Draft Environmental Assessment

UPS Flight Forward, Inc.
Drone Package Delivery Operations
Columbus, Ohio

January 2023

United States Department of Transportation
Federal Aviation Administration

Washington, D.C.

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Cover Image: UPS Flight Forward, Inc.

DEPARTMENT of TRANSPORTATION
Federal Aviation Administration
Washington, D.C.

Notice of Availability of the Draft Environmental Assessment for UPS Flight Forward's Drone Package Delivery Operations in Columbus, Ohio

The Federal Aviation Administration (FAA) hereby gives Notice of Availability (NOA) for the Draft Environmental Assessment (EA) evaluating the potential effects of the FAA decision to authorize UPS Flight Forward, Inc. (UPSFF) to conduct unmanned aircraft (UA) commercial package delivery operations in Columbus, Ohio.

UPSFF is seeking to amend its Part 135 Air Carrier Operations Specifications (OpSpecs) to include a new operating area for package delivery operations in Columbus. UPSFF is proposing to operate at two Distribution Centers (DC) in the approved operating area. The federal action subject to this EA is the requested FAA approval of UPSFF's amended OpSpecs to include a paragraph with descriptive language about the operating area boundaries, which includes the specific locations and operational profile in UPSFF's request.

The Draft EA has been prepared in accordance with the requirements set forth in the Council on Environmental Quality (CEQ) regulations at Title 40, Code of Federal Regulations (CFR), parts 1500-1508, *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* and FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*.

The public comment period for the Draft EA begins with the issuance of this Notice of Availability and lasts 14 days. The FAA encourages all interested parties to provide comments concerning the scope and content of the Draft EA by February 8, 2023, or 14 days from the date of publication of this Notice of Availability, whichever is later. The Draft EA is available to view/download electronically at https://www.faa.gov/uas/advanced_operations/nepa_and_drones/

Comments may be directed in writing to 9-FAA-Drone-Environmental@faa.gov. Please reference the UPSFF Columbus Draft EA in the email subject line when sending comments.

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, be advised that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold from public review your personal identifying information, we cannot guarantee that we will be able to do so.

Posted January 25, 2023

Dave Menzimer

Manager, General Aviation Operations Section
General Aviation and Commercial Division
Office of Safety Standards, Flight Standards Service

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1.0 PURPOSE AND NEED

1.1 Introduction

UPS Flight Forward, Inc. (UPSFF) is seeking to amend its air carrier Operations Specifications (OpSpecs) and other Federal Aviation Administration (FAA) approvals necessary to begin unmanned aircraft (UA) commercial package delivery operations within a 3.77-square mile operating area located in Columbus, Ohio, using the 29-pound Matternet M2 UA. Based on the scope of the proposed action, as discussed in Section 2.1, UPSFF proposes to begin operations in Columbus, OH at two distribution centers (DCs): Ackerman and Bus Depot.[1] UPSFF projects operating a maximum of 28 delivery flights per operating day at the Ackerman DC and 28 delivery flights per day at the Bus Depot DC. One delivery flight includes the outbound takeoff and inbound landing of the UA. The proposed operations would occur during daylight hours up to seven days per week, with no flights on holidays. No nighttime operations are anticipated or requested under the proposed action. The approval of amendments to UPSFF's OpSpecs to include the Columbus operating area is considered a major federal action subject to environmental review requirements.

This Draft Environmental Assessment (EA) is being prepared by the FAA to evaluate the potential environmental impacts that may result from FAA's approval of the proposed action, which would enable UPSFF UA commercial delivery operations at two DCs within a 3.77-square mile airspace box located in Columbus, OH, as depicted in Figure 1 below (the operating area). The FAA has prepared this EA pursuant to the National Environmental Policy Act of 1969 (NEPA) [42 United States Code (U.S.C.) § 4321 et seq.] and its implementing regulations (40 Code of Federal Regulations (CFR) §§1500-1508)). NEPA requires federal agencies to consider the environmental effects of proposed federal actions and to disclose to decision-makers and the interested public a clear and accurate description of the potential environmental impacts of proposed major federal actions. Under NEPA, federal agencies are required to consider the environmental effects of a proposed action, the reasonable alternatives to the proposed action, and a no action alternative (assessing the potential environmental effects of not implementing the proposed action). The FAA has established a process to ensure compliance with the provisions of NEPA through FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*.

1.2 Background and Location

In 2012, Congress first charged the FAA with integrating unmanned aircraft systems (UAS) into the National Airspace System (NAS).[2] The FAA has engaged in a phased, incremental approach to integrating UAS into the NAS and continues to work toward full integration of UAS into the NAS. Part of that approach involves providing safety review and oversight of proposed operations to begin commercial UA delivery in the NAS.

Over the past several years, UPSFF has been working under FAA programs including the UAS Integration Pilot Program (IPP),[3] the Partnership for Safety Plan (PSP) Program,[4] and the BEYOND program,[5] as well as the FAA's established processes to bring certificated commercial UA delivery into practice. Participants in these programs are among the first to prove their concepts, including package delivery by

[1] A Distribution Center (DC) is a ground based service area where UA are assigned and where flights originate and return.
[2] 49 U.S.C. 44802; FAA Modernization and Reform Act of 2012, Pub. L. No. 112-95, Sec. 332. 126 Stat. 11, 73 (2012).
[3] The UAS IPP was announced on October 25, 2017 via a Presidential Memorandum, which has the force and effect of law on executive agencies. https://www.faa.gov/uas/programs_partnerships/completed/integration_pilot_program/
[4] https://www.faa.gov/uas/programs_partnerships/psp/
[5] https://www.faa.gov/uas/programs_partnerships/beyond/

UA, through the use of current regulations and exemptions and waivers from some of these regulatory requirements.

UPSFF was one of the first operators to obtain an FAA Part 135 air carrier certificate, which allows it to carry the property of another for compensation or hire beyond visual line of sight (BVLOS). UPSFF has a standard Part 135 air carrier certificate and the certificate contains a stipulation that operations must be conducted in accordance with the provisions and limitations specified in its OpSpecs. UPSFF's current request for OpSpecs to modify an area of operations, in conjunction with other related FAA approvals, such as a waiver of 14 CFR § 91.113(b) to enable BVLOS operations and a Certificate of Waiver or Authorization (COA), would enable commercial delivery operations in the operating area.

UPSFF proposes to conduct deliveries of healthcare and other consumer products in the Columbus operating area. The location is shown in Figures 1 and 2 below, with the operating area outlined in red and the DCs identified using the green pins. There are no airports within the operating area; there is one heliport in the operating area. The operating area should also be considered as the study area for the purposes of this EA.

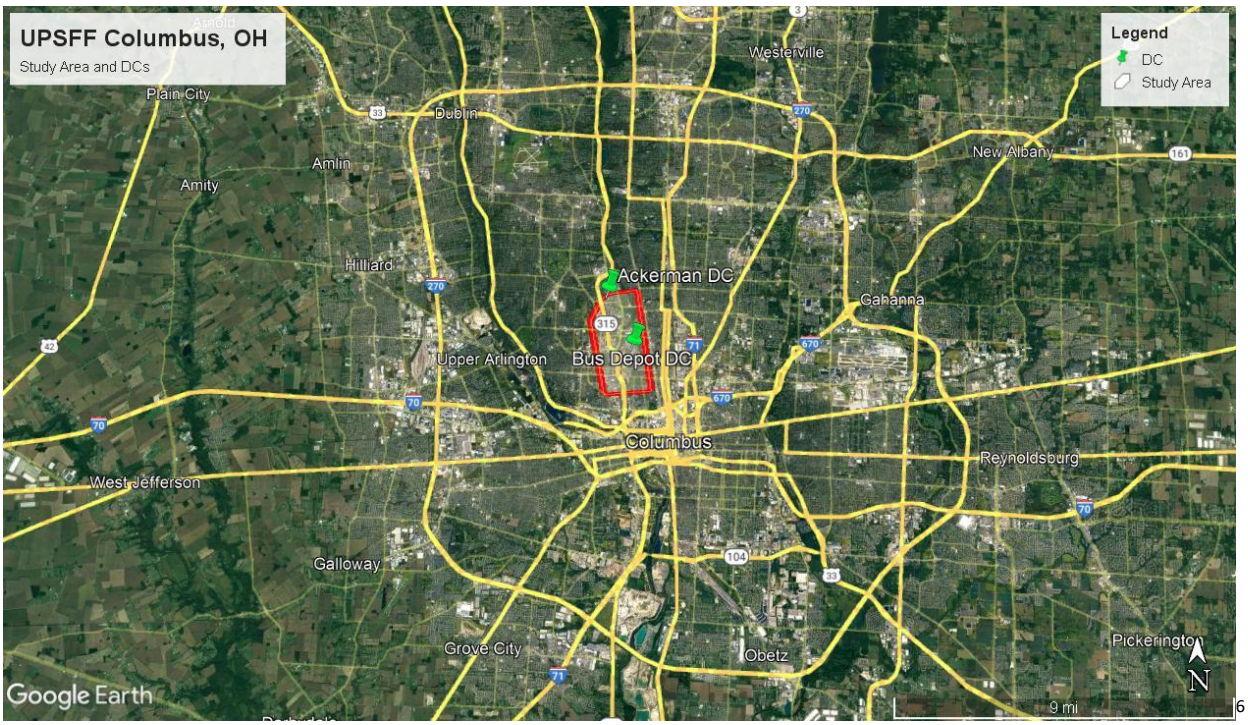
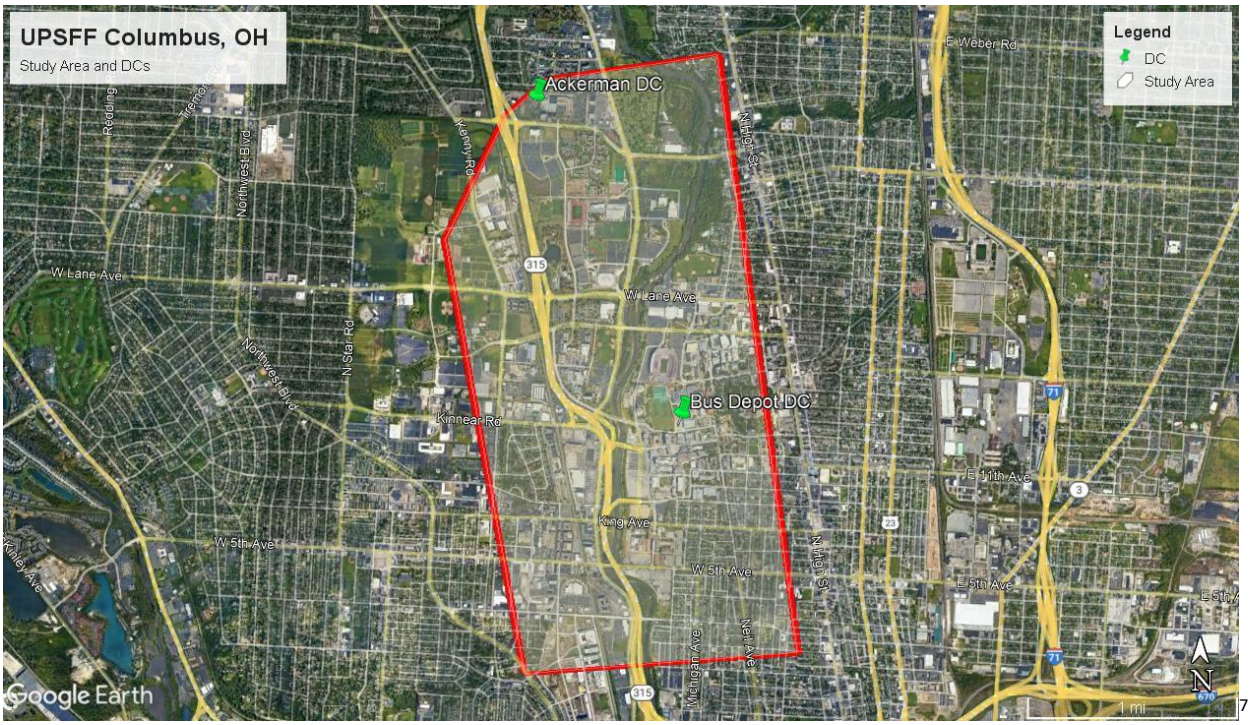


Figure 1 *Study Area in Columbus, OH*

[6] Image: Google Earth, as modified by the FAA.



[7]

Figure 2 *Closer View of the Study Area in Columbus, OH*

1.2.1 Distribution Centers (DCs)

Ackerman DC

The Ackerman DC is located at 690 Ackerman Rd, Columbus, OH 43202. The site is adjacent to a parking lot in a paved area that is part of the Ohio State Wexner Medical Center. The property is zoned for manufacturing.[8] Immediately north of the DC are residential neighborhoods and to the east are student housing apartments and a commercial district where restaurants and other businesses are located. The Ohio State University athletic facilities are to the south and Ohio State Route 315 is approximately 600 feet west of the DC. See the Ackerman DC location in Figure 3. Note: the red line in Figure 3 is the operating area boundary.

[7] Image: Google Earth, as modified by the FAA.
[8] City of Columbus Zoning Map. Available: https://gis.columbus.gov/zoning/. Accessed: September 27, 2022.

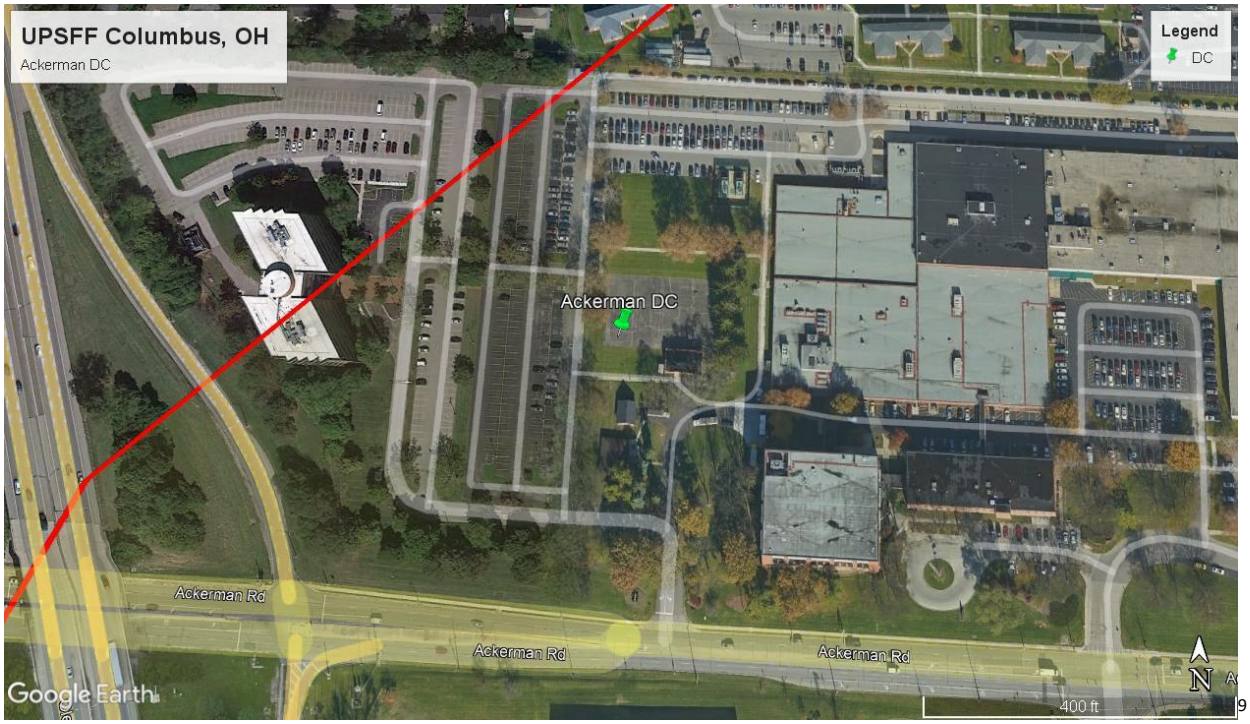


Figure 3 *Location of Ackerman Distribution Center*

Bus Depot DC

The Bus Depot DC is located in a green space island adjacent to an on-campus bus depot at 384 John H. Herrick Drive, Columbus, OH 43212. The property is zoned as a research park.[10] The areas surrounding the DC include The Ohio State University educational buildings, athletic facilities, and student housing. The closest intersection is John H. Herrick Drive and Cannon Drive. See the Bus Depot DC location in Figure 4.

[9] Image: Google Earth, as modified by the FAA.
[10] The City of Columbus Zoning Map. Available: https://gis.columbus.gov/zoning/. Accessed: September 27, 2022.

[11]

Figure 4 *Location of Bus Depot Distribution Center*

1.3 Purpose and Need

As described in FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, the Purpose and Need section of an EA briefly describes the underlying purpose and need for the proposed federal action. It presents the problem being addressed and describes what the FAA is trying to achieve with the proposed action.

1.3.1 FAA Purpose and Need

The FAA has multiple approvals, such as a waiver of 14 CFR § 91.113(b) to enable BVLOS operations, and a COA, associated with the operations in Columbus; however, the FAA issuance of the amended OpSpecs is the approval that will ultimately enable UA commercial delivery operations in the operating area. UPSFF's request for amended OpSpecs to enable operations in Columbus requires FAA review and approval.

The FAA has a statutory obligation to review UPSFF's request to issue the amended OpSpecs and determine whether the amendment would affect safety in air transportation or air commerce and whether the public interest requires the amendment. In general, Congress has charged the FAA to encourage the development of civil aeronautics and the safety of air commerce in the United States. 49 U.S.C. § 40104.

In addition, the FAA has specific statutory and regulatory obligations related to its issuance of a Part 135 certificate and the related OpSpecs. The FAA is required to issue an operating certificate to an air carrier when it "finds, after investigation, that the person properly and adequately is equipped and able to operate safely under this part and regulations and standards prescribed under this part." 49 U.S.C. §

[11] Image: Google Earth, as modified by the FAA

44705. An operating certificate also specifies "terms necessary to ensure safety in air transportation; and (2)…the places to and from which, and the airways of the United States over which, a person may operate as an air carrier." *Id*. Also included in air carrier certificates is a stipulation that the air carrier's operations must be conducted in accordance with the provisions and limitations specified in the OpSpecs. 14 CFR § 119.5 (g), (l). The regulations also specify that a Part 135 certificate holder may not operate in a geographical area unless its OpSpecs specifically authorize the certificate holder to operate in that area. 14 CFR § 119.5(j). The regulations implementing Section 44705 specify that an air carrier's approved OpSpecs must include, among other things, "authorization and limitations for routes and areas of operations." 14 CFR § 119.49(a)(6). An air carrier's OpSpecs may be amended at the request of an operator if the FAA "determines that safety in air commerce and the public interest allows the amendment." 14 CFR § 119.51(a); see also 49 U.S.C. § 44709. After making this determination, the FAA must take an action on the OpSpec amendment.

1.3.2 UPSFF's Purpose and Need

The purpose of UPSFF's request is to begin UA commercial delivery service in Columbus, which, in its business judgment, UPSFF has determined is an appropriate market to begin new commercial delivery operations. UPSFF is already conducting deliveries under its Part 135 OpSpecs in Winston-Salem, North Carolina, and The Villages, Florida. UPSFF's amended OpSpecs are needed so that UPSFF can begin UA commercial delivery operations in the proposed operating area in Columbus. The approval will offer UPSFF an opportunity to expand its UA commercial delivery capabilities under real world conditions and demonstrate that it can conduct operations safely and meet its compliance obligations. The approval could also help UPSFF gauge public demand for UA commercial delivery services and evaluate whether scalable and cost-effective UA delivery expansion is possible in the Columbus area. In addition, the approval could provide an opportunity to assess community response to commercial delivery operations in the area.

2.0 PROPOSED ACTION AND ALTERNATIVES

FAA Order 1050.1F, Paragraph 6-2.1(d) states that, "[a]n EA may limit the range of alternatives to the proposed action and no action alternative when there are no unresolved conflicts concerning alternative uses of available resources." The FAA has not identified any unresolved conflicts concerning alternative uses of available resources associated with UPSFF's proposal. Therefore, this EA only considers the proposed action and the no action alternative.

2.1 Proposed Action

In order for UPSFF to conduct UA package deliveries in a new location, it must receive a number of approvals from FAA, such as a waiver of 14 CFR § 91.113(b) to enable BVLOS operations and a COA. Further, UPSFF has requested the FAA to approve its OpSpecs so that they can expand commercial delivery operations under their Part 135 air carrier certificate. The OpSpec approval is the FAA action that ultimately would enable commercial delivery operations in the operating area, located in Columbus, Ohio.

The B050 OpSpec, *Authorized Areas of En Route Operations, Limitations, and Provisions*, includes a reference section titled Limitations, Provisions, and Special Requirements. The amendment to this reference section – to add a new paragraph with descriptive language about the operating area boundaries, including the specific location and operational profile proposed in UPSFF's request – is the proposed federal action for this EA. The OpSpecs will restrict UPSFF to this particular operating area; any future expansion beyond the authorization and limitations for the area of operations described in the B050 OpSpec, or beyond the current 1:1 pilot to aircraft ratio described in UPSFF's A003 OpSpec, *Airplane/Aircraft Authorization*, will require additional OpSpec amendments from the FAA and will receive appropriate NEPA review at that time.

UPSFF is seeking to begin operations at two DCs, Ackerman and Bus Depot, which are both located in Columbus. Based on the scope of the proposed action, UPSFF projects operating a maximum of 28 delivery flights per operating day at the Ackerman DC and 28 delivery flights per operating day at the Bus Depot DC. The average daily number of operations at each DC location is depicted in Table 2-1. UPSFF anticipates that operational demand could increase the number of delivery flights per day; however, additional regulatory approvals and environmental review would be needed before an increase in the pilot-to-aircraft ratio could be approved to accommodate additional daily flights. The proposed operations would take place during daylight hours up to seven days per week, with no flights on holidays. The UA is capable of nighttime operations; however, no nighttime deliveries are anticipated or requested under the proposed action.

Table 2-1 UPSFF's Average Projected Daily Operations at DC Locations

DC Location	Average Daily Number of Operations
Ackerman	28
Bus Depot	28

The UA has a maximum takeoff weight of 29 pounds, including a payload of 4.4 pounds. It is a quadcopter that uses electric power from rechargeable lithium-ion batteries. The aircraft includes a parachute safety system that can be deployed in cases of emergency.

After launch, UPSFF's UA will rise to a cruising altitude of approximately 250 feet above ground level (AGL) and follow a preplanned route to its delivery site. The aircraft may fly up to 400 feet AGL when needed. The pre-planned route is optimized to avoid terrain and object obstructions, and areas of high population density. The UA will stay at its cruising altitude of roughly 250 feet AGL except when descending to land. When the aircraft starts its initial descent, it will transition to hover and descend to 165 AGL and wait up to 90 seconds for an approval to land. After landing is approved, the aircraft will continue its descent to land for approximately 22 seconds. Once the aircraft has landed, the package is retrieved.

2.2 No Action Alternative

The CEQ regulations at 40 CFR § 1502.14 require agencies to consider a "no action" alternative in their NEPA reviews to compare the environmental effects of not taking action with the effects of the action alternative(s). Thus, the No Action Alternative serves as a baseline to compare the impacts of the Proposed Action. Under the No Action Alternative, the FAA would not issue the amendment to the OpSpecs to enable UPSFF to begin Part 135 UA commercial package delivery operations in the operating area. UPSFF could still conduct package delivery operations in this operating area under Part 107 operating authorities without additional FAA approval; however, these operations could only occur within visual line of sight. As a result, the geographic scope of the operating area would be more limited.

3.0 AFFECTED ENVIRONMENT and ENVIRONMENTAL CONSEQUENCES

This chapter provides a description of the environmental resources that would be affected by the proposed action, as required by the CEQ regulations and FAA Order 1050.1F. The level of detail provided in this section is commensurate with the importance of the impact on these resources (40 CFR § 1502.15). The general study area for each resource is the entire area within the red-lined boundary of Figures 1 and 2 in this EA. As required by FAA Order 1050.1F, this EA presents an evaluation of impacts for the environmental impact categories listed below.

- Air Quality
- Biological Resources (including Fish, Wildlife, and Plants)
- Climate
- Coastal Resources
- Department of Transportation Act, Section 4(f) Resources
- Farmlands
- Hazardous Materials, Solid Waste, and Pollution Prevention
- Historical, Architectural, Archaeological, and Cultural Resources
- Land Use
- Natural Resources and Energy Supply
- Noise and Noise-Compatible Land Use
- Socioeconomic, Environmental Justice, and Children's Environmental Health and Safety Risks
- Visual Effects (Light Emissions)
- Water Resources (including Wetlands, