewide status will be minimized by the number of populations and the extent of habitat likely to remain unaffected by spills and spill responses both within and outside of the action area. Among the 87 populations rangewide, 80 occur outside of the action area (U.S. Fish and Wildlife Service 2018*a*).

8.5.6 Freshwater Mussels

The following spill response activities could adversely affect freshwater mussels within the Action Area:

- Booming
- Dikes or berms
- Construction barriers, dams, pits, and trenches
- Culvert bocking
- Skimming
- Vacuuming
- Sorbents
- Flooding
- Flushing
- Steam cleaning
- Sandblasting
- Manual removal/cleaning of oil, oiled sediment, debris, or vegetation
- Detection of non-floating or submerged oil

- Recovery of non-floating or submerged oil
- Containment of non-floating or submerged oil
- Use of vessels
- Use of vehicles
- Deployment of buoys
- Temporary storage (on water)
- Decanting

The action agencies will consider numerous factors when implementing these activities where they could affect any of the listed mussel species described below. These factors are described for most of these activities in Tables 5 and 6. Activities not addressed in those tables include containment of non-floating or submerged oil and temporary storage (on water) (Table 7).

Table 7. Response activities that would be likely to adversely affect listed mussel species if implemented in or near stream reaches inhabited by the species, potential effects, and some factors that will influence effects to the species. We based the latter on the "Considerations for consultation" for each activity described in the biological evaluation. See Tables 5 and 6 for additional activities that would be likely to adversely affect mussel species.

Response Activity	Potential Effects	Factors action agencies will consider during spill response
Containment of non-floating or submerged oil, including use of machinery and creation of staging areas	Physical disturbance of mussels; crushing or sub-lethal injury; disruption of reproduction; harm due to sedimentation and turbidity; entrainment of mussels or their reproductive hosts	Type of equipment used; water depth; depth of oil penetration; nature of the stream substrate; nature of the oil – e.g., will it refloat; use of divers; whether sediment will be disturbed; how will structures be secured; length of deployment; whether a bubble curtain will be used; disinfection of equipment to prevent spread of invasive species
Temporary storage (on water)	Contamination or oiling due to secondary spillage from vessel or barge	Duration of storage; options for storage and methods to handle or transfer hazardous material; storage capacity; material being stored – is it listed hazardous waste or exhibit those characteristics; relevant regulations; potential for secondary release; need for utilities and other logistical support; disinfection of equipment to prevent spread of invasive species

We anticipate that by coordinating with USFWS the responding agencies will know when these considerations are needed to implement measures avoid or minimize effects to listed mussel species and when the BMPs listed for each species in Appendix H must be implemented.

8.5.6.1 Clubshell

The activities listed above could adversely affect the clubshell if carried out in or upstream of where the species occurs in Illinois, Indiana, Michigan, and Ohio. Adverse effects could occur due to crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding, or oiling. Also, increased sedimentation associated with instream response activities can result in smothering, impaired feeding due to increased suspended sediment, and degradation of suitable habitat. Activities could affect gravid females if they occur between May and July, potentially interfering with attachment of larval mussels to the species' fish hosts.

Interagency coordination will help to avoid or minimize effects if a spill response was needed in or near one of the eleven populations in the action area. We anticipate that this coordination, the considerations made by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the clubshell. Proposed BMPs include the development of spill response plans.

8.5.6.2 Fanshell

The activities listed above could adversely affect the fanshell if carried out in or upstream of where the species occurs in the Ohio, Wabash, White, E. Fork White, Muskingum, an Walhonding Rivers. Adverse effects could occur due to crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding, or oiling. Also, increased sedimentation associated with instream response activities can result in smothering, impaired feeding due to increased suspended sediment, and degradation of suitable habitat.

The species could also be affected adversely if response activities interfere directly with reproduction or otherwise reduce the likelihood of larval attachment to fish hosts. Interagency coordination will help to avoid or minimize effects if a spill response was needed in or near populations in the action area.

We anticipate that interagency coordination, the considerations made by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the fanshell. Interagency coordination will help to avoid or minimize effects if a spill response was needed in or near populations in the action area, which are generally small and isolated. Proposed BMPs include the development of spill response plans. The largest populations of fanshell occur in the Licking, Green, and Rolling Fork Rivers (KY) and the Clinch River (TN), outside of the action area.

8.5.6.3 Fat Pocketbook

The activities listed above could adversely affect the fat pocketbook if carried out in or upstream of where the species occurs in the Ohio, Wabash, Little Wabash, White, and E. Fork White Rivers. Adverse effects could occur due to crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding, or oiling. Also, increased sedimentation associated with instream response activities can result in smothering, impaired feeding due to increased suspended sediment, and degradation of suitable habitat. Interagency coordination will help to avoid or minimize effects if a spill response was needed in or near populations in the action area.

We anticipate that interagency coordination, the considerations made by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the fat pocketbook. A substantial proportion of the species numbers and distribution is outside of the action area in the Lower Mississippi Watershed. This broad distribution outside of the action area will help to buffer it against effects of any local spill responses in the action area. More importantly, however, we anticipate that interagency coordination will help to avoid or minimize effects if a spill response was needed in or near populations in the action area.

8.5.6.4 Higgins Eye

The activities listed above could adversely affect the Higgins eye if carried out at or upstream of locations where the species occurs in the upper Mississippi River, the St. Croix River, the lower Wisconsin River, and the lower Rock River in Illinois. Adverse effects could occur because of crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding, or oiling. Interagency coordination will help to avoid or minimize effects if a spill response was needed in or near populations in the action area.

We anticipate that interagency coordination, the considerations made by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the Higgins eye. Adverse effects could occur locally, but we anticipate that interagency coordination will help to avoid or minimize effects if a spill response was needed in or near populations in the action area.

8.5.6.5 Longsolid

The activities listed above could adversely affect the longsolid if carried out in or upstream of where the species occurs in the Ohio, Tuscarawas, Muskingum and Walhonding Rivers. Adverse effects could occur due to crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding, or oiling. Activities that take place during the brooding period between May and July could interfere directly with the process of larval attachment to the species' fish host. Also, increased sedimentation associated with instream response activities can result in smothering, impaired feeding due to increased suspended sediment, and degradation of suitable habitat. Interagency coordination will help to avoid or minimize effects if a spill response was needed in or near populations in the action area.

We anticipate that interagency coordination, the considerations made by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the longsolid. Adverse effects could occur locally within the action area, but we anticipate that interagency coordination will help to avoid or minimize effects if a spill response was needed in or near any populations. Extant populations of this species occur outside of the action area in Alabama, Kentucky, New York, North Carolina, Pennsylvania, Tennessee, Virginia, and West Virginia will also help to buffer effects to the species' status if any adverse effects occur to populations in the action area.

8.5.6.6 Northern Riffleshell

The activities listed above could adversely affect the northern riffleshell if carried out in or upstream of habitat where the species occurs in the Vermillion River, Tippecanoe River, portions of the Great Lakes, Big Darby Creek, Scioto River, and Maumee River. Adverse effects could occur because of crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding, or oiling. Also, increased sedimentation associated with instream response activities can result in smothering, impaired feeding due to increased suspended sediment, and degradation of suitable habitat. Interagency coordination will help to avoid or minimize effects if a spill response was needed in or near populations in the action area.

