BEFORE THE SECRETARY OF THE INTERIOR

PETITION TO PROTECT THE BIRMINGHAM DARTER (*ETHEOSTOMA BIRMINGHAMENSE*) UNDER THE ENDANGERED SPECIES ACT AND TO CONCURRENTLY DESIGNATE CRITICAL HABITAT

Credit: Dr. Bernie Kuhajda.

CENTER FOR BIOLOGICAL DIVERSITY

13 November 2025

NOTICE OF PETITION

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PETITIONER

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Pursuant to Section 4(b) of the Endangered Species Act ("ESA"), 16 U.S.C. § 1533(b); Section 553(e) of the Administrative Procedure Act ("APA"), 5 U.S.C. § 553(2); and 50 C.F.R. § 424.14(a), the Center for Biological Diversity hereby petitions the Secretary of the Interior, through the United States Fish and Wildlife Service ("FWS" or "Service"), to protect the Birmingham darter (*Etheostoma birminghamense*) as a threatened or endangered species under the ESA.

FWS has jurisdiction over this petition. This petition sets in motion a specific process, placing definite response requirements on the Service. Specifically, the Service must issue an initial finding as to whether the petition "presents substantial scientific or commercial information indicating that the petitioned action may be warranted." 16 U.S.C § 1533(b)(3)(A). FWS must make this initial finding "[t]o the maximum extent practicable, within 90 days after receiving the petition." *Id.* If FWS makes a positive initial finding, it must then determine within 12 months after receiving the petition whether the petitioned action is warranted, and if so, the Secretary shall "promptly" propose to implement the listing action with a general notice. 16 U.S.C. § 1533(b)(3)(B). Finally, the Secretary shall finalize the regulation to implement their listing determination "within the one-year period beginning on the date on which general notice is published." 16 U.S.C. § 1533(b)(6)(A). The petitioner also requests that critical habitat be designated for the Birmingham darter concurrently with the species being listed, pursuant to 16 U.S.C. § 1533(a)(3)(A) and 50 C.F.R. § 424.12. References cited in this petition will be available at the following link: https://diversity.box.com/s/z21oieo3qt2bmgnewoeo99a60nsxmcl6.

The **Center for Biological Diversity ("Center")** is a nonprofit, public interest environmental organization dedicated to the protection of imperiled species and the habitat and climate they need to survive through science, policy, law, and creative media. The Center is supported by more than 1.7 million members and supporters across the country. The Center works to secure a future for all species, great and small, hovering on the brink of extinction. The Center submits this petition on its own behalf and on behalf of its members and staff with an interest in protecting the Birmingham darter and its habitat.

Additional petitioners and supporters include **Alabama Rivers Alliance**, **Black Warrior Riverkeeper**, and **The People's Justice Council.**

Alabama Rivers Alliance is a statewide network of groups working to protect and restore all of Alabama's water resources through building partnerships, empowering citizens, and advocating for sound water policy and its enforcement.

Black Warrior Riverkeeper's mission is to protect and restore the Black Warrior River and its tributaries. We are a citizen-based nonprofit organization dedicated to promoting clean water for

the sake of public health, recreation, and wildlife habitat throughout our patrol area, the Black Warrior River watershed. This vital river basin is entirely contained within Alabama, America's leading state for freshwater biodiversity.

The People's Justice Council is a faith-based group of public theologians from various faith traditions who operate at the intersectionality of justice through interdisciplinary methods. They engage and equip communities with tools to build power from the grassroots up and to fight for justice at the policy level.

Submitted this 13 of November 2025.

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EXECUTIVE SUMMARY

The Birmingham darter (*Etheostoma birminghamense*) is a newly-described member of the vermilion darter (*E. chermocki*) species complex, a six-species group of microendemic snubnose darters endemic to the Black Warrior River system in north-central Alabama. These small, colorful fish dwell in streams flowing over carbonate rock and can be distinguished from other members of the species complex by morphological, genetic, and geographic separation. Birmingham darters, the southernmost members of the *E. chermocki* complex, are only known from six populations, all within Valley Creek or its tributaries in Jefferson County, Alabama.

Unfortunately, this two-inch-long fish faces massive, imminent threats to its survival. The formerly robust Fivemile Creek population is now believed to be either extirpated or greatly reduced as a result of ongoing limestone quarrying, and the Little Blue Creek population is presently imperiled by the proposed construction of a hyperscale data center near Bessemer, Alabama. This data center project is perilously close to approval by the Bessemer City Council. This population is considered fairly robust at present—its loss would be devastating for Birmingham darter viability. However, there is no evidence that the developers of the proposed Bessemer data center plan to take any steps to prevent harm to this creek or its native fauna.

In addition to the immediate and severe threat of the proposed data center at Little Blue Creek and the continued quarrying of limestone at Fivemile Creek, these tiny fish are threatened by at least three ESA listing factors: habitat loss and degradation due to groundwater depletion, urbanization, and pollution; inadequate and often poorly enforced state and federal regulatory mechanisms which continue to permit discharge of pollutants and overconsumption of water for industrial uses; and other factors including climate change-induced drought and extreme weather events, a small geographic range, and a limited ecological niche. The Birmingham darter faces immediate threats to its continued existence and must be protected under the provisions of the Endangered Species Act to ensure its populations do not suffer irreparable harm or loss within the next few years.

INTRODUCTION

The southeastern United States has the most biodiverse temperate aquatic ecosystems in the world. In particular, the state of Alabama's 132,000 miles of rivers and streams harbor 27 percent of all North American freshwater fish species, along with the highest diversity of mussels, crayfishes, snails, and turtles in the country (GSA 2025). Unfortunately, Alabama's rich biodiversity sits in stark contrast with a lackluster track record for conservation. The state ranks second in the country for extinctions, losing only to Hawai'i (NatureServe 2002, 7), with around 100 extinctions since colonial times (Liles 2025). The Coosa River in Alabama is often cited as the largest modern extinction event in the country, with 40 species extirpated by dam construction (Raines 2013). There are currently more than 120 Alabama species listed as federally threatened or endangered under the Endangered Species Act, many of them freshwater fishes and invertebrates (USFWS ECOS).

The Black Warrior River is one of only two watersheds completely contained within Alabama's state boundaries. It drains an area of 6,392 sq. miles, including the city of Birmingham, and makes up most of the densely-populated Jefferson County. The region is rich in mineral resources and has been extensively mined for coal, limestone, iron ore, sand, and gravel for over 150 years. Both mining and industry have left their mark on the watershed and continue to influence the economy and environment (BWCWP n.d., 53).

The newly described Birmingham darter (*Etheostoma birminghamense*) is a microendemic darter found only within the Valley Creek system, a tributary of the Black Warrior River, where it occupies rare and precious reaches of stream flowing over carbonate rock. These small fish are gravely imperiled. Valley Creek and many of its tributaries are heavily developed and impacted by industrialization, and upper Valley Creek—where these darters live—has been designated as one of the lowest-quality waterway types by Alabama due to the impacts of urbanization and pollution. Two significant threats—an active quarrying operation and a proposed hyperscale data center—are distinguished here as being of greatest concern for the species.

The quarry has been in operation for decades, despite a period of time in the early 2000s where its activity caused sinkholes all along a nearby creek and dewatered sections of the creek for months. The quarry committed numerous violations for sedimentation of the water and unacceptable pH of water outflowing from the quarry pit. This site, once home to a robust population of Birmingham darters, is now believed to harbor very few individuals. The proposed hyperscale data center would be a four-million-square-foot campus on the headwaters of a creek where Birmingham darters were recently discovered, subjecting darter populations to years of construction and sedimentation followed by numerous potential impacts once the data center is up and running, including water scarcity and effluent discharge. The developers have done environmental assessments, but refuse to release those results to the public. In addition to these two specific stressors, Birmingham darters are broadly threatened by a small range and specific

habitat niche; urbanization and pollution; and inadequate state regulatory mechanisms which have a track record of failing to address pollution in riparian systems.

USFWS has already listed eight Alabama darters as threatened or endangered under the Endangered Species Act, many of them for threats similar to those now faced by the Birmingham darter. The closely-related vermilion darter (*E. chermocki*) was listed in 2001 in part for threats to its habitat due to development of the surrounding land and siltation of the water. Without protections for the Birmingham darter and its limited remaining habitat, this tiny fish will go extinct.

BIOLOGY

I. TAXONOMY

Kingdom: Animalia
Phylum: Chordata
Class: Teleostei
Order: Perciformes
Family: Percidae
Genus: *Etheostoma*
Subgenus: *Ulocentra*

Species: *Etheostoma birminghamense*
Birmingham darter

The Birmingham darter (*Etheostoma birminghamense*) is a highly imperiled member of the subgenus *Ulocentra* (snubnose darters), a group of more than 20 freshwater fishes spread amongst creeks and tributaries of river systems in the Southeastern United States.

Birmingham darters are one member of a six-species snubnose darter clade known as the vermilion darter (*Etheostoma chermocki*) species complex or species group (see Clabaugh et al. 1996 and Brownstein et al. 2025). The resolution of this complex has taken decades of work and has passed through many pairs of hands. The six species within have ultimately been distinguished from each other on the basis of phylogenomic, phenotypic, and geographic differences which create a compelling argument in favor of their continued recognition as distinct species.

Boschung et al. (1992) first described *E. chermocki* from within the "Warrior snubnose darter", a term applied broadly to the many darter populations located in the Black Warrior River drainage in Alabama. For many years, the Warrior snubnose darter was regarded as a single undescribed species (Clabaugh et al. 1996, 119), but by the 1980s it was understood that the label most likely comprised multiple undescribed species (Boschung et al. 1992, 12). Darters from Turkey Creek, a tributary to Locust Fork of the Black Warrior River, were compared to other populations of Warrior snubnose darter, and were found to be differentiated on the basis fin and body coloration and male morphometrics. Boschung et al. thus delimited Turkey Creek darters as *E. chermocki* (Boschung et al. 1992, 17). The "undescribed Warrior snubnose darters" were from four other creeks/locations: Gurley Creek (tributary of Locust Fork), Mill Creek and its tributaries (tributary of Mulberry Fork), Sipsey Fork proper and its tributary Borden Creek, and Fivemile Creek (tributary of Valley Creek).

Suttkus and Bailey (1993) shortly thereafter supported the recognition of *E. chermocki* and described the Warrior darter (*Etheostoma bellator*) as a single-species resolution of the remaining populations in the "Warrior snubnose darters" group. The geographic distribution of *E. bellator* was described as comprising "several disjunct populations" (Suttkus and Bailey 1993, 22); its diagnosis focused on specimens from the Mill Creek and Valley Creek systems, but did not include examination of darters from Locust Fork or Sipsey Fork (*Id.*). The authors, similar to Boschung et al., relied on morphological differentiation but noted a high degree of variation in color and pattern between individuals (Suttkus and Bailey 1993, 22).

