

MEMORANDUM | December 19, 2022

TO U.S. Fish and Wildlife Service (Service)
FROM Industrial Economics, Incorporated (IEc)
SUBJECT Draft Screening Analysis of the Likely Economic Impacts of the Proposed Rule to Designate Critical Habitat for the Salamander Mussel

The Service intends to publish a proposed rule to designate critical habitat for the salamander mussel (*Simpsonaias ambigua*). As part of the rulemaking process, the Service must consider the economic impacts, including costs and benefits, of the proposed rule in the context of three separate requirements:¹

- **Executive Order (E.O.) 12866 Regulatory Planning and Review**, which directs Agencies to assess the costs and benefits of the regulatory action;²
- **Section 4(b)(2) of the Endangered Species Act (the Act)**, which requires the Secretary of the Interior to consider economic impacts prior to designating critical habitat; and
- **Regulatory Flexibility Act**, which requires Federal agencies to prepare and make available for public comment an initial regulatory flexibility analysis that describes the effect of a proposed rule on small entities. No initial regulatory flexibility analysis is required if the head of the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities.^{3,4}

This memorandum provides information to the Service on the potential costs and benefits of the proposed critical habitat designation to determine whether the proposed rule meets the threshold for an economically significant rule.⁵ This memorandum also identifies the specific activities that could experience the greatest impacts, measured in terms of changes in social welfare, to inform the Secretary's decision under section 4(b)(2).⁶

¹ Additional laws and executive orders require the consideration of the distribution of impacts on vulnerable subpopulations, such as state or local governments. These requirements for distributional analysis are beyond the scope of this memorandum.

² Published September 20, 1993. As affirmed by E.O. 13563 on January 18, 2011.

³ 5 U.S.C. § 601 et seq.

⁴ For a discussion of the Service's findings regarding the Regulatory Flexibility Act (RFA) and other relevant statutes, please refer to the preamble to the proposed rule published in the Federal Register.

⁵ For the definition of "economically significant rule," please refer to section 3(f)(1) of E.O. 12866.

⁶ The discipline of welfare economics focuses on maximizing societal well-being (see Just et. al. 2005. *The Welfare Economics of Public Policy: A Practical Approach to Project and Policy Evaluation*. Edward Elgar Publishing, Cheltenham and Northampton). It measures costs and benefits in terms of the opportunity costs of employing resources for the conservation

To prepare this assessment, we rely on: (1) the Service's incremental effects memorandum (IEM); (2) geographic information systems (GIS) data layers identifying proposed critical habitat for the salamander mussel as well as the existing ranges of five similar listed mussel species; (3) consultation history for the aforementioned five species since 2013 compiled from the Service's Tracking And Integrated Logging System (TAILS) database; and (4) outreach to Federal agencies conducted by the Service.

of the species and individual willingness to pay to conserve those species. Opportunity cost is the value of the benefit that could have been provided by devoting the resources to their best alternative uses. Opportunity costs differ from the measurement of accounting costs (e.g., actual expenses). Welfare economics is recognized by the U.S. Office of Management and Budget (OMB) as the appropriate tool for valuing the costs and benefits of proposed regulatory actions (OMB, "Circular A-4." September 17, 2003).

FINDINGS OF THE SCREENING ANALYSIS

Critical habitat designation for the salamander mussel is unlikely to generate costs or benefits exceeding \$100 million in a single year. Therefore, the rule is unlikely to meet the threshold for an economically significant rule under E.O. 12866.

Section 7 Costs

The economic cost of implementing the rule through section 7 of the Act will most likely be limited to additional administrative effort to consider adverse modification of salamander mussel critical habitat during consultations and technical assistances. This finding is based on the following:

- All 37 proposed units are occupied by the salamander mussel, and occupied units are afforded significant baseline protection under the Act due to the presence of the listed species;
- All projects with a Federal nexus would be subject to section 7 consultation regardless of the designation of critical habitat due to the presence of the listed species;
- Critical habitat designation is not likely to change the Service's recommendations for project modifications as part of future consultations considering the salamander mussel; and
- The salamander mussel receives additional baseline protection from co-occurring listed species and a species with overlapping critical habitat and similar resource needs.

Based on past consultation activity in the areas proposed for critical habitat, the number of future consultations that will consider the salamander mussel is unlikely to exceed 4 formal consultations, 28 informal consultations, and 62 technical assistance efforts per year. The additional administrative cost of addressing adverse modification in these consultations is likely to be less than \$120,000 in a given year.

Other Costs

- The designation of critical habitat is not expected to trigger additional requirements under state or local regulations.
- In some cases, the designation of critical habitat may cause developers or landowners to perceive that private land will be subject to use restrictions or litigation from third parties, resulting in costs. However, the economics literature focused on this topic has not evaluated whether critical habitat designations for aquatic species affect property values.

Section 7 and Other Benefits

The primary intended benefit of the critical habitat designation is the biological benefit to the salamander mussel of increased support for its conservation and recovery. As this economic screening analysis finds that the designation is not likely to result in additional or different project modifications, ancillary economic benefits are not anticipated.

Distribution of Costs by Activity Type

The activities most likely to result in section 7 consultation related to critical habitat for the salamander mussel are associated with hydropower facilities, water control structures, resource extraction, industrial or municipal wastewater discharges, road construction, channel modifications for navigation and recreation, and large-scale instream habitat restoration. Responses from Federal action agencies suggest an increased rate of highway and other transportation infrastructure projects that would require consultation in the proposed critical habitat area.

Distribution of Costs by Geography

The location of future activities that will trigger section 7 consultations for the salamander mussel is uncertain. In recent years, consultation activity for other freshwater mussel species in the areas proposed for critical habitat were greatest in West Virginia, Pennsylvania, and Tennessee. It is unknown if the historical consultation information accurately characterizes the future distribution of costs.

SECTION 1. BACKGROUND^{7, 8, 9}

The salamander mussel (*Simpsonaias ambigua*) is a small freshwater mussel with thin, yellow or brown shells that reach approximately 48–51 mm (1.5–2 inches) long. The species relies on the common mudpuppy salamander (*Necturus maculosus*, hereafter “mudpuppy”) during its larval stage, making it the only known freshwater mussel species to use a non-fish host. Salamander mussel larvae are parasitic and consume nutrients from the mudpuppy’s body until reaching the juvenile stage. Because the salamander mussel has an obligate parasitic relationship with the mudpuppy, the salamander mussel’s survival is dependent on that of the mudpuppy.