We anticipate that interagency coordination, the considerations made by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the northern riffleshell. Adverse effects could occur locally within the action area, but we anticipate that interagency coordination will help to avoid or minimize effects if a spill response was needed in or near any populations. The existence of extant populations of this species outside of the action area in Kentucky and in three watersheds in Pennsylvania will also help to buffer effects on the species' rangewide status if spill responses were to cause some adverse effects in the action area.

8.5.6.7 Orangefoot Pimpleback

The activities listed above could adversely affect the orangefoot pimpleback if carried out in or upstream of where the species occurs downstream of the Tennessee River confluence in the Ohio River. Adverse effects could occur due to crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding, or oiling. Also, increased sedimentation associated with instream response activities can result in smothering and degradation of suitable habitat. Due to the extremely limited range of this species, interagency coordination is critical to avoid or minimize effects if a spill response was needed in or near populations in the action area.

We anticipate that interagency coordination, the considerations made by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the orangefoot pimpleback. Adverse effects could occur locally within the action area, but we anticipate that interagency coordination will help to avoid or minimize effects if a spill response was needed in or near any populations. Two of three of the species' populations known to be extant occur outside of the action area. The action agencies propose the development of a spill response plan as a BMP for this species and the one population known to occur in the action area should be a high priority for a geographically specific plan.

8.5.6.8 Pink Mucket

The activities listed above could adversely affect the pink mucket if carried out in or upstream of habitat where the species occurs in the Ohio River. Adverse effects could occur because of crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding, or oiling. We expect interagency coordination will help to avoid or minimize effects if a spill response was needed in or near one of the two sub-populations in the action area.

We anticipate that interagency coordination, the considerations made by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the pink mucket. Adverse effects could occur locally within the action area, but we anticipate that interagency coordination will help to avoid or minimize effects if a spill response was needed in or near any populations. Populations of pink mucket with highest numbers occur in the lower Tennessee River (TN) and Saline River (AR), outside of the action area and there are additional populations in five additional states outside of the action area. The extent of the species numbers and distribution outside of the action area will buffer impacts on the species' status from any local effects that may occur in the action area.

8.5.6.9 Purple Cat's Paw

The activities listed above could adversely affect the purple cat's paw if carried out in or upstream of where the species occurs in Killbuck Creek and the Walhonding River. Adverse effects could occur due to crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding, or oiling. Also, increased sedimentation associated with instream response activities can result in smothering, impaired feeding due to increased suspended sediment, and degradation of suitable habitat. Due to the extreme rarity of this species, interagency coordination will be critical to avoid or minimize effects if a spill response was needed in or near remaining populations in the action area.

We anticipate that interagency coordination, the considerations made by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the purple cat's paw. Adverse effects could occur locally within the action area, but we anticipate that interagency coordination will help to avoid or minimize effects if a spill response was needed in or near any populations. The species' status is relatively tenuous in the action area and there has been a concerted effort to bolster the population in Killbuck Creek. Therefore, implementation one or more geographic response strategies or site response plans, as proposed as part of the spill response program (BE, App. H) is urgent for this species.

8.5.6.10 Pink Pigtoe

The activities listed above could adversely affect the pink pigtoe if carried out in or upstream of where the species occurs in the Muskingum River below Devola Dam. Adverse effects could occur due to crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding, or oiling. Also, increased sedimentation associated with instream response activities can result in smothering, impaired feeding due to increased suspended sediment, and degradation of suitable habitat. Disturbance during the short brooding period of the species from May to July could upset the ability of the species to attach as larvae to its host fish species.

We anticipate that interagency coordination, the considerations made by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the pink pigtoe. Adverse effects could occur locally within the action area, but we anticipate that interagency coordination will help to avoid or minimize effects if a spill response was needed in or near any populations. In addition, the species relatively broad distribution outside of the action area would buffer effects to the species' status due to any local adverse effects caused by spill responses in the action area. Outside of the action area the species occurs in the Tennessee River, Arkansas-White-Red River, and lower Mississippi River basins.

8.5.6.11 Rabbitsfoot

The activities listed above could adversely affect the rabbitsfoot if carried out in or upstream of occupied areas in the Ohio River, Wabash River, North Fork of the Vermilion, Tippecanoe River, Eel River, Muskingum River, Walhonding River, Fish Creek and the Big and Little Darby creeks. Adverse effects could occur due to crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding (leading to death by predation, thermal extremes, or ammonia build up), or oiling. Also, increased sedimentation associated with instream response activities can result in smothering, impaired feeding due to increased suspended sediment, and degradation of suitable habitat. Interagency coordination will help to avoid or minimize effects if a spill response was needed in or near populations in the action area. Additionally, stable populations of rabbitsfoot occur outside of the action area in the Ohio River in Kentucky, Pennsylvania, and West Virginia; the Green River in Kentucky, and French Creek in Pennsylvania.

We anticipate that interagency coordination, the considerations made by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the rabbitsfoot. Adverse effects could occur locally within the action area, but we anticipate that interagency coordination will help to avoid or minimize effects if a spill response was needed in or near any populations. In addition, the species relatively broad distribution outside of the action area would buffer effects to the species' status due to any local adverse effects caused by spill responses in the action area. The rabbitsfoot has a wide geographic extent, occurring in over 123 watersheds across its range. Outside of the action area this includes stable populations in the Green River (KY) and French Creek (PA).

8.5.6.12 Rayed Bean

The activities listed above could adversely affect the rayed bean if carried out in or upstream of where the species occurs in the 21 streams where extant populations exists in the action area. Adverse effects could occur due to crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding, or oiling. Also, increased sedimentation associated with instream response activities can result in smothering, impaired feeding due to increased suspended sediment, and degradation of suitable habitat. Interagency coordination will help to avoid or minimize effects if a spill response was needed in or near populations in the action area.

We anticipate that interagency coordination, the considerations made by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the rayed bean. Adverse effects could occur locally within the action area, but we anticipate that interagency coordination will help to avoid or minimize effects if a spill response was needed in or near any populations. In addition, the species' numbers, and distribution outside of the action area would buffer effects to the species' status due to any local adverse effects caused by spill responses in the action area. Nevertheless, development of one or more geographic response strategies in the action area may be a high priority for this species. Outside of the action area the species inhabits one stream in the Tennessee River basin and there are populations in the Ohio River basin in Kentucky, New York, Pennsylvania, and West Virginia.

8.5.6.13 Rough Pigtoe

The activities listed above could adversely affect the rough pigtoe if carried out in or upstream of where the species may be present in the East Fork of the White River. Adverse effects could occur due to crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding, or oiling. Also, increased sedimentation associated with instream response activities can result in smothering, impaired feeding due to increased suspended sediment, and degradation of suitable habitat. Interagency coordination will help to avoid or minimize effects if a spill response was needed in or near populations in the action area.

We anticipate that interagency coordination, the considerations made by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the rough pigtoe. Adverse effects could occur locally within the action area if the species is still present in the East Fork White River in Indiana. It has not been observed there since 1992. Currently, the Clinch (Tennessee) and Green (Kentucky) rivers represent the only populations with evidence of successful reproduction.