Clabaugh et al. (1996) examined population genetics of *E. bellator* and *E. chermocki* using allozyme variation (p 119). Analysis of variable gene loci revealed geographic variation which indicated that Suttkus and Bailey's '*E. bellator*' was actually a complex of three geographically distinct species, all of which were also distinct from *E. chermocki.* This corroborated unpublished data from Mayden and Kuhajda which indicated significant morphometric divergence between darters from Sipsey Fork, upper Locust Fork, and other *E. bellator* populations from Mulberry Fork, Gurley Creek, and Valley Creek (pp 119–120).

Kim et al. (2023) used double digest restriction-site associated DNA (ddRAD) loci data to delineate a clade composed of six species: *E. chermocki*, *E. bellator* from Mulberry Fork, and four undescribed species which were all masquerading as *E. bellator*, including the two disjunct populations from Sipsey and upper Locust forks reported by Clabaugh et al. (1996). Kim et al. upheld Sipsey Fork and upper Locust Fork darters as a distinct species, but recognized darters from Valley Creek as distinct species (Kim et al. 2023, 5–6). As noted above, darters from Mulberry Fork retained the specific epithet *bellator*, while the rest were labeled by their respective creeks. Based on a SNAPP strict molecular clock analysis, these species diverged from other snubnose darters 4.18 million years ago, and the final speciation event—between Sipsey Fork darters and Mulberry Fork darters—occurred 0.97 million years ago (Kim et al. 2023, 5–6).

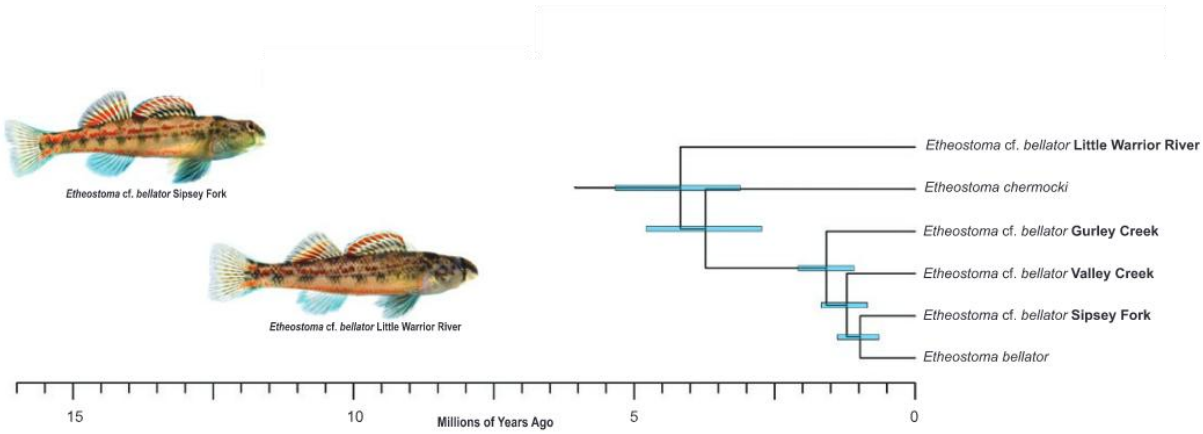

Figure 1. From Kim et al. (2023). Time-calibrated phylogeny for the Etheostoma chermocki *complex inferred from SNAPP. Light blue bars indicate 95% highest posterior density of divergence time estimates for the node.*

In 2025, the four remaining undescribed species of the *E. chermocki* complex were published. Mayden and Kuhajda (2025) published the Sipsey Fork darter (*E. michellae*) and the Locust Fork darter (*E. kimberlae*), while Brownstein et al. (2025) published the Gurley darter (*E. gurleyense*) and the Birmingham darter (*E. birminghamense*). Both studies included additional analysis which supported the recognition of these six darters as individual species.

Figure 2. Male Birmingham darter. Credit: B. Kuhajda.

II. DESCRIPTION

The Birmingham darter is a two-inch-long, brightly colored freshwater fish. This species is a member of the vermilion darter (*Etheostoma chermocki*) species complex within the snubnose darter (subgenus *Ulocentra*) group of the genus *Etheostoma*. Snubnose darters are generally described as having a slightly laterally compressed body shape, complete lateral lines, broadly connected gill membranes, a short head, and a small, pronounced mouth (USFWS 2007, 9). Birmingham darters reach a maximum size of 5.61 cm SL (males) or 5.11 cm SL (females) and are sexually dimorphic, with only the males displaying the stunning crimson coloration for which members of the *E. chermocki* species complex are named. Both male and female Birmingham darters are mottled brown on the dorsal side, lighter tan- or cream-colored on the ventral, with a row of tall (longer vertically than horizontally) black blotches below the anterior lateral line. Males have 1–2 rows of vermilion scales on the belly, along with more bright red scales above the lateral line and red pigmentation on the dorsal fins. Individuals have on average 49.3 lateral line scales and modally 13 pectoral fin rays and 10 dorsal fin spines (Brownstein et al. 2025, 4–5).

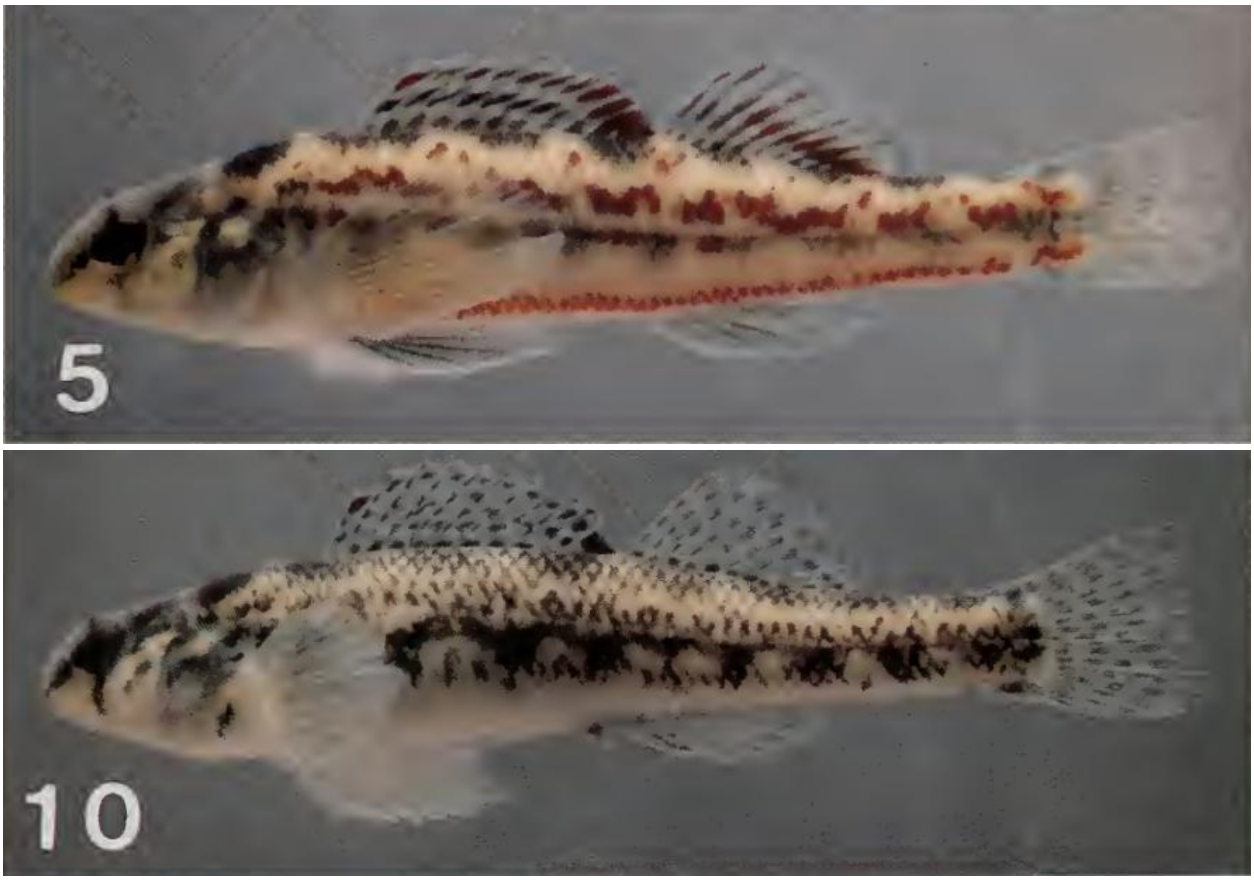

Figure 3. From Suttkus and Bailey (1993, pp 11, 14). These specimens (male, top; female, bottom) from Fivemile Creek were labeled as E. bellator but are now known to be E. birminghamense.

Birmingham darters are one of six species within the vermilion darter (*E. chermocki*) complex, all of which can be differentiated by morphological traits, considerable genetic divergence, and a complete lack of geographic overlap between native ranges (Brownstein et al. 2025, 3). Despite speciation occurring more than one million years ago, the phenotypic differences between these species remain subtle. Birmingham darters, along with Gurley darters (*E. gurleyense*) have the highest number of lateral line scales (~49). Birmingham darters also have fewer pectoral fin rays (13 vs. 14) than all species except for Sipsey Fork darters (*E. michellae*), which also have 13 (Brownstein et al. 2025, 6). The amount of vermilion pigmentation on the bellies of males also varies within the species complex, although Birmingham darters, Gurley darters, and Locust Fork darters (*E. kimberlae*) all have 1–2 rows (p 4).

Figure 4. Male (top/rightmost) and female Birmingham darters caught in a tributary of Valley Creek by B. Kuhajda in October 2025. Credit: B. Kuhajda.

The basic diagnostic criteria are as follows:

Etheostoma chermocki / **Vermillion Darter**: This species has more than 3 vermilion scale rows on its belly, which extend upward toward the lateral band. Resides in Turkey Creek.

Etheostoma bellator / **Warrior Darter**: This species has 2-3 vermilion scale rows on its belly. Resides in Mill Creek and its tributaries, Mulberry Fork, and Blue Springs Creek.

Etheostoma kimberlae / **Locust Fork Darter**: This species has a lateral line strip that is restricted to half a scale row, and has 1-2 vermilion scales on its belly. Resides in Mill Creek and Calvert Prong of the Black Warrior River Basin, and has been extirpated from Little Cove Creek.

Etheostoma michellae / **Sipsey Fork Darter**: This species has an interrupted row of vermilion scale on its belly and a fully turquoise anal fin. Resides in Sipsey Fork and its northern tributaries.

Etheostoma birminghamense / **Birmingham Darter**: This species has deep black blotches below the anterior lateral line and 1-2 vermillion scale rows along its belly. Resides in Valley Creek and its tributaries (Blue Creek, Little Blue Creek, Halls Creek, Nabors Branch), and has possibly been extirpated from Fivemile Creek.

Etheostoma gurleyense / **Gurley Darter**: This species has 1-2 vermillion scale rows on its belly. Resides in Gurley Creek.

Figure 5. Valley Creek at VC-5, less than one mile upstream of documented Birmingham darter habitat in Bessemer (ADEM 2007).

III. HABITAT

All six species in the *E. chermocki* complex are endemic to tributaries of the Black Warrior River system, specifically within or downstream of channels flowing over carbonate rock substrate. This rock was likely exposed over time as rivers eroded downward through layers of siliciclastic rock, leading to patchy areas of suitable carbonate habitat interspersed with unsuitable sections of stream which still flow over siliciclastic rock (Kim et al. 2023, 3). Although geological maps of the Black Warrior River System indicate that several populations of Birmingham darter are not found in known regions of exposed carbonate (see Fig. 7), Brownstein et al. (submitted) confirmed that most of these sites do have small carbonate outcrops in the streambed or on the margins (pp 3–4). The emergence of carbonate rock in the Black Warrior River system occurred over a period beginning 10 million years ago, predating the differentiation of some of the darters within the *E. chermocki* species complex, which occurred between 1 and 5 million years ago (Kim et al. 2023, 8). Kim et al. posited that speciation occurred after darters dispersed over these areas of unsuitable siliciclastic rock habitat and colonized new stretches of carbonate rock, thus creating geographically distinct populations which became morphologically and genetically separate over time (Kim et al. 2023, 7).

Figure 6. Unnamed tributary of Hall's Creek, where Birmingham darters were found in late 2024 by the Alabama Geological Survey. Credit: B. Kuhajda.

Within the stream, Birmingham darters typically prefer areas of cobble or gravel substrate in the slower-moving interface between riffles and pools, although they can be found in shallow, fast-moving riffles as well. These darters are commonly associated with the exposed roots of sycamores or other trees at the stream edges, as well as with instream vegetation, although they may occupy bare ground as well (B. Kuhajda, pers comm, 20 October 2025). This is perhaps different than *E. kimberlae* and *E. michellae,* which reportedly prefer moderate or little current (Mayden and Kuhajda 2025, 361, 365). That said, habitat for the Birmingham darter is likely to be generally similar to that of other snubnose darters (B. Kuhajda, pers comm, 20 October 2025). All members of the *E. chermocki* species complex require clean, clear, flowing water (USFWS 2007, 5).

IV. LIFE CYCLE, BEHAVIOR, AND ECOLOGY

No comprehensive life-history studies have been done on the Birmingham darter, but it is believed that the species' life history is similar to those of other snubnose darter species.

Stomach contents for Gurley darters reveal a diet of gastropods, bivalves, arachnids, isopods, aquatic insects, and fish eggs. The most common items were larvae of chironomids (midges), baetic ephemeropterans (mayflies), and hydropsychid trichopterans (net-spinning caddisflies), with smaller fish generally consuming smaller prey (Khudamrongsawat and Kuhajda 2007, 243).

Similarly, vermilion darters consumed mostly larvae of chironomids, tipulids (crane flies) and hydropsychid trichopterans, and more rarely consumed fish eggs and vegetal matter (Khudamrongsawat et al. 2005, 472). Birmingham darters are likely to share this omnivorous but insect-rich diet.

Watercress darters (*E. nuchale*), which have range overlap with Birmingham darters, have been found gravid in March–July (USFWS 1992, 3). Vermilion darters and Gurley darters are apparently similar, showing evidence of reproductive activities from March–June (Khudamrongsawat and Kuhajda 2007, 243; Khudamrongsawat et al. 2005, 471, 474). Clutch size generally declines throughout the reproductive season, but overall averages ~65–70 eggs based on the species; many darters can spawn multiple times per season (*Id.*). Populations studied by both Khudamrongsawat and Kuhajda (2007) and Suttkus and Bailey (1993) indicate a sex ratio of about two females to one male is common for members of the *E. chermocki* species complex during the breeding season. Mean egg size is 0.99 mm diameter for Gurley darters and 1.03 mm for vermilion darters (*Id.*). Clean rocks, logs, or sand and gravel substrate are required for the attachment of eggs during spawning in spring (USFWS 2007, 12). Eggs hatch six to eight days after being deposited and fish become reproductively mature at one year of age (Khudamrongsawat and Kuhajda 2007; Suttkus and Bailey 1993).

A lifespan of about 3–5 years is common among darters. Gurley darters can live for at least three years, although a study indicated that almost 70% of the population were individuals aged 0–2 (Khudamrongsawat and Kuhajda 2007, 243). A similar pattern was observed for collected museum specimens of vermilion darter, which were primarily younger than 2 and rarely older than 3 (Khudamrongsawat et al. 2005, 473).

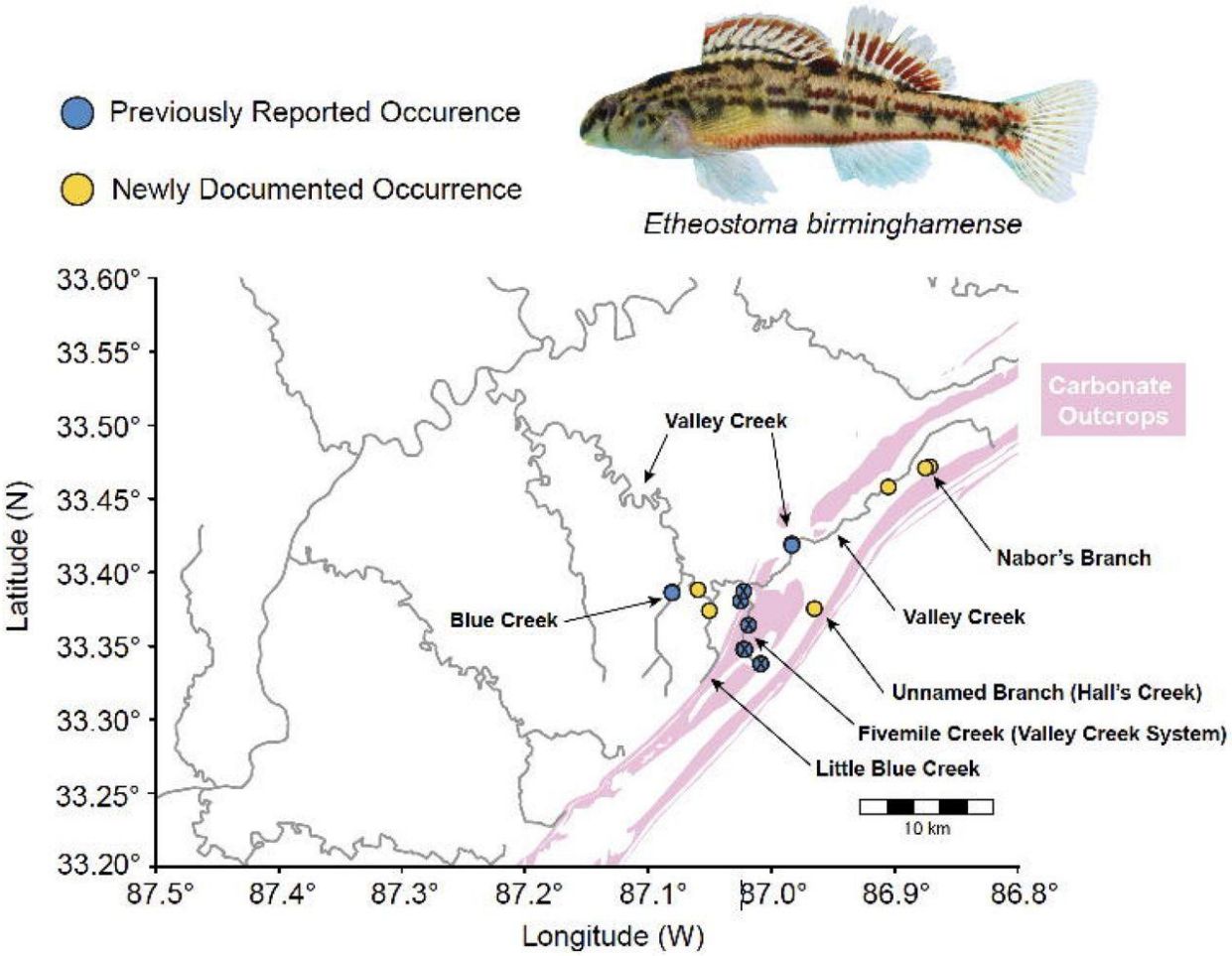

Figure 7. Map showing updated distribution of Birmingham darters in the Valley Creek system. Source: Brownstein et al. (submitted).

DISTRIBUTION

Similar to other members of the *E. chermocki* species complex, the Birmingham darter is a microendemic with an exceptionally limited distribution. This species occurs only in the Valley Creek system near Bessemer and within Bessemer and Birmingham in Jefferson County, AL. Between 1966 and 2006, the species was consistently found along a 7.5-km stretch of Fivemile Creek (Brownstein et al. 2025, 5*;* Fig. 7); another population was found in the Valley Creek mainstem in downtown Bessemer in 2007. Most recently, populations in Nabors Branch and Blue Creek were found in 2018 and 2019, respectively. A population in an unnamed tributary of Hall's Creek, downstream of the Watercress Darter National Wildlife Refuge, was found by the Alabama Geological Survey in late 2024, and another was found near the mouth of Little Blue Creek in 2025 (B. Kuhajda, pers comm 20 October 2025; T. Near, pers comm 24 October 2025; Brownstein et al. submitted). Despite these more recent discoveries, the distribution and total geographic range of the Birmingham darter remains extremely limited. The Fivemile Creek population has also not been observed since 2006, and is believed to be either extirpated or

greatly reduced as a result of quarrying activity in the early 2000s (B. Kuhajda, pers comm 20 October 2025; Brownstein et al. 2025, 5).

Extremely restricted distribution is one of the major factors which make the Birmingham darter vulnerable to extinction. USFWS said as much of the watercress darter (*E. nuchale*) in its 1992 recovery plan for the species, adding that "[f]actors which are most likely to limit or cause the decline of watercress darter populations are those that reduce the quantity or quality of its habitat" (USFWS 1992, 3). That same principle applies to the Birmingham darter, which has a similar number of populations and geographic range size as the watercress darter.

POPULATION STATUS

The Birmingham darter is unquestionably imperiled. This species has only six small populations within the tributaries and mainstem of Valley Creek, including two threatened by imminent or current industrial activity and three located in heavily urbanized areas where development, runoff, and pollution impede water and habitat quality. In the draft 2025–2035 Alabama State Wildlife Action Plan (SWAP), the Alabama Department of Conservation and Natural Resources (ADCNR) Wildlife and Freshwater Fisheries Division (WFF) recognized that Birmingham darters are of high conservation concern. The ADCNR ultimately listed the species as P1 (Priority 1/Highest Conservation Concern) (ADCNR SWAP Chapter 1, 24). These are "[t]axa critically imperiled and at risk of extinction/extirpation because of extreme rarity, restricted distribution, decreasing population trend/population viability problems, and specialized habitat needs/habitat vulnerability due to natural/human-caused factors. Immediate research and/or conservation action required" (p 9). The species is also regarded as warranting "the highest conservation concern status due to its critically imperiled condition and high extinction risk" by C. Brownstein et al., who formally described the species (Brownstein et al. 2025, 5).

The formerly robust Fivemile Creek population is now believed to be either extirpated or greatly reduced as a result of quarrying activity in the early 2000s (B. Kuhajda, pers comm 20 October 2025; Brownstein et al. 2025, 5) and the Little Blue Creek population is presently imperiled by the proposed construction of a hyperscale data center (T. Near, pers comm 24 October 2025; N. Brooke, pers comm 24 October 2025; B. Kuhajda, pers comm 20 October 2025). This data center project is perilously close to approval by Bessemer City Council despite the developer's lack of transparency on the results from any environmental assessments (Hedgepeth and Isom 2025a) and the recent discovery of Birmingham darters directly downstream of the project area (T. Near, pers comm 24 October 2025). This population, one of the southernmost for the Birmingham darter and the *E. chermocki* species complex as a whole, is considered fairly robust at present. Its loss would be devastating for Birmingham darter population size and genetic diversity (T. Near, pers comm 24 October 2025; Brownstein et al. submitted). However, there is no evidence that the developers of the proposed Bessemer data center plan to take any steps to prevent harm to this creek or its native fauna.

In addition to the immediate and severe threat of the proposed data center at Little Blue Creek, these tiny fish are threatened by at least three ESA listing factors: habitat loss and degradation due to groundwater depletion, urbanization, quarrying, and resultant sinkhole formation and loss of creek flow; inadequate and often poorly enforced state and federal regulatory mechanisms which continue to permit and fail to meaningfully address discharge of pollutants and overconsumption of water for industrial uses; and other factors including climate change-induced drought and extreme weather events, a small geographic range, and a limited ecological niche. The Birmingham darter faces immediate threats to its continued existence and must be protected under the provisions of the Endangered Species Act to ensure its populations do not suffer irreparable harm or loss within the next few years.

The Birmingham metropolitan area, the town of Bessemer, and much of Jefferson County are heavily developed for urban, agricultural, and mining uses, with development often occurring without regard for the region's diverse and irreplaceable ecosystems and native species. Within the Black Warrior River system, the watercress darter (*Etheostoma nuchale*) was listed by USFWS as Endangered under the ESA in 1970 (35 FR 199, 16048) due to the threats of urban development, pollution, invasive species, and groundwater depletion (USFWS 1992, 3). Birmingham darters have already been greatly reduced or extirpated from one stream close to the watercress darter's range after damage to the creek from quarrying, and face many of these same threats throughout their equally limited range (N. Brooke, pers comm 24 October 2025).

Birmingham darters are known from five creeks: Little Blue Creek, Blue Creek, and Fivemile Creek, which are neighboring tributaries of Valley Creek to the southwest of Bessemer; two small portions of the mainstem of Valley Creek in downtown Bessemer and Midfield; and two upstream tributaries to Valley Creek, Halls Creek in Bessemer and Nabors Branch in Birmingham (Brownstein et al. submitted). Exact population sizes are not known, but experts on the species estimate that there are likely no more than a few thousand individuals at present (T. Near & C. Brownstein, pers comm 29 July 2025).

VALLEY CREEK POPULATIONS

Two separate populations of Birmingham darter are known from the mainstem of Valley Creek, one at a site in Bessemer and one further north in Midfield, Alabama, between Bessemer and Birmingham (Fig. 7). The Midfield Valley Creek population was discovered by the Alabama Geological Survey in January 2025, and little is known about it beyond its presence; the Bessemer Valley Creek population has been observed twice, in 2007 and 2019. This reach of Valley Creek remains the most urbanized stream known to be inhabited by Birmingham darters.

In 2007 and 2012, the Alabama Department of Environmental Management (ADEM) noted a number of pollutants and markers of low water quality at a site less than one mile upstream of

this population and found that, despite "optimal" or "sub-optimal" physical habitat for macroinvertebrates, the site had an extremely poor-quality macroinvertebrate community which was primarily dominated by pollution-tolerant species (ADEM 2007; ADEM 2012). It is not known how large the population of Birmingham darters at this site is, but T. Near noted that the site, in 2019, was "awful", with compacted silt substrate and only a small patch of available gravel habitat. Five Birmingham darters were found on this patch of gravel, but no others were seen, likely because these bottom-dwelling fish require gravel or cobble and most of the creek bed did not provide that substrate (T. Near, pers comm 24 October 2025). This Population is also less than one mile downstream from Opossum Creek, which is the only stream in the Black Warrior River watershed still designated as an "Agricultural & Industrial" (A&I) water supply by ADEM. In 1989, EPA reported that Opossum Creek had poor habitat and deposits of tar-like substances, with growth impairment to the fathead minnow (ADEM 2001, 10).

FIVEMILE CREEK

This population of Birmingham darters was once very robust, but is now believed to be either significantly reduced in numbers (B. Kuhajda, pers comm 20 October 2025) or extirpated (Brownstein et al. 2025, 5). No collections have been made at this site since 2006 (Brownstein et al. 2025, 5).

This is certainly the most well-represented population of the species in museum collections, with semi-frequent collections occurring from 1966–2006 at sites distributed throughout the lower reaches of the creek. In their 1992 paper describing the vermilion darter (*E. chermocki*), Boschung et al. referenced a total of 77 museum specimens of "*E. bellator* Valley Creek" from the University of Alabama Ichthyological Collection (UAIC) which were collected along Fivemile Creek between 1966 and 1992 (p 20). The online museum collection repository FishNet2 also shows another five records in Fivemile Creek, totaling 117 fish, from Tulane University Museum of Natural History (TU Fish) which were collected at several spots in Fivemile Creek in 1985 and 1992. Another six UAIC collections were made between 1993 and 2006, totaling 16 fish. The 2006 collection, when 6 fish were found, is the most recent attempt to find fish at this site. Darter expert B. Kuhajda believes this population likely numbered in the thousands in the past, but that today, if any remain, there are likely no more than a few hundred located near the mouth of Fivemile Creek (pers comm 20 October 2025).

The primary cause of population decline here has been attributed to quarrying activity directly upstream from the population. For a period of time in the early-mid 2000s, a stretch of Fivemile Creek ran dry and developed sinkholes due to water infilling at the quarry pit. This directly impacted known Birmingham darter habitat (N. Brooke, pers comm 20 October 2025). Birmingham darters may have persisted downstream, near the mouth of the creek, but the population—if it still exists at all—is likely to number only a few hundred today (B. Kuhajda, pers comm 20 October 2025). Although the quarry pit which originally caused Fivemile Creek to

run dry has since been abandoned and allowed to fill with water, allowing the diversion from the aquifer to end and Fivemile Creek to resume more continuous flow, a new quarry pit on the other side of the creek is now being actively mined. ADEM regulations are insufficient to prevent this habitat destruction for Birmingham darters, highlighting the necessity of stronger federal protections which would include Section 7 consultation and critical habitat designation.

BLUE CREEK

Little is known about this population. It has been visited in 2019, 2022, 2023, and 2025 by T. Near and members of his lab. A total of 26 museum specimens have been collected from this population, all from approximately the same site near Johns Rd.

LITTLE BLUE CREEK

This population was first observed by T. Near in October of 2025. Birmingham darters were found near the mouth of the creek and in the immediately adjoining portion of Valley Creek itself. This population is directly threatened by a proposed 4.5-million-square-foot data center which would be sited directly over the creek's headwaters and use at least 2.0 million gallons of water per day in its operations (Hedgepeth 2025b).

HALLS CREEK

This population was discovered in an unnamed tributary to Halls Creek in 2025 by the Alabama Geological Survey. Only three specimens were captured at this site, which is impacted by urban stormwater runoff resulting in highly fluctuating water levels and poor aquatic habitat (B. Kuhajda, pers comm 12 November 2025).

This population overlaps with the federally endangered watercress darter (*E. nuchale*) which resides in Thomas Spring within the Watercress Darter National Wildlife Refuge. The new site is downstream of the Refuge, but watercress darters were collected with Birmingham darters in this small stream, therefore it is partially protected by the upstream Refuge; however, Birmingham darters elsewhere in the Halls Creek watershed have no protection.

NABORS BRANCH/SEVEN SPRINGS RUN

This population has been observed multiple times since its discovery in 2018 by darter expert B. Kuhajda. Fish have been found in both Seven Springs Run, a tributary of Nabors Branch, and Nabors Branch, a tributary of Valley Creek (B. Kuhajda, pers comm 20 October 2025). This population is farther upstream than other populations, and is separated from the closest population, in the Valley Creek mainstem, by approximately nine miles of creekbed. Threats to this population include urbanization of the region, which has increased the creek's hydrological flashiness (B. Kuhajda, pers comm 20 October 2025) and upstream pollution sources including a bulk fuels depot and an adhesives company. N. Brooke has noted an oily sheen on the creek surface in the area (pers comm 24 October 2025).

This population overlaps with the federally endangered watercress darter (*E. nuchale*) which resides in Seven Springs. These springs are partially protected and stewarded through a conservation easement which was placed on the adjoining lands in 2023. Birmingham darters in the Seven Springs run may benefit from these protections, but those in the adjoining Nabors Branch do not.

THREATS

Under the ESA, 16 U.S.C. § 1533(a)(1), FWS is required to list the Birmingham darter if it is in danger of extinction or likely to become endangered across all or a significant portion of its range. This species must meet at least one of the factors enumerated in section 4(a):

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;
(B) Overutilization for commercial, recreational, scientific, or educational purposes;
(C) Disease or predation;
(D) The inadequacy of existing regulatory mechanisms;
(E) Other natural or manmade factors affecting its continued existence.

16 U.S.C. § 1533(a)(1)(A)-(E); 50 C.F.R. § 421.11(c)(1)-(5). The review and determination by FWS must be based solely on the best scientific and commercial data available.

The 2025 Draft State Wildlife Plan (SWAP) for Alabama uses the International Union for Conservation of Nature (IUCN)'s ten-item standardized Threats Classification System to categorize the threats to its Species of Greatest Conservation Need (SGCN). Threats to Birmingham darters identified by the 2025–2035 Draft SWAP broadly include: 1) Residential & Commercial Development (Urban Development, Recreation Areas); 4) Transportation & Service Corridors (Roads, Railroads, Utility Lines, Flight Paths); 6) Human Intrusion & Disturbance (Recreational Activity, Military Activity); 7) Natural System Modifications (Fire & Fire Suppression, Water Quality & Quantity (Dams), Lack of Management, Fragmentation); and 9) Pollution (Sewage/Wastewater, Industrial Effluent, Solid Waste, Airborne Pollution) (ADCNR 2025 SWAP Ch. 3, 38).

The Birmingham darter is gravely threatened by habitat degradation and loss due to the proposed 700-acre Bessemer Data Center, which would be constructed perilously close to some of the only remaining habitat this species has, and by ongoing limestone quarrying around Fivemile Creek. In addition, these tiny fish are threatened by at least three ESA listing factors: habitat loss and degradation due to groundwater depletion, urbanization, and pollution; inadequate and often poorly enforced state and federal regulatory mechanisms which continue to permit and fail to meaningfully address discharge of pollutants and overconsumption of water for industrial uses; and other factors including climate change-induced drought and extreme weather events, a small geographic range, and a limited ecological niche. The Birmingham darter faces immediate threats to its continued existence and must be protected under the provisions of the Endangered Species Act to ensure its populations do not suffer irreparable harm or loss within the next few years.

(A) PRESENT OR THREATENED DESTRUCTION, MODIFICATION, OR CURTAILMENT OF HABITAT

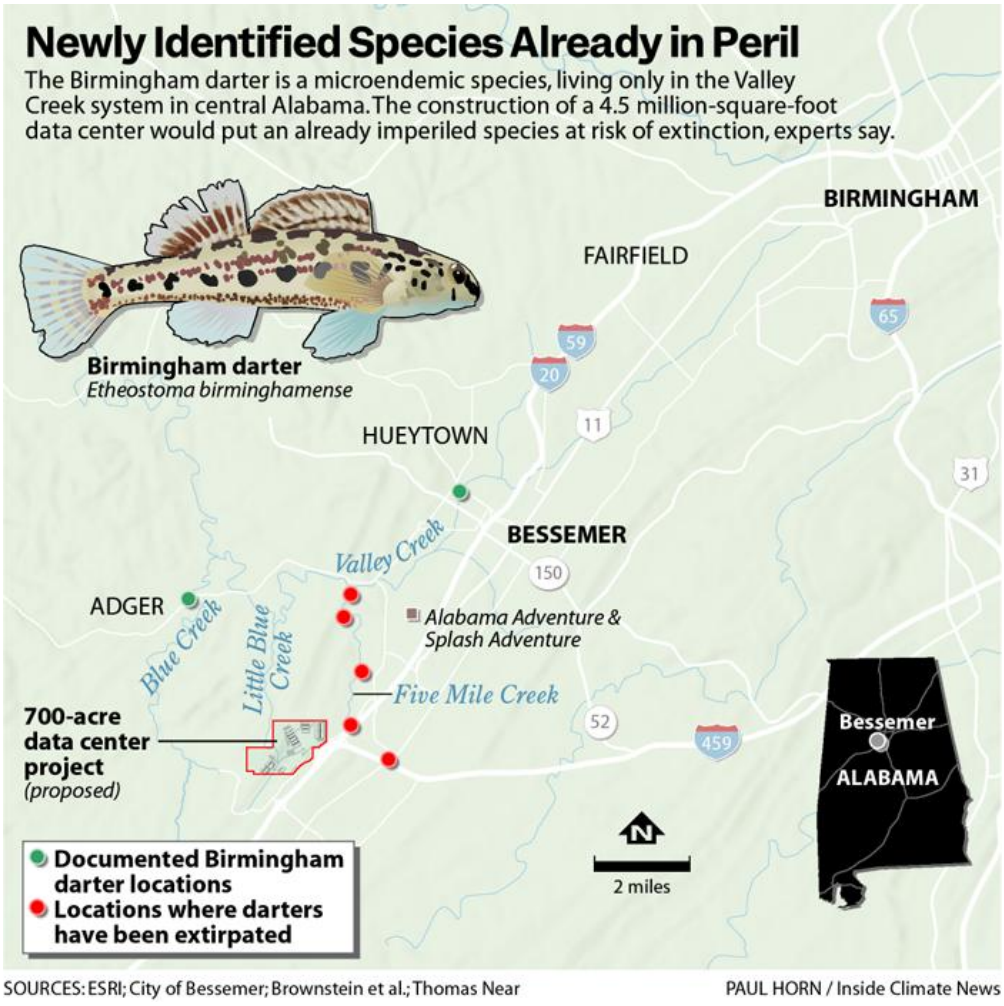

Figure 8. Location of proposed data center project. Source: Inside Climate News.

PROPOSED BESSEMER DATA CENTER

Little Blue Creek, home to the most recently discovered population of Birmingham darters, winds primarily through woodlands in a rural area to the southwest of Bessemer. This creek, and its darters, is imminently threatened with extirpation by a proposed hyperscale data center called Project Marvel which would be sited near the creek's headwaters (Fig. 8).

Until recently, the 700-acre parcel proposed for this data center was zoned for agricultural use, but on June 17 of 2025, Bessemer's zoning commissioners voted to rezone the parcel for light industrial use (Hedgepeth 2025c). On October 7, they voted to change Bessemer's zoning ordinance to explicitly permit the construction of data centers under this usage (Isom 2025). One City Council vote to approve Project Marvel did not pass, but another vote is scheduled for 18

November of 2025 (*Id.*). Project Marvel represents an existential threat to the Birmingham darter. With Bessemer officials and developers clearly working to move the project forward as quickly as possible, the extirpation of the Little Blue Creek population is a real possibility and would represent a profound and irreversible loss to the already limited genetic diversity and small occupied range of this tiny fish.

The proposed Project Marvel would be a 4.5-million-square-foot campus comprising 18 buildings, each the size of a Walmart Supercenter. The compound is estimated to consume up to 1,200 MWh of electricity (Hedgepeth and Isom 2025a) and an unknown amount of water. Final water consumption will reportedly not be known until the proposed data center's end user is determined, although the developers have already requested an estimate of 2.0 million gallons per day from a local water utility (Hedgepeth 2025b).

Little else is known about Project Marvel at this time due to developers and local government officials keeping an extremely tight lid on the project. At one Bessemer City Council meeting, a representative of the developer for Project Marvel argued that there would be "virtually no impacts on residents or the environment" (Hedgepeth 2025c). However, this cannot be confirmed because the developers for Project Marvel have not released an Environmental Impact Statement, a finalized figure for water usage, or any other information as to how this data center would impact vulnerable species in Little Blue Creek and the surrounding areas. There is no evidence that its developers have even consulted with USFWS regarding the potential impacts to as many as fifteen federally-listed species potentially found within the project area. The Birmingham darter, which receives no federal protections for its habitat right now, is unlikely to be adequately protected from habitat loss if even federally-listed species in the region are not being given the legally required due consideration.

Impacts from construction

Construction alone will pose a risk to water quality and habitat availability for Birmingham darters at Little Blue Creek. Removing vegetative cover during site work and construction exposes bare soil, which is then washed into the creek during heavy rainfall events (Ehrhart et al. 2002, 4). Rainfall and runoff water can also pick up logging slash and chemicals from the construction site and transport them into the stream channel more readily. ADEM issues stormwater permits, but developers often skirt or ignore stormwater permits and regulations, or simply pay fees from violations without making meaningful changes to their activity.[1] Construction of the data center would take multiple years and involve clearcutting of at least 100 acres of forest for development, per limited available knowledge from Project Marvel's developers (Hedgepeth and Isom 2025a). The impacts to Little Blue Creek during this time may

[1] See, for example, SELC and Coosa Riverkeeper's suit: https://coosariver.org/newcastlesuit/ or this Consent Order between ADEM and a developer: https://www.jdsupra.com/legalnews/stormwater-enforcement-alabama-3185843/. Accessed 30 October 2025.

harm available Birmingham darter habitat, further reducing the species' already-limited range and population.

Forested creeks in eastern North America tend to be wider and slower-moving than deforested reaches (Sweeney et al. 2004, 14134). Nitrogen uptake in deforested streams is significantly lower (*Id.*), as is macroinvertebrate abundance (p 14135). Forested reaches also have significantly greater rates of heterotrophy, indicating a better ability to process organic matter (p 14136). The wider channels of forested streams also create a greater availability of benthic habitat, which directly benefits benthic-dwelling Birmingham darters.

Due to its location, the construction of Project Marvel will most directly impact the headwaters of Little Blue Creek. Headwater food webs of the upper Chattahoochee basin in Georgia shift to be less reliant on terrestrial subsidies where deforestation occurs, potentially altering the stream's overall linkages to downstream sites (England and Rosemond 2002, 729–730). Even if Birmingham darters are not present in the headwaters of Little Blue Creek—which they very well may be—the impacts to the creek source may affect downstream processes and nutrient availability in addition to the potential effects of sedimentation and pollutant input.

Lastly, parts of Little Blue Creek are already prone to run dry during times of summer drought (T. Near, pers comm 24 October 2025). Construction which alters streamflow may worsen this issue and adversely impact Birmingham darters at this site.

Water requirements of hyperscale data centers

As generative and other artificial intelligence (AI) tools become more popular and ubiquitous, the massive "hyperscale" data centers required to process AI requests are rapidly becoming one of the largest consumers of electricity and water among US data centers (Shehabi et al. 2024, 50, 56). These data centers require not only great amounts of water and electricity, but also the infrastructure and space necessary to generate and transport those resources to the site.

Hyperscale data centers use an average of half a million gallons per day (MGD) of water in their cooling and humidification systems (Zhang 2024). Some of the largest existing data centers use more—such as Google's Council Bluffs, IA location, which used a total of 1.33 billion gallons of water (approximately 3.7 MGD) in 2024 (Google 2024, 80). According to a data center water use calculator created by AI expert Masheika Allgood, the estimated 1,200-MW-Project Marvel may require even more—as much as 10.6 MGD of water, or nearly 4 billion gallons of water per year.[2] Any estimates are inherently uncertain because no information regarding the data center's method of cooling, its use, or its ultimate end users is available to the public.

[2] ALL AI (n.d.). Data Center Water Consumption Calculator. https://www.tapsrundry.com/data-center-water-consumption-calculator. Accessed 16 October 2025.

Despite these estimates, Project Marvel's developers have currently only requested 2.0 MGD of water from the Warrior River Water Authority (WRWA) (Hedgepeth 2025b). As of 2015, WRWA provided a total of 4.30 MGD of water for public supply, 3.2 MGD of which came from surface water and 1.10 MGD of which was drawn from groundwater (OWR 2015, B-39), suggesting that Project Marvel's request will increase WRWA's withdrawal by nearly 50%. This 2.0 MGD figure already represents more than twice the 0.87 MGD withdrawn in Jefferson County for industrial use (*Id.*), further indicating how significant the water resources requested for this project will be compared to existing water uses in the county. In an email sent on 14 November 2024 to an employee of the engineering firm contracted by the developers, WRWA stated, "due to the large volume of usage requested by this project, agreements will be needed to assure the usage will match this commitment and the Authority's investment in additional infrastructure" (Hedgepeth 2025b).

It is unclear where this water will come from and how it will be transported to the data center site. One possibility may involve the drilling of new wells on or near the site proposed for Project Marvel, which may be more likely as groundwater was the sole source for industrial-use water in Jefferson County in 2015 (OWR 2015, B-39). Because at least two, if not all three, of the streams closest to the Project Marvel site—Blue Creek, Little Blue Creek, and Fivemile Creek—are home to Birmingham darters, new or intensified groundwater pumping near this facility could adversely affect water availability for all three populations. T. Near reported that parts of Little Blue Creek were already dry in early October 2025 due to drought conditions; groundwater extraction could worsen the problem and gravely impact habitat availability and quality for Birmingham darters (T. Near, pers comm 24 October 2025). Even smaller data centers, like one in Georgia which consumes approximately half a million gallons of water per day for cooling, have been implicated in groundwater depletion and pollution for surrounding residents (Tan 2025). The Birmingham darter's reliance on specific carbonate streambed environments will preclude easy migration in the event of habitat destruction or lost streamflow, so preservation of existing habitat is paramount to the species' survival.

Further, it is entirely possible that Project Marvel's developers do not expect their end user to track the water consumed onsite. A study revealed that only half of data center operators track water usage, and only 10% track it across all their facilities (Ahmad 2024). This oversight would make impacts to Birmingham darter even more difficult to fully predict or mitigate.

Alabama's water laws allow landowners to use water from a river or stream on or adjacent to their property with very little oversight (Hedgepeth and Isom 2025c), meaning that it would be easy for Project Marvel to dewater Little Blue Creek and eliminate this sensitive habitat upon which Birmingham darters rely.

Wastewater discharge

Water used for cooling at data center facilities is either evaporated or discharged, with one estimate suggesting that up to 80% evaporates and the remaining 20% must be discharged (Li et al. 2025). Discharged wastewater from Project Marvel may be transported offsite to the Jefferson County Wastewater Treatment Plant nearby. However, if the developers obtain a National Pollutant Discharge Elimination System (NPDES) permit to treat and discharge effluent, then Little Blue Creek—the only waterway on the project site—will be the most likely location for water outflow. Data centers treating and discharging their own water is already being done at other facilities, such as one owned by Google in Douglas County, Georgia (Ahmad 2024).

Data centers use more than just water to cool their facilities. Data centers that use water as a cooling medium must add chemicals to prevent corrosion, scaling, and microbial growth. Data centers may also use immersive cooling systems that can include carcinogenic per- and polyfluoroalkyl substances (PFAS), also known as "forever chemicals" due to their status as persistent organic pollutants (Electronics Cooling Magazine 2024). Chemical treatments designed to prevent corrosion, scaling, and microbial growth may include pollutants like phosphates and zinc,[3] copper, and iron.[4] Other, unknown pollutants may be present in proprietary cooling water treatment blends as well. Additionally, data centers require robust fire suppression systems that often contain chemicals, including gaseous hydrofluorocarbons (HFCs) (Isberto 2021). Industrial effluents have been linked to an increase in stream temperature, conductivity, and alkalinity (Nedeau et al. 2003, 4). Effluent inputs to streams have also been associated with a reduction in dissolved oxygen and a suite of negative impacts to macroinvertebrates and fish (Hamdhani et al. 2020).

[3] Veolia. E.C.O Film. Available at: https://www.watertechnologies.com/products/cooling-water/non-phosphorus-cooling-water-treatment. Accessed 7 November 2025.
[4] Veolia. Spectrus NX1100 Fact Sheet. Available at https://www.watertechnologies.com/products/cooling-water/microbiological-control-agents. Accessed 7 November 2025.

QUARRYING AT FIVEMILE CREEK

Figure 9. Google Earth satellite image from 24 March 2024 showing the quarrying operation on both the east and west banks of Fivemile Creek. Retrieved 23 October 2025.

Fivemile Creek, historically home to a robust population of Birmingham darters, has been subjected to extreme habitat degradation by limestone quarrying. Despite environmental consequences, quarrying continues to this day. Over the years, quarrying activity has had a documented impact on the availability and quality of water flowing in Fivemile Creek, including allegedly leading to the formation of deep sinkholes in the creekbed. The formation of sinkholes disturbed documented Birmingham darter habitat, dewatered parts of the stream, and disrupted habitat connectivity between other known upstream and downstream occupied habitat as a result. Other impacts have included periods of extreme turbidity and high total suspended solid (TSS) levels due to outflow from a flooding quarry pit (N. Brooke, pers comm 24 October 2025). Birmingham darters have not been collected at this creek since 2006, but researchers hold out hope that some may remain. If surveys reveal that Birmingham darters persist in Fivemile Creek, action must be taken to prevent the continued destruction of this habitat by the limestone quarry. There is no evidence that new quarrying will not have these same devastating effects on stream health.

Figure 10. The bed of Fivemile Creek, shown here to be completely dry and interrupted by a deep sinkhole. Per N. Brooke and Black Warrior Riverkeeper, many of these sinkholes are still present in the creekbed despite attempts by the mining company to fill them with grout and concrete (N. Brooke, pers comm 24 October 2025).

Sinkhole formation and water availability

In October 2002, an investigator with ADEM responded to a complaint that Fivemile Creek ran dry where it approached the limestone quarry. The investigator reported that a sinkhole had opened in the creekbed upstream of the Freeman Avenue bridge, swallowing all upstream creek flow, and that as a result the creek had run dry downstream for two months (ADEM unpublished memo dated 27 October 2003). Photographs taken by ADEM and Black Warrior Riverkeeper show the severity of these sinkholes (Figs. 10, 11), and at least one sinkhole reported on by ADEM (not in the creekbed) was forty feet deep or more (ADEM unpublished memo). Even in October 2003, when flow from upstream of the Freeman Avenue bridge had been restored, ADEM reported that another sinkhole had formed 800 ft downstream which was again causing all the creek flow to vanish (*Id.*). The Freeman Avenue bridge over Fivemile Creek was a collection point for Birmingham darters; therefore, it is likely that mortality of Birmingham darters would have occurred in this spot due to the sinkhole formation and the dewatering of that stream reach. Further, because Birmingham darters are benthic dwellers and lack swim bladders, their reliance on suitable creek substrate makes them prone to more considerable disruption when sinkholes alter the shape of the benthos.

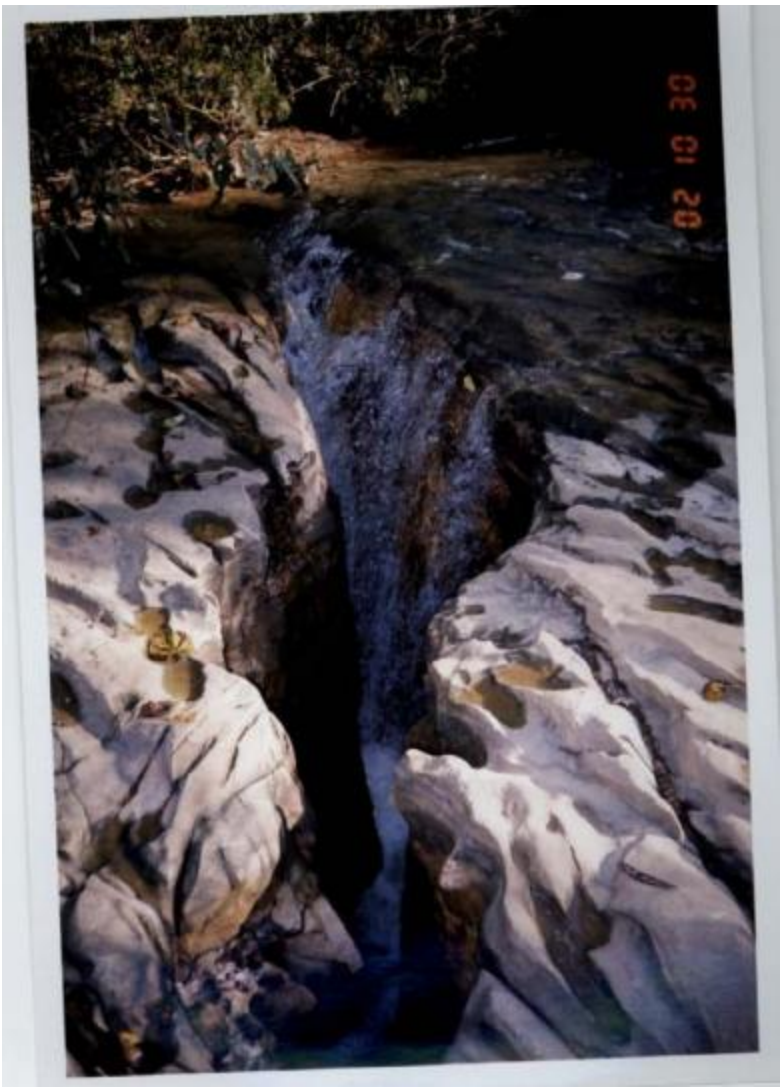

Figure 11. Fivemile Creek's flow completely intercepted by a sinkhole. Photo taken by ADEM investigator Jacques Chassé in October 2002.

According to Nelson Brooke, who has been the Black Warrior Riverkeeper for over a decade, the cause of these sinkholes and the damage to Fivemile Creek came when the quarry cut deep enough to intercept the aquifer which feeds it in the early 2000s. This caused the quarry pit to divert flow from the creek and begin filling with water, which the mine company then had to constantly pump out to continue quarrying. The lack of water to supply Fivemile Creek caused a one-mile stretch of the creek to run dry, and after continuous pumping of the quarry pit, sinkholes began to form in the region. Flow for Fivemile Creek was only restored downstream where water from the quarry was pumped back into the creek bed (N. Brooke, pers comm 24 October 2025).

The mining company which operates the quarry has not accepted responsibility for these sinkholes, but it was working to fill them as they formed in 2002, and the company reportedly

planned to get a permit from the Army Corps of Engineers to fill the sinkholes in the creek with grout in order to reestablish flow (ADEM 2003 unpublished memo). They also agreed as a result of a Consent Order with ADEM to close the quarry pit. Although the quarry pit east of Fivemile Creek is now filled with water and inactive (Fig. 9), ADEM permitted the mining company to continue quarrying on the western bank of Fivemile Creek, and that quarry pit remains in use. The same issues which plagued the area as a result of limestone quarrying may well arise again without adequate protections.

Figure 12. Aerial photograph taken by N. Brooke on 10 May 2004 showing outfall from Bessemer Quarry with heavy siltation and turbidity. The natural flow of Fivemile Creek, seen to the right in this image, is barely visible in comparison to the pale and sediment-laden effluent.

Water quality

The presence of the limestone quarry so close to documented Birmingham darter habitat has unquestionably influenced the quality of available water in Fivemile Creek. The NPDES permit for the limestone quarry specifies that pH at the effluent outfalls must remain between 6.0 and 9.0 and that total suspended solids (TSS) measurements must remain below 45.0 mg/l as a daily maximum and below 25.0 mg/l as a monthly average (ADEM 2020b, 5). There has been a history of water quality violations at this site, however. In 2002, ADEM found TSS concentrations of 755.0 mg/l at one inspection (ADEM 2004, 4), at which point they instructed the mining company to remedy the issue; another inspection nearly two years later found that outfall TSS levels remained elevated, at 94.0 mg/l. ADEM also noted five occasions when the mining company neglected to report elevated levels in a timely manner (ADEM 2004, 7).

Black Warrior Riverkeeper noted extreme turbidity in Fivemile Creek downstream of the quarry outflow in photos taken from the air and the ground (Figs. 12, 13). ADEM's Consent Order states that in August of 2004, an inspection indicated that upstream turbidity was 31.3 NTUs while turbidity downstream of the quarry outflow was 164.0 NTUs (ADEM 2004, 5).

Figure 13. Significant downstream turbidity in Fivemile Creek due to outflow from Bessemer Quarry. Photo taken on 10 May 2004 by N. Brooke.

Limestone quarrying in Florida has been suggested to lead to higher concentrations of sulfate and chloride in surface water through increased groundwater/surface water interactions (Naja et al. 2011). Effluent from limestone quarrying in the UK has been linked to clear declines in wetland floristic diversity, increased sedimentation, and changes in physicochemical properties (Mayes et al. 2005). Notably, pH of the water was found to increase from 6.1–8.5 at the reference site to as high as 12.75 at the quarry effluent outflow, with 8.8 being the average pH of the effluent (p 449).

In their 2001 Final Rule for the listing of the vermilion darter (*E. chermocki*), USFWS wrote, "Excessive siltation renders the habitat unsuitable for feeding and reproduction of vermilion darters and associated fish species. Sediment has been shown to wear away and suffocate periphyton (organisms that live attached to objects underwater), disrupt aquatic insect communities, and negatively impact fish growth, physiology, behavior, reproduction, and survival" (66 FR 229 59370). This is undoubtedly a threat to Birmingham darters downstream of the Bessemer Quarry.

URBANIZATION AND POLLUTION

Outside of the aforementioned threats to the species from ongoing quarry activity and from the proposed Bessemer data center, Birmingham darters in Valley Creek, Halls Creek, and Nabors Branch are exposed to high levels of pollution and habitat degradation as a result of urbanization in Jefferson County. Ecologists have called this continuous process of ecological degradation "urban stream syndrome" (Meyer et al. 2005).

The Valley Creek watershed is at least 90% developed (ADEM 2012, 1) with 130 permitted discharges in the Upper Valley Creek watershed alone.[5] In a 2006 case study regarding Valley Creek, the EPA wrote, "the biological health of Valley Creek is dependent on good physical and hydrological characteristics, including proper flow, adequate zones, and diverse substrate. The urbanization of the watershed has fostered habitat destruction through erosion, channelization, concrete substrate, and excessive light and heat penetration" (EPA 2006, 4). Compounding these physical changes, Upper Valley Creek has been shown to have poor dissolved oxygen (DO) levels, high pathogen levels, and elevated biochemical oxygen demand (BOD) (EPA 2006, 2), along with elevated nitrogen, arsenic, mercury, total dissolved solids, specific conductance, and hardness and alkalinity concentrations (ADEM 2007; ADEM 2012). There are many other contaminants which could be present. For example, an urbanized waterway in Ontario, Canada had detectable levels of multiple herbicides, including atrazine and dicamba; the artificial sweetener sucralose; and multiple pharmaceuticals, including naproxen and ibuprofen, in the water (Diamond et al. 2016, 130–131).

This broad range of pollutants and other water quality issues is likely to affect the metabolism, growth, behavior, and reproduction of Birmingham darters in Valley Creek. Polluted waters with urban and agricultural contaminant sources have been linked to altered biomarkers in the liver, gills, and brain of rainbow darters (*Etheostoma caeruleum*) and fantail darters (*E. flabellare*) in Ontario (Diamond et al. 2016, 130–132), and wastewater outflows have been linked to oxidative stress in juvenile rainbow trout (*Oncorhynchus mykiss*) (Sturve et al. 2008, 448). Environmental pollutants and sedimentation in freshwater systems also affect fish behaviors relating to predator avoidance, courtship and spawning, and intraspecific signaling (see Scott and Sloman 2004 and references therein).

The mouth of Fivemile Creek, close to the site where Birmingham darters were collected in 2006, is immediately downstream from an oil recycling and animal feed plant located on Valley Creek which was the site of a spill in 2024. The spill released thousands of gallons of grease and animal fat into the water, and although the plant quickly reported the spill and cleanup efforts were undertaken, this example highlights the potential for unpredictable ecological disasters in urbanized streams (Lewallen 2024). This population has also likely been heavily reduced in size

[5] https://mywaterway.epa.gov/community/031601120101/overview.

due to the impacts of quarrying on Fivemile Creek, which are discussed extensively in the previous section of this petition.

The Bessemer Valley Creek site, where Birmingham darters were collected in 2019, is less than one mile downstream from the mouth of Opossum Creek, which is the only remaining stream in the Black Warrior River system classified under Agriculture & Industrial water supply (A&I) use (ADEM Admin. Code R. 335-6-11-.02). Although the waters of A&I streams must be suitable for "fish survival", they are not suitable for "fishing, bathing, recreational activities, including water-contact sports, or as a source of water supply for drinking or food-processing purposes" (ADEM Admin. Code R. 335-6-10-.09(7)(a–b)). In 1989, EPA reported that Opossum Creek had "poor habitat and deposits of tar-like substances, with growth impairment to the fathead minnow" (EPA 2006, 3). Conditions such as those impacting fathead minnow growth are unlikely to be completely isolated to Opossum Creek, as it drains directly into Valley Creek. T. Near noted that the Bessemer Valley Creek habitat for Birmingham darters was "awful" and that only a few darters had been found on a small patch of usable substrate (T. Near, pers comm 24 October 2025).

This stretch of Valley Creek is designated by the Alabama Department of Environmental Management (ADEM) as Limited Warmwater Fishery (LWF). Despite its name, the LWF designation has little to do with ecological integrity or fish and wildlife habitat. Its waters are "suitable for agricultural irrigation, livestock watering, and industrial cooling waters. The waters will be usable after special treatment, as may be needed under each particular circumstance, for industrial process water supplies. The waters will also be suitable for other uses for which waters of lower quality will be satisfactory." ADEM Admin. Code R. 335-6-10-.09(6)(c)(2). This reach was listed as a §303(d) impaired waterway under the Clean Water Act (CWA) in 2004; it remained on the list until 2012. The justification for removing it stated only that "the Alabama Department of Public Health (ADPH) [had] determined that no restrictions on consumption of fish [were] necessary" (ADEM 2014, 10). The EPA currently lists this reach of Valley Creek as being in 'Good' condition; however, this means only that the stream is "fully supporting [its] designated uses under the Clean Water Act"[6] and not that it meets the ecological standards required to support microendemic species like the Birmingham darter. It is clear that Valley Creek is poor-quality habitat which is not sufficiently protected or managed to ensure the persistence of Birmingham darters.

[6] https://mywaterway.epa.gov/waterbody-report/21AWIC/AL03160112-0101-101/2022.

(D) Inadequacy of existing regulatory mechanisms

Lack of state ESA

Alabama is one of only three states (alongside Wyoming and West Virginia) without a state-level counterpart to the federal Endangered Species Act. State agencies work with USFWS and other federal agencies to conserve federally-listed species, but no Alabama agency maintains a list of imperiled species which receive legal or regulatory protections through state law. The closest thing is the list of Protected Nongame Species (Ala. Admin. Code R. 220-2-.92), but Birmingham darters are not included in this list. Therefore, Alabama possesses no regulatory mechanisms through which Birmingham darters can or do receive sufficient protections to ensure their continued survival. Federal listing under the ESA is necessary to conserve this microendemic Alabama fish.

Alabama's State Wildlife Action Plan (SWAP)

Birmingham darters are designated as a P1 (highest-priority) Species of Greatest Conservation Need (SGCN) under the 2025–2035 Draft SWAP. Unfortunately, this designation does not automatically afford them any meaningful protections, nor does it guarantee allocation of adequate funding, monitoring efforts, or other conservation actions. There are 452 species, including 45 fishes, designated as P1 in the new draft SWAP. This designation clearly will not be sufficient to protect Birmingham darters or the many other species needing help.

Water quality and water use standards

Water quality standards in Alabama are largely focused on anthropogenic uses, rather than on maintaining ideal habitat quality for riparian fauna, and therefore provide little protection for Birmingham darters. There are six use designations, from lowest to highest quality: Agricultural & Industrial Water Supply; Limited Warmwater Fishery; Fish & Wildlife; Shellfish Harvesting; Swimming and Other Whole Body Water-Contact Sports; Public Water Supply; and Outstanding Alabama Water (ADEM Admin. Code R. 335-6-11-.01).

Valley Creek, from its source to the mouth of Blue Creek, is designated a Limited Warmwater Fishery (LWF) by the Alabama Department of Environmental Management (ADEM). Despite its name, the Limited Warmwater Fishery (LWF) designation has little to do with ecological integrity or fish and wildlife habitat. Its waters are "suitable for agricultural irrigation, livestock watering, and industrial cooling waters. The waters will be usable after special treatment, as may be needed under each particular circumstance, for industrial process water supplies. The waters will also be suitable for other uses for which waters of lower quality will be satisfactory." (ADEM Admin. Code R. 335-6-10-.09(6)(c)(2)). There are no required fish or macroinvertebrate assessments which must be conducted in order for this status to be retained (ADEM 2020a). LWF designation and standards are not sufficient to protect Birmingham darters.

Further, Valley Creek is fed by Opossum Creek, which is the only remaining creek in the Black Warrior River watershed with the "Agriculture and Industrial" (A&I) water supply designation—the lowest and least stringent designation. A&I waters are not suitable for "fishing, bathing, recreational activities, including water-contact sports, or as a source of water supply for drinking or food-processing purposes" (ADEM Admin. Code R. 335-6-10-.09(7)(a–b)). In 1989, EPA reported that Opossum Creek had "poor habitat and deposits of tar-like substances, with growth impairment to the fathead minnow" (ADEM 2001, 10). Opossum Creek is a direct tributary of Valley Creek, and is therefore subjected to some of the same pollutants which have so significantly degraded its waters. Birmingham darters are not sufficiently protected by the standards imposed by ADEM on Alabama water quality.

ALABAMA WATER USE LAWS

Alabama has no water withdrawal permitting requirements, meaning no state agency is responsible for regulating or even comprehensively tracking water consumption. Landowners are able to use water from a river or stream on or adjacent to their property with very little oversight. Public information regarding the amount of water consumed by users will only be available if the user files a certificate of use with the Alabama Department of Economic and Community Affairs (ADECA), but few mechanisms are in place to ensure that such certificates submitted are truthful, or that certificates are submitted at all. Such a lack of oversight is highly dangerous to the Birmingham darter, which relies on multiple small streams in areas of high industrial use or development. Potential dewatering of Little Blue Creek is of great concern with regards to the Project Marvel hyperscale data center, and has already proven a concern for the quarrying of Fivemile Creek.

ADEM PERMITTING AND ENFORCEMENT ISSUES

The Alabama Department of Environmental Management (ADEM) is responsible for administering all major federal environmental laws and state environmental programs through a unified regulatory and permit system. This includes the responsibility to "issue, modify, suspend, or revoke orders, citations, notices of violation, certifications, or permits pertaining to environmental regulations" (ADEM Admin. Code R. 335-1-1-.05(10)). Most of the known populations of Birmingham darters live in close proximity to urban and industrial activities which are permitted and regulated, at least in part, by ADEM. Meaningful enforcement of environmental laws by the department is critical to the survival of Birmingham darters.

Unfortunately, ADEM has a long track record of failing to enforce egregious permit violations, or of punishing violators with little more than a slap on the wrist. In early spring 2023, the agency received complaints that a quarry in Addison, AL had opened and been operating for a year without any permits; ADEM conducted multiple site visits and noted numerous violations, including that "[t]he site fuel tanks are single walled, without secondary containment, and show signs of fuel spillage. There are other areas that show signs of oil spillage from heavy equipment.

The silt fence that is installed along the entry road is not trenched in. There are air gaps under the fence". Heavy siltation of a nearby creek was noted. When told to cease operations until permits were acquired, the operator of the mine "told [ADEM] that he has millions of dollars of equipment, was not able to shut down, and that he would have to accept whatever fine came along with the violation." That fine, ultimately levied after nearly a year of complaints and failed inspections, was only $50,000—with the consent order making no mention of certain violations, including discharging wastewater to a water of the state without a permit (Hedgepeth 2023a). In another recent case, a landfill in Opp, AL was documented committing dozens of environmental violations spanning 20 years, but ADEM repeatedly chose to issue citations without any fines at all despite the clear lack of compliance by the operator. The civil penalty issued after two decades of violations was a total of $152,000, with the agency discounting $30,000 of the fine "in the spirit of cooperation" (Hedgepeth 2023b).

ADEM permitting and enforcement decisions have already had a noted impact on Birmingham darters in Fivemile Creek. In 2020, following the release of a renewed draft National Pollutant Discharge Elimination System (NPDES) permit for the mining company operating the Bessemer limestone quarry, the nonprofit Black Warrior Riverkeeper raised numerous concerns that the new permit would not be sufficient to prevent further habitat destruction for Fivemile Creek. Riverkeeper cited concerns that the draft permit and application provided insufficient information on the contents of effluent being discharged into the creek, making it difficult for ADEM to determine whether or not discharges from the quarry would cause or contribute to violations of water quality standards (BWRK 2020, 3). They also drew attention to the lack of required macroinvertebrate surveys, conductivity measurements, or total dissolved solids (TDS) measurements (*Id.*). Ultimately, these concerns were brushed off by ADEM and no updates were made to the permit in response to submitted comments (ADEM 2021).

This quarry has already been fined $50,000 for repeated violations of TSS and pH in mining outfalls which fed into Fivemile Creek, including the failure to report violations within a timely manner on five occasions. The actions of the quarry operator, including the failure on multiple occasions to report elevated TSS or pH levels in a timely manner and the ongoing nature of the compliance issues, indicates that the current regulations, enforcement, and penalty structure from ADEM are not strong enough to protect Birmingham darters from habitat destruction in Fivemile Creek.

This lax handling of flagrant and egregious environmental violations is typical of ADEM. In 2015, ADEM director Lance LeFleur said, "The state has made the decision that we will run a bare-bones environmental program. … It's intentional here that the environmental program be the minimum it can be. ... Industry wants the minimum amount of regulation, the state wants to keep government out of people's lives" (Harris 2015). The unfortunate result of this philosophy is that ADEM is primarily motivated to keep Alabama's industry running while making as few

concessions for the environment as possible. This state department cannot be relied upon as the only enforcement for laws which might protect Birmingham darter habitat. If Project Marvel is approved by the Bessemer City Council, ADEM is unlikely to take a sufficiently stringent approach to the issuance and enforcement of permits granted for its construction and operation; nor is it likely to address future violations at the quarry or in the city of Bessemer with expediency or real conviction. Without federal ESA listing, the Birmingham darter will not be protected by state-level environmental law enforcement.

PROTECTIONS FOR OTHER SPECIES DO NOT BENEFIT BIRMINGHAM DARTERS

Birmingham darters are not protected by existing efforts to conserve other imperiled species or their habitats. Although another member of the species complex, the vermilion darter (*E. chermocki*) is listed as endangered under the ESA, its populations are confined to Turkey Creek—further upstream in Valley Creek than any populations of Birmingham darter. There is also very little overlap between the federally endangered watercress darter (*E. nuchale*) and the Birmingham darter, although they co-occur around Seven Springs and the spring run, which feeds into Nabors Branch, and in the unnamed tributary to Halls Creek downstream of the Watercress Darter National Wildlife Refuge. These may be the only populations of Birmingham darter benefitting from conservation efforts to another species: the NWR provides some protection, and the lands around Seven Springs are protected for watercress darters under a conservation easement which has been in place since 2021 (Freshwater Land Trust 2021). Unfortunately, this represents a very small amount of Birmingham darter occupied habitat and is not sufficient to protect the species from extinction.

BLACK WARRIOR RIVER WATERSHED MANAGEMENT PLAN

The Black Warrior River Watershed Management Plan, though apparently undated, was seemingly published sometime prior to 2005, likely around 2003–2004. This management plan is thus 20+ years old and predates the Birmingham darter's description, along with three other members of the *E. chermocki* complex, by almost two decades. Any provisions laid out in this management plan will be insufficient to protect Birmingham darters (BWCWP, n.d.).

(E) OTHER NATURAL OR MANMADE FACTORS AFFECTING SURVIVAL

CLIMATE CHANGE

Earth's climate system is rapidly changing, causing widespread impacts that are projected to increasingly affect humans and animals, especially those species that cannot adapt quickly. In the southeastern US, the annual average temperature has increased by 2°F (Karl et al. 2009, 111). By the 2080s, the average temperatures of the southeast are predicted to rise between 4.5–9°F, with an increase of up to 10.5°F in summer months.

Both drought and heavy rainfall are predicted to continue increasing throughout the century. The area of moderate to severe spring and summer drought has increased by 12 percent and 14

percent, respectively, since the mid-1970s. Even in the fall months, when precipitation tended to increase in most of the region, the extent of drought increased by 9 percent (*Id.*). Increasing frequency of droughts will impede groundwater recharge, which will affect streams inhabited by the Birmingham darter and may lead to increased groundwater pumping as water needs for human use must be met under reduced surface water availability (p 113). This will further compound the impacts of drought on Birmingham darters, whose streams are already prone to run dry in summer and which risk becoming more so under increased water usage by the proposed Bessemer data center or the limestone quarry discussed earlier in this petition.

The predicted increase in maximum temperature will have myriad impacts on freshwater ecosystems, among them a decline in dissolved oxygen in stream, lakes, and shallow aquatic habitats leading to fish kills and loss of aquatic species diversity (Karl et al. 2009, 113). The report by Karl et al. also calls out the local loss of many threatened and endangered species as a result of changing daily maxima and minima (*Id.*).

Birmingham darters are vulnerable to temperature change in their environment because they, like most fish, are ectotherms which lack the ability to perform internal temperature regulation. The impacts of temperature change have been investigated for other species of darter and show a range of results: Weber and Craig (2025) found differing thermal tolerance limits among three species in the genus *Etheostoma* which ranged from 87–92°F (Weber and Craig 2025, 6). The difference was posited to be potentially a result of microhabitat temperature or of microhabitat temperature variability, with both higher temperature and higher variability associated with higher thermal tolerance limits (p 10). All three species of darter examined showed indicators of significant metabolic challenges at temperatures between 68–77°F, considerably lower than their thermal tolerance limits, indicating that higher temperatures may demand higher energy allocation (p 12). The average temperatures of the river where these darters were collected is 39–68°F (p 3), while temperatures measured in Valley Creek in 2007 and 2012 were 77 and 67°F, respectively (ADEM 2007; ADEM 2012). Therefore, Birmingham darters certainly have a higher thermal tolerance limit than these fish, but a higher limit or higher comfort range may be associated with a lower thermal safety margin (Weber and Craig 2025, 12). The temperature at which Birmingham darters experience thermal metabolic stress may therefore be lower compared to the normal temperature of their habitat than for species adapted to cooler waters, meaning that less of an increase will pose a problem for these tiny fish.

SMALL POPULATION SIZE, NARROW HABITAT NICHE, AND GENETIC ISOLATION

Birmingham darters rely on exposed carbonate outcrops in the streambed to create suitable habitat, but these outcrops are relatively few and far between within the Valley Creek system (see Fig. 7). Although Brownstein et al. (submitted) report the presence of unmapped carbonate outcrops in some streams, there are still large areas of streambed which are unsuitable for habitation by Birmingham darters. These considerable barriers to dispersal are believed to be

responsible in part for creating the genetic isolation which led to speciation within the *E. chermocki* complex (see Kim et al. 2023), so it is likely that this patchy habitat results in lower gene flow within the species as well. T. Near estimates that some gene flow occurs between populations of Birmingham darter, but that gene flow is not high (T. Near & C. Brownstein, pers comm 29 July 2025). Artificial barriers to dispersal may be creating greater separation and impeding that already-limited gene flow between populations. For example, Fivemile Creek harbors numerous sinkholes and has run dry in the past due to quarry activity, which has disrupted known Birmingham darter habitat and likely created significant barriers to migration between populations known to exist both upstream and downstream of that point.

Other darters have been shown to suffer genetic isolation as a result of anthropogenic habitat fragmentation. The Yazoo darter (*Etheostoma raneyi*) exhibits genetically distinct populations on either side of impoundments, along with rates of current gene flow which are lower than historical rates and a partitioning of genetic variation among populations (Sterling et al. 2012).

Small population sizes can worsen the threats from genetic isolation, as small populations are more at risk of stochastic losses, genetic bottlenecks, and other issues which compromise diversity and viability over time. A study of the topminnow *Poeciliopsis monacha* revealed that a rapid loss of variation during an extinction/recolonization event was associated with concomitant losses of developmental stability, tolerance to physical extremes, competitive ability, and an increase in parasite load. This instability was only restored when genetic variation from a nearby population was reintroduced (Vrijenhoek 1994), highlighting the importance of diversity to maintain stability in small or recovering populations. Given the impacts of pollution, development, and mining on Birmingham darter habitat—including the complete removal of habitat seen in Fivemile Creek while the creek ran dry—the possibility of periodic extirpation/recolonization events seems likely, and recolonizing populations may be at risk from these and similar issues.

REQUEST FOR CRITICAL HABITAT DESIGNATION

Critical habitat as defined by Section 3 of the ESA is: "(i) the specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the provisions of section 1533 of this title, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) the specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 1533 of this title, upon a determination by the Secretary that such areas are essential for the conservation of the species." (16 U.S.C. § 1532(5)).

Congress recognized that the protection of habitat is essential to the recovery and/or survival of listed species, stating that: "classifying a species as endangered or threatened is only the first step in ensuring its survival. Of equal or more importance is the determination of the habitat necessary for that species' continued existence... If the protection of endangered and threatened species depends in large measure on the preservation of the species' habitat, then the ultimate effectiveness of the Endangered Species Act will depend on the designation of critical habitat." H. Rep. No. 94-887 at 3 (1976).

The Center requests that the Service propose to designate critical habitat concurrently with the Birmingham darter's proposed listing. Protecting the Birmingham darter without designating critical habitat will be insufficient to ensure the species' survival, particularly in light of the numerous imminent threats to several of its populations from habitat destruction.

CONCLUSION

The Birmingham darter is a critically imperiled fish endemic to one of the most heavily developed and industrialized areas of Alabama. A history of exploitative mining practices and industrial uses have created a highly altered landscape which remains under constant pressure as new economic interests continue to present new or worsening threats. Alabama's environmental policies and enforcement, including its outdated regulatory mechanisms for water use and its lax treatment of permit violations by developers, have cultivated a culture where industry is prioritized and environmental concerns remain unaddressed for years or decades. Without stronger protections, Birmingham darters will continue to decline under present conditions, particularly as projects like the proposed hyperscale data center continue to be introduced in and around Bessemer. This tiny fish must receive protections under the Endangered Species Act to ensure its continued existence.

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