The salamander mussel occupies small streams, large rivers, and lakes. Historically, the species has been found across 14 states (Arkansas, Illinois, Indiana, Iowa, Kentucky, Michigan, Minnesota, Missouri, New York, Ohio, Pennsylvania, Tennessee, West Virginia, and Wisconsin). The species populations are considered extirpated within Iowa (although the species is found within the Mississippi River along the eastern border of the State) and Lake Erie and severely diminished in Illinois.

The Service considers the following threats to be the primary risk factors for the salamander mussel: degradation of water quality due to contaminants, host vulnerability from the lack of regulation of collection of mudpuppies, and lack of connectivity due to barriers. Other threats include invasive species, impacts to the hydrologic regime, habitat degradation and loss due to urbanization and agriculture, and the lack of riparian buffers. Due to their limited mobility and use of mudpuppy hosts, it is unlikely that salamander mussels would disperse or shift their range in response to these habitat changes.

Pursuant to the Act, the Service concurrently proposes to list the salamander mussel as endangered and to designate critical habitat for the species. As part of the proposed rule, the Service proposes 37 occupied critical habitat units for the salamander mussel. The salamander mussel requires the following physical or biological features (PBFs):

- Adequate flows, or a hydrologic flow regime necessary to maintain benthic habitats where the species and host are found and stream connectivity;
- Suitable substrates and connected instream habitats, characterized by geomorphically stable stream channels and banks;
- Water and sediment quality necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages; and
- The presence and abundance of the mudpuppy necessary for recruitment of the salamander mussel.

⁷ Watson, E.T., Metcalfe-Smith, J.L., & Di Maio, J. (2001). COSEWIC status report on the Mudpuppy Mussel *Simpsonaias ambigua* in COSEWIC assessment and status report on the Mudpuppy Mussel *Simpsonaias ambigua* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa.

⁸ U.S. Fish and Wildlife Service. 2021. Species Status Assessment (SSA) Salamander Mussel (*Simpsonaias ambigua*), page 3.

⁹ U.S. Fish and Wildlife Service. Incremental Effect Memorandum for the Economic Analysis for the Proposed Rule to Designate Critical Habitat for the Salamander mussel, September 27, 2022. Pages 4-5.

Proposed critical habitat includes 2,012 stream miles within 37 units across 9 states. All units are currently occupied by the salamander mussel. As shown in Exhibit 1, approximately 308 stream miles (15 percent) are adjacent to Federal, state, county, or local government lands as well as land owned by non-governmental organizations (NGOs), while the remaining 1,704 stream miles (85 percent) are adjacent to private land.

Exhibit 2 depicts the full geographic extent of proposed critical habitat for the species. As demonstrated in the Exhibit, the proposed units of critical habitat are located in Indiana, Kentucky, Michigan, New York, Ohio Pennsylvania, Tennessee, West Virginia, and Wisconsin. The total stream miles proposed are distributed by state as follows¹⁰:

- **Indiana:** approximately 21 percent of total proposed critical habitat across eight proposed units.
- **Kentucky:** approximately 21 percent of total proposed critical habitat across seven proposed units.
- **Michigan:** approximately two percent of total proposed critical habitat across two proposed units.
- **New York:** approximately six percent of total proposed critical habitat across one proposed unit.
- **Ohio:** approximately two percent of total proposed critical habitat across two proposed units.
- **Pennsylvania:** approximately nine percent of total proposed critical habitat across three proposed units.
- **Tennessee:** approximately eight percent of total proposed critical habitat across two proposed units.
- **West Virginia:** approximately 11 percent of total proposed critical habitat across 5 proposed units.
- **Wisconsin:** approximately 21 percent of total proposed critical habitat across eight proposed units.

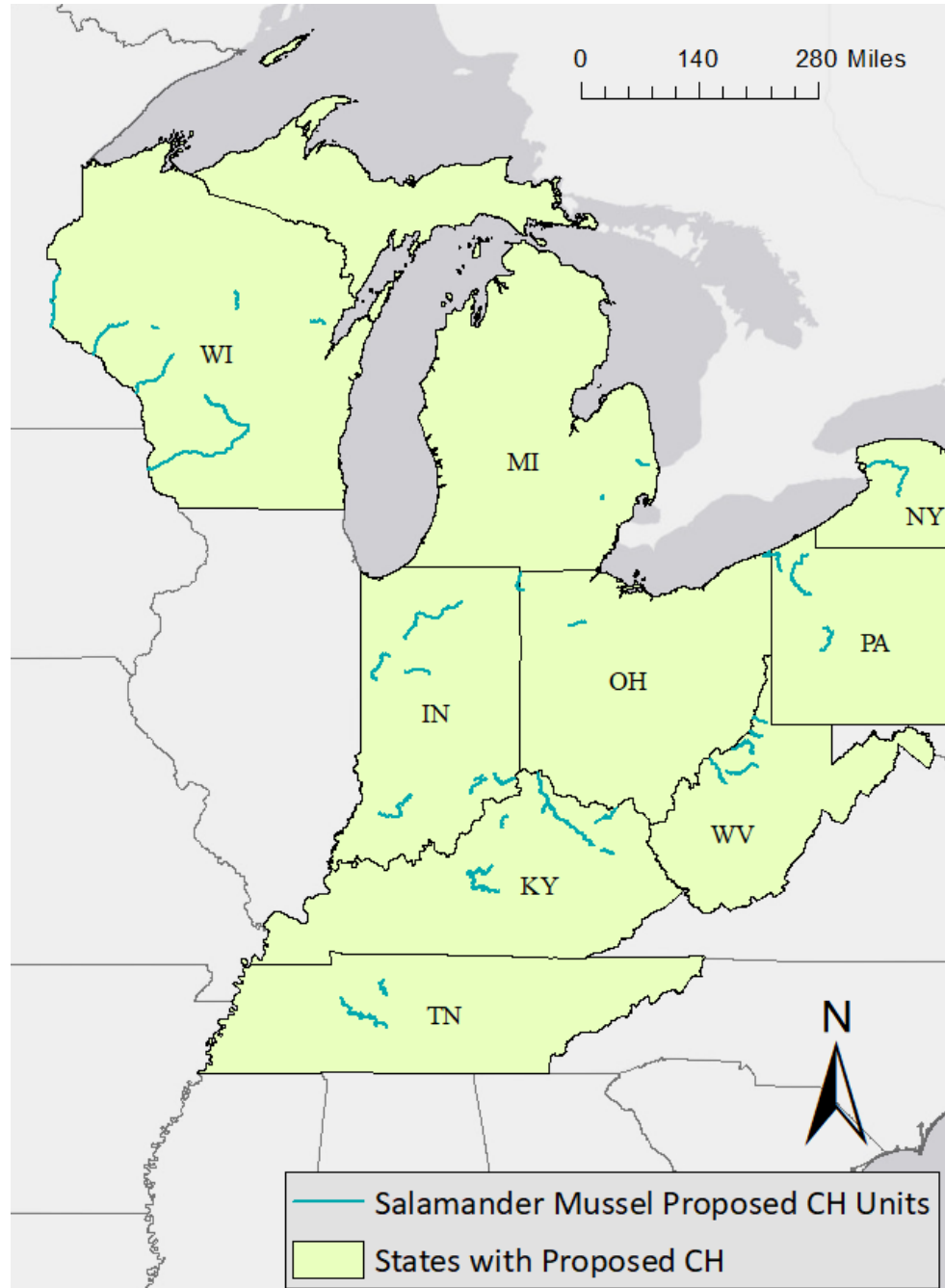
¹⁰ IEC calculations. Percentages sum to over 100 percent due to rounding.

EXHIBIT 1. SUMMARY OF PROPOSED CRITICAL HABITAT UNITS FOR THE SALAMANDER MUSSEL

UNIT NAME (STATE)	TOTAL LENGTH (STREAM MILES)	FEDERAL, STATE, COUNTY, LOCAL OR NGO ADJACENT (STREAM MILES)	PRIVATE LAND ADJACENT (STREAM MILES)	OVERLAP WITH EXISTING CRITICAL HABITAT FOR AQUATIC OR RIPARIAN SPECIES ¹ (STREAM MILES)
Blanchard River (OH)	25.02	0.94	24.08	
Clinton River (MI)	7.02	0.28	6.74	
Conneaut River (PA)	62.00	2.31	59.69	
Fish Creek (IN, OH)	37.37	1.02	36.34	5.53
Mill Creek (MI)	23.65	1.54	22.11	
North Branch Pensaukee River (WI)	19.93	1.24	18.69	
Tonawanda Creek (NY)	113.21	8.69	104.52	
Allegheny River (PA)	39.44	4.60	34.85	
Beech Fork River (KY)	50.39	1.99	48.40	
Big Pine Creek (IN)	51.23	1.30	49.93	
Drennon Creek (KY)	22.36	0	22.36	
East Fork White River (IN)	78.58	6.12	72.45	
Fish Creek (WV)	26.58	0	26.58	
Fishing Creek (WV)	23.32	0.13	23.19	
French Creek (PA)	74.37	5.83	68.54	74.37
Graham Creek (IN)	41.50	0	41.50	
Harpeth River (TN)	43.32	6.07	37.25	
Kinniconick Creek (KY)	51.01	0	51.01	
Laughery Creek (IN)	44.52	3.01	41.51	
Licking River (KY)	179.56	20.82	158.74	
Little Kanawha River (WV)	49.82	0	49.82	

UNIT NAME (STATE)	TOTAL LENGTH (STREAM MILES)	FEDERAL, STATE, COUNTY, LOCAL OR NGO ADJACENT (STREAM MILES)	PRIVATE LAND ADJACENT (STREAM MILES)	OVERLAP WITH EXISTING CRITICAL HABITAT FOR AQUATIC OR RIPARIAN SPECIES ¹ (STREAM MILES)
Middle Fork Wildcat Creek (IN)	35.70	0	35.70	
Middle Island Creek (WV)	62.25	0.15	62.10	
North Fork Living River (KY)	20.67	13.13	7.54	
Otter Creek (IN)	17.96	0	17.96	
Rolling Fork River (KY)	87.90	0	87.90	
South Fork Hughes River (WV)	57.44	0	57.44	
South Fork Licking River (KY)	18.26	0	18.26	
Tippecanoe River (IN)	124.25	7.43	116.83	28.14
Duck River (TN)	116.42	0.52	115.90	116.42
Black River (WI)	75.38	35.71	39.67	
Chippewa River (WI)	59.24	34.04	25.20	
Eau Claire River (WI)	7.40	4.23	3.17	
Lemonweir river (WI)	37.50	2.11	35.39	
St. Croix River (WI)	52.93	27.07	25.86	
Wisconsin River North (WI)	21.19	4.11	17.08	
Wisconsin River South (WI)	152.88	102.78	50.10	
TOTAL²	2,011.61	307.79	1,703.82	224.46
<p>Sources: 1) U.S. Fish and Wildlife Service. Incremental Effect Memorandum for the Economic Analysis for the Proposed Rule to Designate Critical Habitat for the Salamander mussel, September 27, 2022. Pages 6-8; 2) email communication with the Service on December 16, 2022.</p> <p>Notes:</p> <p>¹ The only other species with existing overlapping critical habitat is the rabbitsfoot mussel. Several other mussel species identified in the Service's IEM have overlapping <i>proposed</i> critical habitat.</p> <p>² Total stream miles may not sum due to rounding.</p>				

EXHIBIT 2. OVERVIEW OF PROPOSED CRITICAL HABITAT FOR THE SALAMANDER MUSSEL



Source: IEc map produced using (1) critical habitat shapefiles provided by the Service on September 27, 2022, (2) USA States shapefile from Esri; U.S. Department of Commerce, Census Bureau; U.S. Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), National Geodetic Survey (NGS), and (3) World Light Grey Canvas Base shapefile from Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community.

SECTION 2. FRAMEWORK

Guidelines issued by the U.S. Office of Management and Budget (OMB) for the economic analysis of regulations direct Federal agencies to measure the costs and benefits of a regulatory action against a baseline (i.e., costs and benefits that are “incremental” to the baseline). OMB defines the baseline as the “best assessment of the way the world would look absent the proposed action.”¹¹ In other words, the baseline includes any existing regulatory and socio-economic burden imposed on landowners, managers, or other resource users affected by the designation of critical habitat. The baseline includes the economic impacts of listing the species under the Act, even if the listing occurs concurrently with critical habitat designation. Impacts that are incremental to the baseline (i.e., occurring over and above existing constraints) are those that are solely attributable to the designation of critical habitat. This screening analysis focuses on the likely incremental effects of the critical habitat designation.

We consider incremental effects of the designation in two key categories: 1) those that may be generated by section 7 of the Act; and 2) other types of impacts outside of the context of section 7:

- **Incremental section 7 impacts:** Activities with a Federal nexus that may affect listed species are subject to section 7 consultation to consider whether actions may jeopardize the existence of the species, even absent critical habitat.¹² As part of these consultations, critical habitat triggers an additional analysis evaluating whether an action will diminish the recovery potential or conservation value of the designated area. Specifically, following the designation, Federal agencies must also consider the potential for activities to result in the destruction or adverse modification of critical habitat. These consultations are the regulatory mechanism through which critical habitat rules are implemented. Any time and effort spent on this additional analysis, as well as the costs and benefits of implementing any recommendations resulting from this review, are economic impacts of the critical habitat designation.
- **Other incremental impacts:** Critical habitat may also trigger additional regulatory or behavioral changes. For example, in some cases, a critical habitat designation may cause other Federal, state, or local regulatory agencies to expand or change standards or requirements. Regulatory uncertainty generated by critical habitat may also have impacts. For example, landowners or buyers may perceive that a critical habitat rule would restrict land or water use activities, and therefore value the use of the land less than they would have absent critical habitat. This is a perceptual, or stigma, effect of critical habitat on markets. The potential for this effect is described in further detail in Section 4.

¹¹ OMB, “Circular A-4,” September 17, 2003. Circular A-4 provides “guidance to Federal Agencies on the development of regulatory analysis as required under Section 6(a)(3)(c) of E.O. 12866...”, page 1.

¹² A Federal nexus exists for activities authorized, funded, or carried out by a Federal agency.

SECTION 3. SECTION 7 COSTS OF THE CRITICAL HABITAT RULE

Section 7 of the Act requires Federal agencies to consult with the Service to ensure that their actions will not jeopardize the continued existence of the salamander mussel regardless of whether critical habitat is designated. Thus, section 7 provides some baseline protection and generates baseline costs associated with conservation and recovery of the salamander mussel due to the species listing, regardless of whether critical habitat is designated. Once critical habitat is designated, section 7 additionally requires that Federal agencies ensure their actions will not adversely modify critical habitat. Thus, a key focus of this screening analysis is to determine the likelihood that the designation of critical habitat would trigger project modifications to avoid adverse modification that would be above and beyond any modifications triggered by adverse effects to the species itself.

This screening analysis finds that the incremental costs associated with section 7 consultations for the salamander mussel are likely limited to administrative costs. In other words, project modification recommendations to avoid adverse modification of critical habitat for the salamander mussel are not anticipated given other baseline protections of the habitat. Therefore, in all proposed units, the incremental costs of the proposed critical habitat rule are most likely limited to the additional effort to consider the adverse impacts on critical habitat for salamander mussel during section 7 consultations or technical assistance efforts. This conclusion is based on multiple factors:

- **The concurrent listing of the salamander mussel under the ESA provides substantial baseline protection.**
 - **All projects with a Federal nexus will be subject to section 7 consultation regardless of whether critical habitat is designated.** All 37 proposed units are occupied by the salamander mussel. According to the Service, “[b]ecause all of the units being proposed for designation as critical habitat are occupied, we do not expect that the critical habitat designation will result in any additional consultations.”¹³ That is, the nature of activities that may require section 7 consultation is not different with or without the critical habitat. As a result, designating critical habitat is not expected to result in additional consultations beyond those required due to the presence of the species.
 - **Critical habitat designation is not likely to change the Service’s recommendations for project modifications as part of future consultations considering the salamander mussel.** For future consultations in the proposed critical habitat area, the Service anticipates that the same kinds of conservation recommendations made to avoid jeopardy would also avoid adverse modification of critical habitat.¹⁴ the

¹³ U.S. Fish and Wildlife Service. Incremental Effect Memorandum for the Economic Analysis for the Proposed Rule to Designate Critical Habitat for the Salamander mussel, September 27, 2022. Page 53.

¹⁴ *Ibid*, Pages 52-53.

Service notes “[t]he conservation recommendations provided to address impacts to the occupied critical habitat will be the same as those recommended to address impacts to the species because the habitat tolerances of the Salamander Mussel are inextricably linked to the health, growth, and reproduction of the mussels, which are present year-round in their occupied streams. Furthermore, because the critical habitat and known species’ range are identical, any proposed action that would result in a finding of adverse modification of occupied habitat would also result in a finding of jeopardy to the species.”¹⁵ Thus, the outcome of these consultations is unlikely to be different with or without the designation of critical habitat. Because the salamander mussel is not currently listed, the Service considered its experience with other Federally listed freshwater mussels in making this determination.¹⁶

- **Species and habitat conservation efforts for co-occurring listed species and critical habitats provide baseline protection for the salamander mussel.** There are 26 freshwater mussels and three other aquatic species listed under the Act that occur within the salamander mussel’s proposed critical habitat.¹⁷ As a result, the Service states “the Salamander Mussel may receive some collateral benefits in areas of habitat overlap. For example, because free-flowing and stable river and stream habitats which contain good water quality are also essential for these aquatic species, their habitat requirements can help protect similar Salamander Mussel habitat needs.”¹⁸ The Service also notes that section 7 consultations considering these other mussel species would also consider the salamander mussel where there ranges overlap.¹⁹ In addition, approximately 11 percent of the salamander mussel’s proposed critical habitat overlaps with the rabbitsfoot’s designated critical habitat.²⁰

Accordingly, costs of section 7 consultations are likely to be limited to the additional administrative effort to evaluate the potential for adverse modification of salamander mussel critical habitat during the consultation process. The following sections provide information on the anticipated levels of consultation activity to gauge the potential magnitude of these administrative costs. First, we estimate future section 7 consultations for the salamander mussel based on historical consultation activity levels in areas proposed for critical habitat designation. We then summarize the associated

¹⁵ *Ibid*, Pages 52-53.

¹⁶ *Ibid*, Page 48.

¹⁷ *Ibid*, Page 38.

¹⁸ *Ibid*, Page 38.

¹⁹ Personal communication between IEc and the Service on October 17, 2022.

²⁰ U.S. Fish and Wildlife Service. Incremental Effect Memorandum for the Economic Analysis for the Proposed Rule to Designate Critical Habitat for the Salamander mussel, September 27, 2022. Page 5. See also Exhibit 1 of this memorandum.

costs of these incremental administrative efforts. This analysis finds that incremental administrative costs are unlikely to exceed \$120,000 in a given year. The section concludes with a description of the likelihood of project modification costs.

EXPECTED FUTURE CONSULTATIONS

The Service anticipates that projects associated with hydropower facilities, water control structures, resource extraction, industrial or municipal wastewater discharges, road construction, channel modification for navigation and recreation, and large-scale instream habitat restoration will have a Federal nexus and require section 7 consultation that considers salamander mussel critical habitat in the future.²¹ However, the *number* of potential consultations that may arise from projects or activities with a Federal nexus is uncertain. In developing its IEM, the Service conducted outreach to Federal agencies likely to consult on projects or activities in the proposed critical habitat. The Minnesota, Michigan, and Ohio Departments of Transportation (DOT) all described projects that may occur over the next 10 years within the salamander mussel's proposed critical habitat. The letters from the DOTs mentioned plans for eight bridge-related projects in Minnesota, six bridge-related projects in Michigan, 20 bridge-related projects in Ohio, and 20 paving and striping projects in Ohio that may require instream work.²² These three agencies are unlikely to be the only Federal agencies to consult within proposed critical habitat for the salamander mussel therefore the information they provide, while instructive, is insufficient to develop a comprehensive consultation and technical assistance forecast.

Instead, this analysis considers historical consultation and technical assistance activity levels that considered five mussel species (hereafter "proxy species") with similar ranges and habitat needs to the salamander mussel: the Higgin's eye (*lampsilis higginsii*), snuffbox mussel (*epioblasma triquetra*), winged mapleleaf (*quadrula fragosa*), sheepnose (*plethobasus cyphus*), and rabbitsfoot (*quadrula cylindrica cylindrica*).²³ These proxy species were chosen by the Service because they are broadly representative of the range of the salamander mussel and have similar resource needs.²⁴ Exhibit 3 presents the number of consultations and technical assistances that considered any of the proxy species between 2013 and 2021. All the historical consultations considered in this analysis occurred near the salamander mussel's proposed critical habitat (see Appendix A).

²¹ *Ibid*, page 52.

²² Email communication between Minnesota DOT's Office of Environmental Stewardship and the Service on February 24, 2022; email communication between Michigan DOT and the Service, undated; and email communication between Ohio DOT and the Service on February 23, 2022.

²³ Historical consultation information is documented in the Service's TAILS database. The Service provided IEc with this information via email communication on September 27, 2022.

²⁴ Personal communication between IEc and the Service on October 17, 2022.

EXHIBIT 3. HISTORICAL CONSULTATIONS FOR HIGGINS EYE, SNUFFBOX, WINGED MAPLELEAF, SHEEPNOSE, AND RABBITSFOOT (“PROXY” SPECIES)

YEAR	FORMAL CONSULTATIONS	INFORMAL CONSULTATIONS	TECHNICAL ASSISTANCES ¹
2013	1	0	0
2014	0	0	0
2015	0	0	0
2016	0	1	0
2017	1	5	6
2018	0	8	9
2019	0	5	22
2020	1	3	15
2021	0	10	16
TOTAL	3	32	68
AVERAGE/YR	0.3	3.6	7.6
MAX/YR	1	10	22

Source: Historical consultation information documented in the Service’s TAILS database and provided by the Service via email communication on September 27, 2022.
Note: ¹Information-for-Planning-and-Consultation (IPaC) generated species lists are not included in the counts of technical assistance efforts. All other species lists included in TAILS are included in this count.

GIS analysis identifies 1,066 stream miles (53% of the total proposed critical habitat) in 20 proposed units for the salamander mussel overlapping with the ranges of the five proxy species.²⁵ To forecast future consultation activity in the remaining proposed units, this analysis calculates and applies an estimated rate of consultations per stream mile for the five proxy species in the overlap area to the remaining proposed units for the salamander mussel. Given the uncertainty in future consultation rates, we offer both low-end and high-end scenarios.

For the low-end scenario, we forecast future consultations based on the maximum number of historical consultations in a given year provided in the TAILS data: 1 formal consultation, 10 informal consultations, and 22 technical assistances (see Exhibit 3). Accordingly, we calculate the rate of consultation activities per stream mile by dividing these numbers by the salamander mussel’s total overlapped proposed critical habitat. Per stream mile, the anticipated consultation rates are 0.00094 formal consultations, 0.0094 informal consultations, and 0.021 technical assistance efforts.²⁶ Applying this

²⁵ U.S. Fish and Wildlife Service. “Current Range for All Listed Species” GIS Layer. Accessed in October 2022.

²⁶ This assessment calculates a rate of historical consultations per stream mile across the entire area instead of by state given the low volume and limited spatial coverage of consultations across the analysis timeframe. For instance, only three states have been the site of formal consultations, four of informal consultations, and four for technical assistances. It is uncertain whether this historical geographic distribution will be representative of the future geographic

rate, we calculate the low-end annual number of formal consultations, informal consultations, and technical assistances across all proposed units for the salamander mussel to be approximately two, 19, and 41, respectively (see Exhibit 4). Though we call this scenario a “low-end” to distinguish it from our high-end scenario, it is still conservative (i.e., more likely to overstate than understate costs) because it considers the maximum number of historical consultations in a given year.

EXHIBIT 4. CONSULTATION AND TECHNICAL ASSISTANCE FORECAST CALCULATION FOR SALAMANDER MUSSEL PROPOSED CRITICAL HABITAT

	FORMAL CONSULTATIONS	INFORMAL CONSULTATIONS	TECHNICAL ASSISTANCES
Maximum annual historical number from proxy species in TAILS ¹	1	10	22
Total overlap between ranges for the five proxy species and salamander mussel proposed critical habitat (stream miles) ²	1,066		
Historical consultation rate per stream mile per year ³	0.00094	0.0094	0.021
Total salamander mussel proposed critical habitat (stream miles) ⁴	2,012		
LOW-END ANNUAL CONSULTATION ESTIMATE FOR THE SALAMANDER MUSSEL⁵	2	19	41
HIGH-END ANNUAL CONSULTATION ESTIMATE FOR THE SALAMANDER MUSSEL⁶	4	28	62
<p>Sources: (a) Historical consultation information documented in the Service’s TAILS database and provided by the Service via email communication on September 27, 2022. (b) proposed critical habitat for the salamander mussel identified using shapefiles provided by the Service on September 27, 2022. (c) the Service’s “Current Range for All Listed Species” GIS layer, accessed in October 2022.</p> <p>Notes:</p> <ol style="list-style-type: none"> 1. See Exhibit 3. 2. Represents the total stream miles of listed species ranges for the five proxy species that overlap salamander mussel proposed critical habitat. 3. Calculated by dividing maximum estimate from TAILS by total overlap with salamander mussel (e.g., $1/1066 = 0.00094$). Estimates are rounded to two significant digits. 4. See Exhibit 1. 5. Calculated by multiplying the rate per stream mile by total salamander mussel proposed critical habitat (e.g., $0.0094 \times 2,009.6$ is approximately 19 annual consultations). Estimates are rounded to the nearest whole number. 6. Calculated by doubling the number of formal consultations and adding 50 percent to the low-end number of informal consultations and technical assistances to account for a potential uptick in highway and infrastructure spending (e.g., $19 + (19 * 0.5)$ is approximately 28 annual informal consultations). Estimates are rounded to the nearest whole number. 			

distribution, particularly since the area proposed for salamander mussel habitat is greater than the area of the proxy species’ ranges. See Section 5 of this memorandum for more details.

Responses to the Service from the Minnesota DOT and Michigan DOT indicate a potential increase in highway and infrastructure projects in the near future relative to the past.²⁷ To account for this potential increase in projects, we offer an illustrative high-end consultation forecast by doubling the number of formal consultations (given most highway and other transportation infrastructure projects trigger formal consultations) and increasing our low-end informal consultation and technical assistance forecasts by 50 percent.²⁸ Accordingly, the high-end annual number of formal consultations, informal consultations, and technical assistances across all proposed units for the salamander mussel are approximately four, 28, and 62, respectively (see Exhibit 4).

ADMINISTRATIVE COSTS OF SECTION 7 CONSULTATIONS

The cost associated with a section 7 consultation varies by both type of consultation as well as whether the consultation considers adverse modification, jeopardy, or both. Exhibit 5 presents the per-consultation administrative costs, including 1) the total cost of consultations that consider both jeopardy and adverse modification and 2) the incremental cost of effort to consider adverse modification in a consultation that also considers jeopardy. In this analysis we apply the costs associated with additional effort to consider adverse modification to the consultation forecast.

The incremental costs to consider critical habitat as part of technical assistance efforts, informal consultations, and formal consultations total \$420, \$2,600, and \$5,400, respectively, across all participating parties (2022 dollars). These estimates assume that consultations would occur even in the absence of critical habitat due to the presence of the listed species in the proposed critical habitat areas. The fraction of the total consultation costs relevant to this analysis reflect the fraction of time focused specifically on consideration of adverse modification.

²⁷ Email communication between Minnesota DOT's Office of Environmental Stewardship and the Service on February 24, 2022; email communication between Michigan DOT and the Service, undated.

²⁸ The information contained in letters from Minnesota DOT and Michigan DOT did not offer a multiplier for use in our assessment. The high-end scenario is illustrative.

EXHIBIT 5. RANGE OF ADMINISTRATIVE CONSULTATION COSTS PER EFFORT (2022 USD)

CONSULTATION TYPE	SERVICE	FEDERAL AGENCY	THIRD PARTY	BIOLOGICAL ASSESSMENT	TOTAL COSTS
TOTAL COST OF CONSULTATION CONSIDERING BOTH JEOPARDY AND ADVERSE MODIFICATION					
Technical Assistance	\$640	N/A	\$1,100	N/A	\$1,700
Informal	\$2,800	\$3,500	\$2,100	\$2,000	\$10,000
Formal	\$6,300	\$7,100	\$3,500	\$4,800	\$22,000
Programmatic	\$19,000	\$16,000	N/A	\$5,600	\$40,000
ADDITIONAL EFFORT TO ADDRESS ADVERSE MODIFICATION IN A NEW CONSULTATION					
Technical Assistance	\$160	N/A	\$260	N/A	\$420
Informal	\$700	\$880	\$510	\$500	\$2,600
Formal	\$1,600	\$1,800	\$880	\$1,200	\$5,400
Programmatic	\$4,700	\$3,900	N/A	\$1,400	\$10,000
Source: IEc analysis of administrative costs is based on data from the Federal Government Schedule Rates, Office of Personnel Management, 2022, and a review of consultation records from several Service field offices across the country conducted in 2002.					
Notes:					
1. Estimates are rounded to two significant digits and may not sum to the totals reported due to rounding.					
2. Estimates reflect average hourly time required by staff.					

Based on the average annual rate of consultations described in Exhibit 4 and the values presented in Exhibit 5, this analysis finds that the incremental administrative costs of consultation are unlikely to exceed \$120,000 in a given year (undiscounted, 2022 dollars), including \$20,000 for formal consultations, \$73,000 for informal consultations, and \$26,000 for technical assistance efforts. In both the low-end and high-end scenarios, informal consultations compose over 60 percent of the additional administrative costs associated with the proposed rule.

EXHIBIT 6. TOTAL ANNUAL INCREMENTAL ADMINISTRATIVE SECTION 7 CONSULTATION COSTS FOR THE SALAMANDER MUSSEL PROPOSED CRITICAL HABITAT (2022 USD)

CONSULTATION TYPE	LOW-END	HIGH-END
Formal consultations	\$10,000	\$20,000
Informal consultations	\$49,000	\$73,000
Technical assistances	\$18,000	\$26,000
Total	\$77,000	\$120,000
Sources: Data described in Exhibit 4 and Exhibit 5. See Exhibit 4 and the main text for definitions of “low-end” and “high-end” consultation forecasts.		
Note: We use unrounded consultation counts and costs per consultation action to estimate the administrative costs associated with the rule. Final estimates are rounded to two significant digits and may not sum to the total reported due to rounding.		

PROJECT MODIFICATION COSTS

The Service describes several possible project modifications it would suggest to avoid jeopardy: relocating project activities, reducing the amount of area impacted (e.g., spanning the stream with a bridge or bottomless/arch culvert), requiring strict pollution control methods (e.g., tertiary treatment, increased monitoring), or requiring flow alteration (e.g., flows and temperatures that closely mimic natural regimes).²⁹ As described earlier in this section, the Service anticipates suggesting the same project modifications to avoid adverse modification of critical habitat. In other words, the Service would request the same conservation measures during section 7 consultations regardless of whether critical habitat was designated. Therefore, no project modification costs are anticipated for the proposed critical habitat rule.

SECTION 4. OTHER COSTS OF THE CRITICAL HABITAT RULE

This section discusses the potential for incremental costs to occur outside of the section 7 consultation process. These types of costs include triggering additional requirements or project modifications under state laws or regulations, and perceptual effects on markets. These types of costs may occur even when activities do not have a Federal nexus for consultation.

ADDITIONAL STATE OR LOCAL REGULATION

Indirect incremental impacts may occur if the designation of critical habitat increases awareness of the presence of the species or the need for protection of its habitat, particularly when new regulations or requirements are triggered. The Service does not expect additional state or local regulations to be triggered by the designation of critical habitat for the salamander mussel.³⁰

POSSIBLE IMPACTS OF PUBLIC PERCEPTION

Existing economics literature suggests that critical habitat may affect property values.³¹ This literature references particular species and geographic contexts, and the transferability of the results to other species and regions is uncertain. Similarly, comments received regarding proposed designations of critical habitat in various locations throughout the United States indicate that the public perceives critical habitat designation as potentially resulting in incremental changes to private property values, above and beyond any effects associated with specific forecast project modifications

²⁹ U.S. Fish and Wildlife Service. Incremental Effect Memorandum for the Economic Analysis for the Proposed Rule to Designate Critical Habitat for the Salamander mussel, September 27, 2022. Page 49-50.

³⁰ Personal communication with the Service on October 17, 2022.

³¹ These studies include analysis of the cactus ferruginous pygmy owl in Arizona (List, John A., Michael Margolis, and Daniel E. Osgood. 2006. *Is the Endangered Species Act Endangering Species?* National Bureau of Economic Research Working Paper Series) as well as the red-legged frog and the Bay checkerspot butterfly in California (Auffhammer, Maximilian, May Duru, Edward Rubin, and David L. Sunding. 2020. "The Economic Impact of Critical Habitat-Designation: Evidence from Vacant-Land Transaction" *Land Economics*, 96(2): 188-206).

under section 7 of the Act.³² These commenters suggest that, all else being equal, a property that is inhabited by a threatened or endangered species, or that lies within a critical habitat designation, will have a lower market value than an identical property that is not inhabited by the species or that lies outside of critical habitat. This lower value results from the perception that critical habitat will preclude, limit, or slow development, or somehow alter the highest and best use of the property. This perception results from regulatory uncertainty.

Public attitudes about the limits and costs that the Act may impose can cause real economic effects to the owners of property, regardless of whether such limits are actually imposed. Over time, as public awareness of the regulatory burden placed on designated lands grows, particularly where no Federal nexus compelling a section 7 consultation exists, the effect of critical habitat designation on properties may subside.

As a riverine species, the salamander mussel does not occur on land, and the literature has not evaluated effects of riverine critical habitat on property values. While perceptual effects on land values are possible, the likelihood and magnitude of such effects for this proposed rule are uncertain.

SECTION 5. GEOGRAPHIC DISTRIBUTION OF SECTION 7 AND OTHER COSTS

The geographic distribution of future section 7 consultations and associated costs are uncertain. Of the nine states with proposed critical habitat, only eight of the states have proposed critical habitat that overlaps with the ranges of the five proxy species (all but New York), and only five of the states (Kentucky, Pennsylvania, Tennessee, West Virginia, and Wisconsin) were the sites of historical section 7 consultations. Even within the five states with consultation history, there are areas of proposed salamander mussel critical habitat that do not overlap with the ranges of the proxy species.

If historical consultation information for the proxy species is a good indicator of the future geographic distribution of section 7 consultations that consider salamander mussel critical habitat, then most future consultations are expected to occur in West Virginia, Pennsylvania, and Kentucky (see Exhibit 7). It is unknown if this historical consultation information accurately characterizes the future distribution of costs.

³² See, for example, public comments on the possible impact of designating private lands as critical habitat for the Northern spotted owl (as summarized in Industrial Economics, Incorporated. Economic Analysis of Critical Habitat Designation for the Northern Spotted Owl: Final Report. Prepared for the U.S. Fish and Wildlife Service. November 20, 2012. p.5-21) and the cactus ferruginous pygmy owl (as summarized in Industrial Economics, Incorporated. Economic Analysis of Critical Habitat Designation for the Cactus Ferruginous Pygmy-Owl. Prepared for the U.S. Fish and Wildlife Service. June 1999. p.44).

EXHIBIT 7. GEOGRAPHIC DISTRIBUTION OF ALL HISTORICAL SECTION 7 CONSULTATIONS THAT CONSIDERED THE “PROXY” MUSSEL SPECIES BETWEEN 2013-2021

STATE	FORMAL CONSULTATIONS	INFORMAL CONSULTATIONS	TECHNICAL ASSISTANCES
Indiana	0	0	0
Kentucky	0	2	15
Michigan	0	0	0
New York ¹	N/A	N/A	N/A
Ohio	0	0	0
Pennsylvania	1	8	7
Tennessee	1	2	0
West Virginia	0	20	36
Wisconsin	1	0	10

Sources: (a) Historical consultation information documented in the Service’s TAILS database and provided by the Service via email communication on September 27, 2022, (b) proposed critical habitat for the salamander mussel identified using shapefiles provided by the Service on September 27, 2022, and (c) the Service’s “Current Range for All Listed Species” GIS layer, accessed in October 2022.

Notes: 1) New York is considered N/A because it does not contain proposed critical habitat that overlaps with the ranges of the five proxy species. 2) The five rows with gray shading denote the states with any historical consultation history for the five proxy species.

SECTION 6. SECTION 7 AND OTHER ECONOMIC BENEFITS

The primary intended benefit of critical habitat is to support the conservation of threatened and endangered species, such as the salamander mussel. Quantification and monetization of species conservation benefits requires information on: (1) the incremental change in the probability of conservation of the salamander mussel that is expected to result from the designation; and (2) the public’s willingness to pay for such beneficial changes. Additional efforts to conserve the salamander mussel are not predicted. As the designation is unlikely to result in additional or different project modifications, ancillary economic benefits are not anticipated.

SECTION 7. SUMMARY

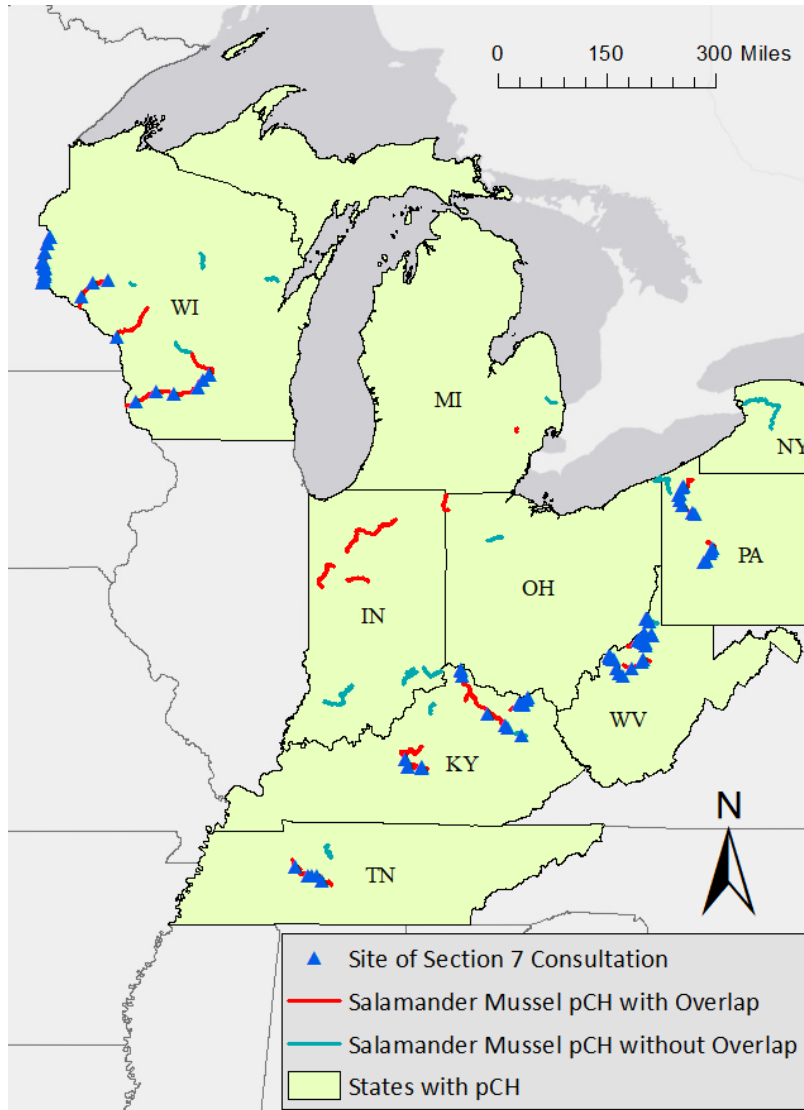
In conclusion, the incremental costs of designating critical habitat for the salamander mussel are likely to be limited to additional administrative effort to consider adverse modification in consultations for the species. This finding is based on several factors, including:

1. All 37 proposed units are considered occupied by the salamander mussel, and occupied units are afforded significant baseline protection under the Act due to the presence of the listed species;

2. All projects with a Federal nexus would be subject to section 7 consultation regardless of the designation of critical habitat due to the presence of the listed species;
3. Critical habitat designation is not likely to change the Service's recommendations for project modifications as part of future consultations considering the salamander mussel; and
4. The salamander mussel receives additional baseline protection from co-occurring listed species and a species with overlapping critical habitat and similar resource needs.

The incremental administrative burden is not anticipated to reach \$100 million in any given year based on the anticipated annual number of consultations and associated consultations costs, which are not expected to exceed \$120,000.

APPENDIX A. MAP OF THE SALAMANDER MUSSEL'S PROPOSED CRITICAL HABITAT AND HISTORIC CONSULTATIONS FOR THE FIVE PROXY SPECIES



Sources: (a) Historical consultation information documented in the Service's TAILS database and provided by the Service via email communication on September 27, 2022, (b) proposed critical habitat for the salamander mussel identified using shapefiles provided by the Service on September 27, 2022, and (c) the Service's "Current Range for All Listed Species" GIS layer, accessed in October 2022.

Note: This map illustrates that all historical consultation actions used in developing forecasts of future consultation activity occur within or near the proposed critical habitat for the salamander mussel that overlaps with the ranges of the five proxy species. We identified which proposed critical habitat was overlapped by the proxy species' ranges by conducting spatial analysis with sources (b) and (c) listed above.