8.5.6.14 Round Hickorynut

The activities listed above could adversely affect the round hickorynut if carried out in or upstream of where the species occurs in the 22 streams described above that intersect the action area. Adverse effects could occur due to crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding, or oiling. Also, increased sedimentation associated with instream response activities can result in smothering, impaired feeding due to increased suspended sediment, and degradation of suitable habitat. Interagency coordination will help to avoid or minimize effects if a spill response was needed in or near populations in the action area.

We anticipate that interagency coordination, the considerations made by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the round hickorynut. In addition to expected efforts to minimize any adverse effects locally, effects of the proposed spill response program rangewide will be buffered to some degree by the existence of about 70 populations rangewide (U.S. Fish and Wildlife Service 2022*j*). About 27 of these occur in states in EPA Region 5 where they may intersect the action area. There are only four populations rangewide that have a current condition ranking of High. Of these, only one – in the Grand River in Michigan – inhabits a river that intersects with the action area. We assume that this population would be the initial and highest priority for the development of a spill response plan due to its importance to the species' conservation.

8.5.6.15 Salamander Mussel (Proposed Species)

The activities listed above could adversely affect the salamander mussel if carried out in or upstream of where the species occurs in the Great Lakes, Ohio and Upper Mississippi River basins. Adverse effects could occur due to crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding, or oiling. Also, increased sedimentation associated with instream response activities can result in smothering, impaired feeding due to increased suspended sediment, and degradation of suitable habitat. Interagency coordination will help to avoid or minimize effects if a spill response was needed in or near populations in the action area.

We anticipate that interagency coordination, the considerations made by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the salamander mussel. A high proportion of salamander populations in and outside of the action area face a high risk of extirpation and risk of contamination is in many cases a primary factor (U.S. Fish and Wildlife Service 2023*b*).

8.5.6.16 Scaleshell

The activities listed above have the potential to affect the scaleshell if carried out in or upstream of habitat where the species occurs in the Illinois River, however due to its limited instance of occurrence in the action area, chances of adverse effects are low. Adverse effects could occur because of crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding, or oiling. Also, increased sedimentation associated with instream response activities can result in smothering, impaired feeding due to increased suspended sediment, and degradation of suitable habitat. We expect interagency coordination will help to avoid or minimize effects if a spill response was needed in or near in the action area.

We anticipate that interagency coordination, the considerations made by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the scaleshell. The species may only have a marginal presence in the action area with most of its numbers and distribution lying outside of EPA Region 5. Stronghold populations of scaleshell occur outside of the action area in the Meramec River, Bourbeuse River, and Gasconade River in Missouri.

8.5.6.17 Sheepnose

The activities listed above could adversely affect the sheepnose if carried out in or upstream of where the species occurs in streams that intersect the action area in Minnesota, Wisconsin, Illinois, Ohio, and Indiana. Adverse effects could occur due to crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding, or oiling. Also, increased sedimentation associated with instream response activities can result in smothering, impaired feeding and reproduction due to increased suspended sediment, and degradation of suitable habitat. Interagency coordination will help to avoid or minimize effects if a spill response was needed in or near populations in the action area.

We anticipate that interagency coordination, the considerations made by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the sheepnose. Adverse effects from spill responses are expected to be localized in the action area and minimized through the implementation of BMPs and site-specific response plans and geographic response strategies. Although only about 30% of historical sheepnose populations remain extant, the existence of about 37 extant populations will help to buffer local adverse effects on the species' status rangewide.

8.5.6.18 Snuffbox

The activities listed above could adversely affect Snuffbox if carried out in or upstream of habitat where the species occurs within the action area. Adverse effects could occur due to crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding, or oiling. Also, increased sedimentation associated with instream response activities can result in smothering, impaired feeding due to increased suspended sediment, and degradation of suitable habitat. Interagency coordination will help to avoid or minimize effects if a spill response was needed in or near populations in the action area.

We anticipate that interagency coordination, the considerations made by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the snuffbox. Adverse effects from spill responses are expected to be localized in the action area and minimized through the implementation of BMPs and site-specific response plans and geographic response strategies. Spectaclecase

The activities listed above could adversely affect the spectaclecase if carried out in or upstream of where the species occurs in the Mississippi River, St. Croix, and Ohio Rivers, and their tributaries, in Illinois, Minnesota, and Wisconsin. Adverse effects could occur due to crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding, or oiling. Also, increased sedimentation associated with instream response activities can result in smothering, impaired feeding due to increased suspended sediment, and degradation of suitable habitat. Interagency coordination will help to avoid or minimize effects if a spill response was needed in or near populations in the action area.

We anticipate that interagency coordination, the considerations made by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the spectaclecase. Adverse effects from spill responses are expected to be localized in the action area and minimized through the implementation of BMPs and site-specific response plans and geographic response strategies. The existence of forty extant populations occurring across the Ohio River, Tennessee River, Upper and Lower Mississippi River, and Missouri River basins will also help to buffer effects to the species' rangewide status that may occur if the species is affected locally by response activities.

8.5.6.19 White Catspaw

The activities listed above could adversely affect the white catspaw if carried out in or upstream of where the species occurs in Fish Creek (OH). Adverse effects could occur due to crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding, or oiling. Also, increased sedimentation associated with instream response activities can result in smothering, impaired feeding due to increased suspended sediment, and degradation of suitable habitat.

Due to the extreme rarity of this species, interagency coordination will be critical to avoid or minimize effects if a spill response is needed in or near what is likely the last remaining population of the species in Fish Creek. As mentioned above in the section, *Area Contingency Plans – Intent and Incorporation of Fish and Wildlife Information,* EPA has initiated a sub-area contingency plan that includes Fish Creek and its watershed – the Inland Zone Sub-Area Contingency Plan (SACP) for Great Black Swamp. USFWS is already coordinating with EPA on this plan and will continue to emphasize the need to incorporate measures to ensure that spill response activities avoid or minimize effects to white catspaw and to other listed mussel species that are present in the area where the species may persist. The other listed mussel species include the federally threatened rabbitsfoot and the federally endangered clubshell, northern riffleshell, and rayed bean.

We anticipate that interagency coordination, including continued development of the Black Swamp sub-area contingency plan, the normal considerations and coordination carried out by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the white catspaw.

8.5.6.20 Winged Mapleleaf

The activities listed above could adversely affect the winged mapleleaf if carried out in or upstream of where the species occurs in the St. Croix, Mississippi, and Chippewa Rivers. Adverse effects could occur due to crushing or other physical trauma, impeding movement, dewatering habitat, entrainment, stranding, or oiling. Also, increased sedimentation associated with instream response activities can result in smothering, impaired feeding due to increased suspended sediment, and degradation of suitable habitat. Interagency coordination will help to avoid or minimize effects if a spill response was needed in or near populations in the action area.

We anticipate that interagency coordination, the considerations made by the action agencies during responses, and implementation of proposed BMPs will ensure that the spill response program will not appreciably reduce the numbers, reproduction, or distribution of the winged mapleleaf. Adverse effects from spill responses are expected to be localized in the action area and minimized through the implementation of BMPs and site-specific response plans and geographic response strategies.

There are already geographic response strategies that explicitly consider the winged mapleleaf or its habitats in the action area and that include coordination with USFWS. These include the:

- Inland Zone Sub-Area Contingency Plan (SACP) for Minneapolis/St. Paul
- National Park Service St. Croix National Scenic Riverway Initial Incident Action Plan

These plans address areas inhabited by the winged mapleleaf in the Mississippi River and St. Croix River, respectively. In addition to the measures in place to avoid or minimize adverse effects to the species in these rivers, the impacts of any localized effects in the action on the species' rangewide status may be buffered by the existence of populations outside of the action area in the Ouachita and Saline Rivers (AR), Bourbeuse River (MO), and Little River (OK and AR).

8.5.7 Critical Habitat

8.5.7.1 Short's Bladderpod Critical Habitat

The spill response activities that affect the Short's bladderpod itself also have the potential to adversely affect the species' critical habitat. The activities that would be likely to adversely affect the species indirectly via effects to its habitat would be similar in scope and effect to those that are likely to adversely affect critical habitat in the action area. In addition, the same considerations made during spill responses for those actions would apply when response actions may affect the specific areas designated as critical habitat.

We anticipate that coordination with USFWS and Indiana DNR and implementation of BMPs during responses will ensure that the proposed spill response program is not likely to reduce the ability of Short's bladderpod critical habitat to fulfill its conservation role for the species.

8.5.7.2 Topeka Shiner Critical Habitat

The spill response activities that affect the Topeka shiner itself also have the potential to adversely affect the species' critical habitat (Table 6). Most of the species' distribution in the action area has been designated as critical habitat and except when dewatered due to drought, Topeka shiners are likely to be present in all stream reaches designated as critical habitat in Minnesota. The activities that would be likely to adversely affect the species indirectly via effects to its habitat would be similar in scope and effect to those that are likely to adversely affects critical habitat in the action area. In addition, the same considerations made during spill responses for those actions would apply when response actions may affect the specific areas designated as critical habitat.

We anticipate that coordination with USFWS and implementation of BMPs during responses will ensure that the proposed spill response program is not likely to degrade the ability of Topeka shiner critical habitat to fulfill its conservation role for the species. Effects to the fish (Table 6) reflect the way in which spill responses could cause adverse effects to one or more essential features of critical habitat (Table 8).

Table 8. Response activities that could adversely affect Topeka shiner critical habitat.

Response Action(s)	Potential Effects
Booming	degradation of aquatic invertebrate food base; degradation of water quality; destruction or removal of overhanging terrestrial vegetation and aquatic plants
Dikes or berms and construction barriers, pits, and trenches	disruption of connections between streams and off-channel habitats; reduction in abundance of terrestrial and aquatic prey
Culvert blocking	dewatering of instream or off-channel habitat
Skimming and vacuuming	entrainment of *Lepomis* sunfish associates
Flooding and flushing	degradation of water quality; sedimentation of pools or runs and sand, gravel, and cobble substrates; removal or sedimentation of instream woody debris and aquatic vegetation; destruction of *Lepomis* sunfish nests; degradation of aquatic invertebrate food base
Sandblasting	degradation of water quality; reduction in density or diversity of *Lepomis* sunfish associates; degradation of aquatic invertebrate food base; destruction or removal of overhanging terrestrial vegetation and aquatic plants
Detection, recovery, and containment of non-floating or submerged oil	degradation of benthic aquatic invertebrate food base; destruction of *Lepomis* sunfish nests; disruption of sunfish spawning; entrainment of sunfish associates; degradation of aquatic invertebrate food base; degradation of water quality
Creation/Use of new access points	destruction or removal of overhanging terrestrial vegetation; sedimentation of pools or runs and sand, gravel, and cobble substrates
Deployment of buoys	Anchored buoys could damage aquatic invertebrate food base

As with spill responses that may affect the species itself, we anticipate USFWS to play an active role advising responders regarding the locations and important features of Topeka shiner critical habitat if any of its essential features may be exposed to the effects of spill responses. We expect responders will coordinate with USFWS to implement general and activity-specific BMP to the extent feasible and to adjust those practices to account for the locations and nature of the critical habitat essential features. There is already a sub-area contingency plan that explicitly addresses Topeka shiner critical habitat in the action area – EPA's Siouxland Subarea Contingency Plan (RRT5 website, https://rrt5.org/Portals/0/docs/SiouxlandSACP_PublicAccess_Sept2020.pdf; accessed 18 Dec 2023). This plan covers a substantial portion of the Topeka shiner critical habitat in the action area.

Due to the likely interagency coordination and implementation of BMPs, the existence of a sub-area plan that covers a large portion of the Topeka shiner critical habitat in the action area, and because a large proportion of stream miles designated as critical habitat for the Topeka shiner lie outside of the action area, we conclude that the proposed action is not likely to reduce the ability of the critical habitat to fulfill its conservation role for the species.

8.5.7.3 Hine's Emerald Dragonfly Critical Habitat

Construction of barriers, pits, and trenches and manual removal or cleaning of oil, sediment, debris, or vegetation is likely to adversely affect Hine's emerald critical habitat if carried out in or near one of the ten critical habitat units in the action area. Details on how these response activities could result in adverse effects to Hine's emerald critical habitat and the considerations and BMPs that could avoid or minimizes those effects are detailed in this section above on effects to the Hine's emerald itself. These activities could alter the sensitive hydrology and structure of Hine's emerald habitats that relies on inputs of calcareous water from seeps and springs to form slow-flowing rivulets, small channels, or sheet flow in fens (E. Karecki, USFWS, Chicago, IL, pers. comm. 2023).

Response activities could also remove or degrade organic soils used for egg deposition and larval development, remove or degrade plant communities on which Hine's emerald relies for refugia and emergence as adults, destroy of devil crayfish (*Cambarus diogenes*) and their burrows, and degrade populations of invertebrate prey of both larvae and adults.

Hine's emerald critical habitat is likely to retain its ability to fulfill its role in the species' conservation despite the potential for some adverse effects from one or more spill responses. We expect site-specific spill plans, interagency coordination before, during, and after responses, and the actions agencies' considerations of potential ramifications of response activities to avoid or minimize any effects. Hine's emerald critical habitat is already addressed in at least the following plans (RRT 5 Website - https://rrt5.org/Sub-Areas.aspx; accessed 18 Dec 2023):

- EPA Region 5 Will County, Illinois Initial Incident Action Plan (IAP)
- Inland Zone Sub-Area Contingency Plan (SACP) for Southeast Wisconsin May 2022/Version 1
- Sub - Area Contingency Plan (SACP) for Northeast Wisconsin 2022/Version 1

Eighteen Hine's emerald critical habitat units occur entirely outside of the action area and will not be affected by the proposed action.

8.5.7.4 Poweshiek Skipperling Critical Habitat

About 4,853 acres (1,964 hectares) overlap with the action area –about 19% of the entire area designated as critical habitat.

Of greatest concern are Michigan units 3 and 4 – both are extremely important due to the persistence of the species at the sites, the high degree of overlap with the action area, and the proximity of readily identifiable and significant spill threats (Table 3). Great care is being taken at these sites to avoid even impacts of excessive foot traffic, demonstrating the degree to which the integrity of these habitats is important to conservation of the Poweshiek skipperling. Any spill response that is not carried out with the utmost of careful planning, interagency coordination, and implementation could affect their ability to fulfill their critical role in the species' conservation.

Due to the importance of the two Michigan units and the presence of a rail line and a crude oil pipeline in their proximity, the EPA proposed during consultation to cooperate with USFWS and other partners to develop site specific spill response strategies for these two sites. Coordination between the USFWS, EPA, and state partners to this end has already begun. These strategies will not eliminate the potential for a spill to affect either site. They are likely, however, to significantly reduce the potential for response activities to be carried out in a way that does not sufficiently consider potential effects to the features of critical habitat that are essential to their role in the species' conservation.

There are also moderate to high degrees of overlap between the action area and Michigan Unit 2 and Minnesota Units 7, 8, and 17. Potential sources of spills at these sites include rail lines, and interstate highway, a U.S. highway, and state highways. Spill responses at these sites could result in excavation of oiled or contaminated soils that could adversely affect essential critical habitat features, including plant communities and hydrologic functions. Although essential, none of these sites currently play the extremely elevated role that Michigan sites 3 and 4 have in supporting conservation of the Poweshiek skipperling. Each of these sites consist primarily of state or private conservation lands. If a spill were to occur at any of these sites, we would expect USFWS and the managing agencies and organizations to coordinate quickly with spill responders to facilitate implementation of BMPs and other conservation measures that would avoid or minimize adverse effects to the critical habitat.

We conclude that the proposed spill response program is not likely to reduce the ability of the critical habitat to fulfill its conservation role for the species. This is due to the general BMPs and conservation measures, which include coordination with USFWS and other resource agencies on spill responses and EPA's proposed development of site-specific geographic response strategies to address potentially significant adverse effects at the two crucial sites in Michigan.

8.5.7.5 Rabbitsfoot Critical Habitat

Spill response activities that affect the Rabbitsfoot itself also have the potential to adversely affect the species' critical habitat (Table 9). The activities that would be likely to adversely affect the species indirectly via effects to its habitat would be similar in scope and effect to those that are likely to adversely affect critical habitat in the action area. In addition, the same considerations made during spill responses for those actions would apply when response actions may affect the specific areas designated as critical habitat.

Table 9. Response activities that could adversely affect Rabbitsfoot critical habitat.

Response Action(s)	Potential Effects
Booming	Destruction of suitable habitat by anchors or the anchor chain; degradation of water quality
Dikes or berms and construction barriers, pits, and trenches	Disruption of connections between streams and off-channel habitats; destruction of suitable habitat and host fish displacement
Culvert blocking	Dewatering of instream or off-channel habitat
Skimming and vacuuming	Disruption or destruction of suitable habitat and fish host displacement
Sorbents	Suitable habitat disturbance from destruction or smothering, or entrainment; fish host disturbance
Flooding and flushing	Water quality degradation: sedimentation of pools or runs and sand, gravel, and cobble substrates; smothering, movement of oiled sediment leading to contamination or fish host death or displacement
Steam Cleaning	Degradation of suitable habitat and water quality through potential remobilization of oil and oiled sediments
Sandblasting	Disruption or destruction of suitable habitat and fish host displacement
Manual Removal/Cleaning	Destruction of suitable habitat from penetration of oil deeper into sediments
Detection, recovery, and containment of non-floating or submerged oil	Degradation or destruction of suitable habitat; degradation of water quality, displacement of fish hosts
Use of vehicles or vessels	Destruction or compaction of suitable habitat
Deployment of buoys	Anchored buoys could damage suitable habitat and displace fish hosts
Temporary Storage on Water	secondary spillage from container failure or overfill; destruction of suitable habitat (i.e., crushing substrate and turbidity) from anchoring temporary storage vessel/barge; direct exposure (if open-top or uncovered)

We anticipate interagency coordination and implementation of BMPs will combine to avoid affecting the critical habitat to the extent that its conservation role for the species would be appreciably diminished. USFWS is likely to play an active role advising responders regarding the locations and important features of rabbitsfoot critical habitat that may be exposed to the effects of spill response activities. If site-specific spill response plans are unavailable, we expect spill responders will coordinate with USFWS to implement general and activity specific BMPs to the extent feasible and to adjust those practices to account for the locations and nature of the critical habitat essential features.

8.5.7.6 Round Hickorynut Critical Habitat

Like critical habitat for other aquatic species, spill response activities that may adversely affect the round hickorynut have the potential to adversely affect the species' critical habitat. Activities that would be likely to adversely affect the species indirectly via effects to its habitat would be similar in scope and effect to those that are likely to adversely affect critical habitat in the action area (Table 10).

Considerations made during spill responses for those actions would apply when response actions may affect the specific areas designated as critical habitat.

Table 10. Response activities that could adversely affect Round Hickorynut critical habitat.

Response Action(s)	Potential Effects
Booming	Destruction of suitable habitat by anchors or the anchor chain; degradation of water quality
Dikes or berms and construction barriers, pits, and trenches	Disruption of connections between streams and off-channel habitats; destruction of suitable habitat and host fish displacement
Culvert blocking	Dewatering of instream or off-channel habitat
Skimming and vacuuming	Disruption or destruction of suitable habitat and fish host displacement
Sorbents	Suitable habitat disturbance from destruction or smothering, or entrainment; fish host disturbance
Flooding and flushing	Water quality degradation: sedimentation of pools or runs and sand, gravel, and cobble substrates; smothering, movement of oiled sediment leading to contamination or fish host death or displacement
Steam Cleaning	Degradation of suitable habitat and water quality through potential remobilization of oil and oiled sediments
Sandblasting	Disruption or destruction of suitable habitat and fish host displacement
Manual Removal/Cleaning	Destruction of suitable habitat from penetration of oil deeper into sediments
Detection, recovery, and containment of non-floating or submerged oil	Degradation or destruction of suitable habitat; degradation of water quality, displacement of fish hosts
Use of vehicles or vessels	Destruction or compaction of suitable habitat
Deployment of buoys	Anchored buoys could damage suitable habitat and displace fish hosts
Temporary Storage on Water	Secondary spillage from container failure or overfill; destruction of suitable habitat (i.e., crushing substrate and turbidity) from anchoring temporary storage vessel/barge; direct exposure (if open-top or uncovered)

Like for rabbitsfoot, we anticipate interagency coordination between USFWS and spill responders regarding the locations and features of critical habitat that may be exposed to the effects of spill response activities. Further coordination is expected in the absence of site-specific response plans to implement general and activity-specific BMP to the extent feasible and to adjust those practices to account for the locations and nature of the critical habitat essential features.

We anticipate interagency coordination and implementation of BMPs will combine to avoid affecting the critical habitat to the extent that its conservation role for the species would be appreciably diminished. Critical habitat for the round hickorynut in Alabama, Arkansas, Kansas, Kentucky, Mississippi, Missouri, Oklahoma, Pennsylvania, and Tennessee is entirely outside of the action area and will not be affected by the proposed spill response activities in EPA Region 5.

8.5.7.7 Salamander Mussel Critical Habitat (Proposed)

Spill response activities that may adversely affect the salamander mussel have the potential to adversely affect the species' critical habitat (Table 11). Activities that would be likely to adversely affect the species indirectly via effects to its habitat would be similar in scope and effect to those that are likely to adversely affect critical habitat in the action area. Considerations made during spill responses for those actions would apply when response actions may affect the specific areas designated as critical habitat.

Table 11. Response activities that could adversely affect salamander mussel critical habitat.

Response Action(s)	Potential Effects
Booming	destruction of suitable habitat by anchors or the anchor chain; degradation of water quality
Dikes or berms and construction barriers, pits, and trenches	disruption of connections between streams and off-channel habitats; destruction of suitable habitat and host fish displacement
Culvert blocking	dewatering of instream or off-channel habitat
Skimming and vacuuming	disruption or destruction of suitable habitat and fish host displacement
Sorbents	Suitable habitat disturbance from destruction or smothering, or entrainment; fish host disturbance
Flooding and flushing	Water quality degradation: sedimentation of pools or runs and sand, gravel, and cobble substrates; smothering, movement of oiled sediment leading to contamination or fish host death or displacement
Steam Cleaning	Degradation of suitable habitat and water quality through potential remobilization of oil and oiled sediments
Sandblasting	disruption or destruction of suitable habitat and fish host displacement
Manual Removal/Cleaning	Destruction of suitable habitat from penetration of oil deeper into sediments
Detection, recovery, and containment of non-floating or submerged oil	Degradation or destruction of suitable habitat; degradation of water quality, displacement of fish hosts
Use of vehicles or vessels	Destruction or compaction of suitable habitat
Deployment of buoys	Anchored buoys could damage suitable habitat and displace fish hosts
Temporary Storage on Water	secondary spillage from container failure or overfill; destruction of suitable habitat (i.e., crushing substrate and turbidity) from anchoring temporary storage vessel/barge; direct exposure (if open-top or uncovered)

We anticipate interagency coordination between USFWS and spill responders regarding the locations and features of critical habitat that may be exposed to the effects of spill response activities. Further coordination is expected in the absence of site-specific response plans to implement general and activity-specific BMP to the extent feasible and to adjust those practices to account for the locations and nature of the critical habitat essential features.

We anticipate interagency coordination and implementation of BMPs will combine to avoid affecting the critical habitat to the extent that its conservation role for the species would be appreciably diminished. We conclude that the proposed action is not likely to destroy or adversely modify the critical habitat. Proposed critical habitat in New York, Pennsylvania, West Virginia, Kentucky, and Tennessee lies entirely outside of the action area.

9 CUMULATIVE EFFECTS

Cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02 "Cumulative effects").

Future effects to species or critical habitats from spills themselves, unless they involve federal activities, are cumulative effects. In the BE, the action agencies state that "major and medium spills in the Great Lakes coastal zone occur infrequently" and that 99% "of the response cases within the last 10 years have been spills of less than 1,000 gallons." The agencies point to this record as a successful outcome "of a system of preparedness and response that has successfully safeguarded Great Lakes waters from significant environmental damage wherever possible." Although infrequent, large spills can be devastating to affected habitats, fish, wildlife, and plants as is evidenced by examples described in the BE by the action agencies.

Wildlife action plans developed by each state conservation agency in EPA Region 5 describe State or private activities that are reasonably certain to affect the listed species and critical habitats addressed in this biological opinion (Derosier et al. 2015, Indiana Department of Natural Resources 2015, Iowa Department of Natural Resources 2015, Ohio Division of Wildlife 2015, Wisconsin Department of Natural Resources 2015, Minnesota Department of Natural Resources 2016, Holtrop 2022). In addition to spills, the species and critical habitats in the action area are likely to respond to numerous stressors caused the activities in the action area.

These include:

- agriculture
- residential, commercial, and recreational development
- consumptive use including both deliberate and unintentional harvesting
- non-consumptive recreation
- incompatible natural resource management, including activities that interrupt natural disturbance regimes, alter aquatic habitats, remove essential habitat features, or directly affect individuals of listed species
- logging
- energy production and mining
- transportation
- pollution from urban, municipal, and industrial polluting activities
- intentional and accidental introduction of exotic species
- fire suppression
- groundwater withdrawal

These activities are likely result in consequences to species addressed in this consultation, including:

- Alteration, interference with, fragmentation, and degradation of natural systems, processes, and habitats, including hydrologic regimes and successional states
- Decline in the extent of available habitat
- Spread of invasive species and other exotic, both terrestrial and aquatic
- Exposure to toxins
- Altered nutrient inflows
- Direct adverse effects to individuals, including mortality
- Reduction in forage or prey bases
- Stress caused by the removal of traditional habitats used by species that have site fidelity
- Decline in reproduction by plants that are dependent on insect pollinators
- Predation by urban adapted predators
- Competition from exotic species
- Lack of effective deer management
- Road mortality
- Pollution –thermal, chemical, and biological (e.g., sewage) pollution and sedimentation
- Increased disease
- Restricted fish movements

10 INTEGRATION, SYNTHESIS, AND CONCLUSION

After reviewing the current status of the species and critical habitats described above in the section, EFFECTS TO SPECIES AND CRITICAL HABITATS, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of these species and is not likely to destroy or adversely modify designated critical habitat.

We base this conclusion on the following:

1. The action agencies have committed to general and activity specific BMPs and conservation measures that will avoid or minimize adverse effects. This, in combination with existing geographic response strategies and the proposed and anticipated development of new ones, is likely to ensure that any localized effects of spill responses will be minimized.
2. The action agencies have an established partnership and spill response infrastructure that includes USFWS and other conservation agencies. When spills occur USFWS is typically able to quickly determine what species and critical habitats, if any, could be affected by the spill itself and by subsequent spill responses. USFWS is also well positioned with a network of regional and field-based spill response experts to coordinate with the action agencies to ensure that responders have access to key information that they can build into standard activity-specific considerations as they may apply to any species and critical habitats that may be affected by spill response activities.
3. In addition to identifying general BMPs, during this consultation EPA committed to working with USFWS and other partners to develop geographic response strategies species to the Poweshiek

skipperling. These strategies will focus on the few remaining populations of this highly imperiled species in the U.S., both in Michigan.

4. In addition to initiating the geographic response strategies for the Poweshiek skipperling, the action agencies and USFWS agreed to coordinate on a prioritization of species for the development of additional geographic response strategies. This coordination is likely to prioritize species based on degree of imperilment and vulnerability to spills and spill responses.

10.1 The conclusions of this biological opinion are based on full implementation of the project as described in the **DESCRIPTION OF THE PROPOSED ACTION** section of this document, including any conservation measures that were incorporated into the project design.

11 CONSERVATION RECOMMENDATIONS

During formal consultation it is USFWS' responsibility to formulate discretionary conservation recommendations, if any, which will assist the Federal agency in reducing or eliminating the impacts that its proposed action may have on listed species or critical habitat. These conservation recommendations. are advisory and are not intended to carry any binding legal force.

Appendix H of the BE includes the following BMPs for each species:

1. A wildlife monitoring plan,
2. Buffer zones with the concurrence of USFWS.
3. Spill Response Plan that has pre-identified staging areas for personnel and equipment that minimize disturbance.
4. When installing or placing temporary structures or material (i.e., booms, berms, dikes, culvert blocks, or other oil collection equipment, material, and structures), ensure that construction, deconstruction, and removal plans are in place and are Scheduled and implemented in a way to eliminate or minimize impacts to threatened and endangered species and their habitats.

The following conservation recommendations are intended to supplement those BMPs and have been developed for a few, but not all the species addressed by the biological opinion.

11.1 PLANTS

11.1.1 American Hart's Tongue Fern

- Avoid or minimize tree removal when in areas where American Hart's tongue fern may be present.

11.1.2 Eastern Prairie Fringed Orchid

- In cooperation with USFWS, review the list of eastern prairie fringed orchid sites that intersect with the action area and decide which should be the highest priority to develop site-specific spill response plans.
- For each individual site, compile contact information for key contacts so that if a spill occurs, responders will know who to contact to get key information about eastern prairie fringed orchid and its habitat at the site. This information would also be in the site-specific response plans addressed by the first bullet above, but it will take a while to develop those site-specific plans. Therefore, this compilation of site-specific contacts should occur while preparing to develop full site-specific response plans.

11.1.3 Leedy's roseroot

- Ensure that response measures avoid or minimize effects to sinkholes or any other karst features upslope of any Leedy's roseroot populations in a manner that could affect groundwater discharge into the species cliffside habitats.
- Ensure that a biologist is on-site if any mechanical or manual cleaning or removal of oil or oiled material is carried out where Leedy's roseroot may be present.

11.1.4 Northern wild monkshood

- Avoid or minimize tree removal within areas where northern wild monkshood may be present, particularly above cliff features.

11.1.5 Pitcher's thistle

- Plants may be transplanted if necessary. When transplanting Pitcher's thistle, dig out the entire root ball, wrap the root ball in burlap and move the plant to the new, pre-dug hole. Fall and winter periods are more conducive to transplanting.
- Clearly mark all areas where plants occur and avoid disturbing or destroying individual plants and habitat within 10 feet of plants
- Within 50 feet of the existing plants, stockpile existing disturbed soil before construction and replace salvaged soil at the end of construction to preserve suitable habitat
- Clean all vehicles and equipment to remove invasive species
- Conduct work in suitable habitat when species is dormant (November 1 – March 31) and avoid ground disturbance in areas occupied by listed plants
- Avoid broadcast herbicide use within 1 mile of a known occurrence. Spot spraying target species and cut and stump treatments can help protect sensitive plant species.
- Disturbed areas should be revegetated with natural vegetation to a condition equal or better than existed prior to construction. Environmentally friendly restoration seeding should be utilized. All restoration plantings should be monitored for proper establishment and supplemental plantings implemented as necessary.
- Reduce number of plants impacted/area of impact as much as possible
- Translocations of individuals that would otherwise be destroyed in area of impact. Work with the Service to determine proper translocation procedures for the specific project area.
- Stockpile existing soil before construction and store with clay cap (or tarp if clay cap is not possible). Replace salvaged soil at the end of construction to encourage regrowth from the seedbank.
- If project will last longer than a year, collect seed from plants in the action area and reseed in the project area after completion of construction. Discuss proper seed collection and planting procedures for your project area with the Service.
- Habitat management activities in ROW areas with that species
  - Woody vegetation removal
  - Invasive species removal for 3 years following disturbance
- Monitoring
  - Translocation/Soil Stockpiling/Planting
    - Pre and post (in year 3) counts of plants in work/relocation area
    - Number of plants translocated/area of soil salvaged/salvaged/number of seed collected and planted
    - Geospatial data collected during monitoring efforts
  - Habitat Management
    - Spatially explicit description of management actions
    - Pre and post (in year 3) counts of plants in management area

11.1.6 Western prairie fringed orchid

- Coordinate with USFWS Minnesota-Wisconsin ESFO to incorporate contact information for managers of western prairie fringed orchid sites (Minnesota DNR, TNC, National Park Service, etc.) into species-specific BMPs.

11.2 INSECTS

11.2.1 Hine's emerald

- To ensure that appropriate buffer zones are established during spill responses, coordinate with USFWS and USGS to delineate groundwater recharge areas for each site Hine's emerald site that intersects with the action area.
- If a spill occurs (1) within a Hine's emerald groundwater recharge area or (2) within 12-miles of any Hine's emerald dragonfly habitat for which recharge areas have not been mapped, implement the following measures:
    - Initiate dewatering activities if groundwater is encountered. Direct any trench water to an adjacent well-vegetated upland area, discharged through carbon filtration, and a geotextile filter bag placed within a straw bale and geotextile filtration structure, and allow to infiltrate. Alternative "best available technologies" may be considered on a case-by-case basis.
    - Do not use polyacrylamides to settle out solids during the dewatering process.
    - If a sheen is observed on the water, stop dewatering activities and contact USFWS. The source of the sheen should be determined through observation and sampling. If the sheen is confirmed to be petroleum based, the water must be pumped to a tank and properly treated; it should not be discharged on site.
    - Do not use products containing per- and polyfluoroalkyl substances (PFAS).
    - Stage pumps in secondary containment in case of fuel spills and locate them as far away from the excavation and wetland as possible. If dewatering must be conducted 24 hours per day, onsite refueling may be required. Any onsite refueling should be conducted with absorbent materials available at the refueling location and on impermeable surfaces.
    - Porta-toilets should not be permitted directly in pervious ground. If porta-toilets are necessary, they should be staged in an appropriate nearby area with limited risk of spill (e.g. impermeable pavement etc.).
    - Overnight equipment parking should only occur at adjacent existing roads or parking lots, where allowed an on impermeable surfaces.

11.2.2 Hungerford's Crawling Water Beetle

- Cooperate with USFWS to identify Hungerford's crawling water beetle habitats most at risk of exposure to spill responses and prioritize those areas for the development of site-specific response plans.
- Hungerford's crawling water beetle pupae likely inhabit damp sand along occupied streams in April – early May and mid-August – mid-October. Whenever feasible, avoid or minimize effects to this habitat type within the species' range during this time frame.

- If feasible considering the needed response, before installing any structures or conducting any instream work, including skimming or vacuuming, coordinate with USFWS to determine whether attempts to capture and remove Hungerford's crawling water beetle from the affected area may be warranted.

11.3 Fishes

11.3.1 Topeka Shiner (apply also to Topeka Shiner Critical Habitat

- Deploy and maintain booms in a way that minimizes disturbance of stream bottom, banks, riparian and aquatic vegetation.
- Where feasible, construct dikes, berms, construction barriers, pits, and trenches to avoid disrupting surface water connections between instream and off-channel habitats.
- Avoid or minimize creation and use of access points that disturb riparian vegetation or streambanks; avoid or minimize soil compaction.
- To avoid and minimize impacts to Topeka shiner related to in-water work within potentially inhabited streams, it is recommended to exclude fish from entering the Project Work Area for the duration of in-water work. The easiest way to address this issue is to use two standard seine nets to herd fish out of the area and to block fish movement into the area, while also allowing water to flow freely. Please contact Nick Utrup (nick_utrup@fws.gov) with any questions.

Step 1:

- Use two standard seine nets with a weighted bottom (e.g., lead line)
- Recommended Dimensions:
  - Knotless Seine with delta mesh (¼ inch mesh)
  - Floats on the top and weighted lead line on the bottom
  - 6 ft deep (or deeper for larger pools)
  - Long enough to reach across entire stream with plenty of excess
- Recommended net vendors
  - Memphis Net and Twine (https://www.memphisnet.net/)
  - Duluth Nets (https://duluthfishnets.com/)
  - Miller Net Company (https://millernets.com/)

Step 2:

- Attach a dowel to each end of the two seines and stretch each across the center of the Project Work Area (Fig. 17).

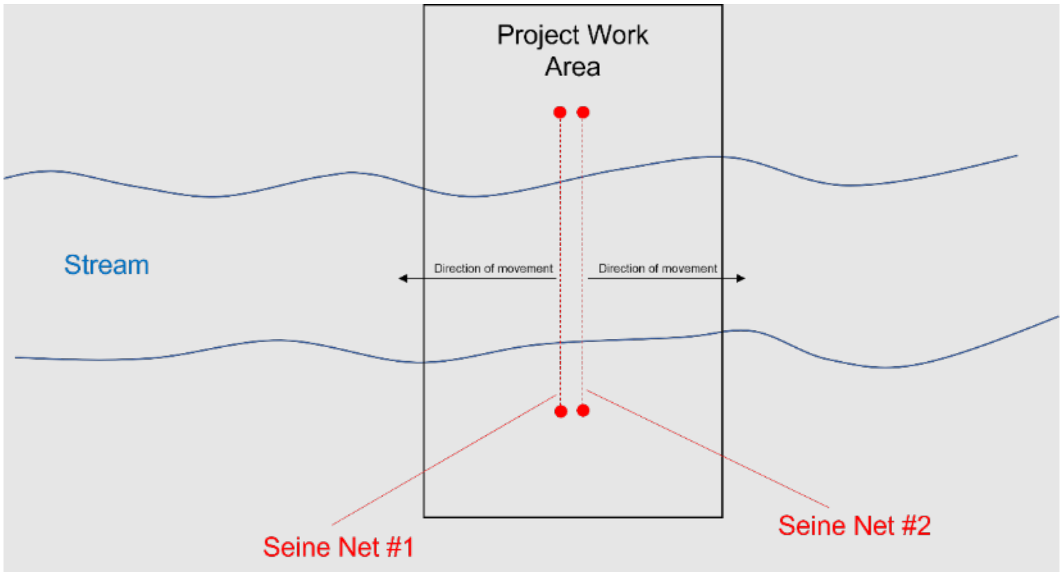

Figure 17. Diagram showing where to initially place the two seine nets and which direction to move them. The purpose is to herd potential fish out of the Project Work Area.

- Slowly move each seine in opposite directions, effectively herding all potential fish out of the Project Work Area. Make sure to keep the weighted lead line on the bottom of the stream to prevent fish from escaping. The process requires a person on each end of the seine (holding on to the dowel). It is helpful to have a third person in the stream making sure the net does not get hung up or become snagged (and keeping the weighted lead line on the stream bottom).

Step 3:

- Anchor each seine on either side of the Project Work Area to keep fish from entering the area for the duration of in-water work (Fig. 18).

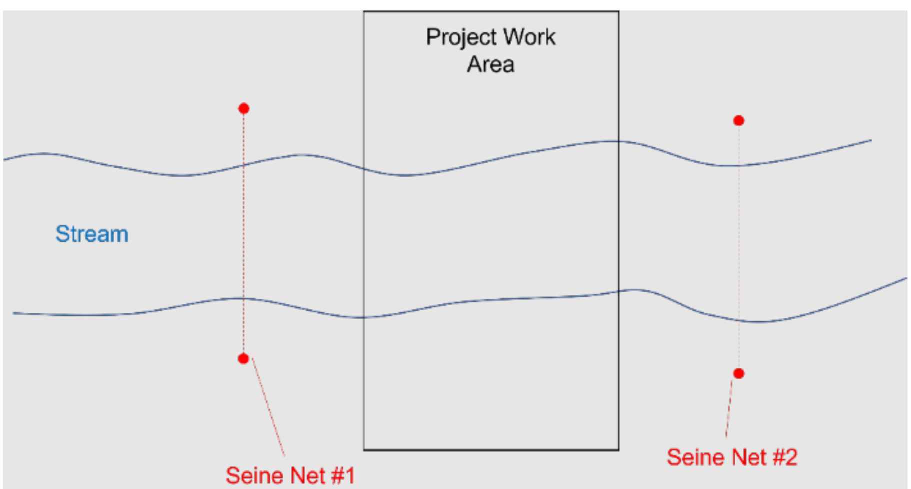

Figure 18. Diagram showing where to place the two seine nets after herding the potential fish out of the Project Work Area. Make sure each net is secured across the stream both upstream and downstream of the Project Work Area for the duration of the in-water work.

For the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

12 REINITIATION NOTICE

12.1 CONFERENCE

This concludes the conference for the salamander mussel and for salamander mussel critical habitat. You may ask USFWS to confirm the conference opinion as a biological opinion issued through formal consultation if the proposed species is listed or critical habitat is designated. The request must be in writing. If USFWS determines there have been no significant changes in the action as planned or in the information used during the conference, USFWS will confirm the conference opinion as the biological opinion for the project and no further section 7 consultation will be necessary. We recommend a similar process to confirm our continued concurrence with the determination of may affect, not likely to adversely affect for the tricolored bat if it is listed.

12.2 CONSULTATION

This concludes formal consultation on the Regional Response Team 5 (RRT5) Spill Response Program in the states of Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin (EPA Region 5). As provided in 50 CFR §402.16, reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this biological opinion or written concurrence; or (4) a new species is listed or critical habitat designated that may be affected by the action.

Please refer to the ECOSphere Project Number 2023-0129763 in future correspondence concerning this project. Should you require further assistance or if you have any questions, please contact Phil Delphey (phil_delphey@fws.gov; 612.713-5318).

12.3 POST-BIOLOGICAL OPINION COORDINATION

USFWS and the federal action agencies will coordinate regularly to ensure the consultation is updated as needed to respond to changes in the list of threatened and endangered species and critical habitats. This will occur as follows:

1. At least once every six months after completion of the biological opinion, USFWS will notify USCG and EPA of any changes to the list of proposed or listed species in the action area.
2. The action agencies determine whether any newly listed or proposed species or newly designated or proposed critical habitat may be affected by the spill response program. USFWS will assist the agencies with this determination, as requested.
3. If any newly listed species or newly designated critical habitat may be affected by the spill response program the agencies will request reinitiation of consultation. Whether the reinitiated consultation requires an update to the biological opinion or a

concurrence letter from USFWS will depend on whether adverse effects to the species or critical habitat are likely.

4. USFWS will follow regulatory timelines for completion of any necessary reinitiated consultation.

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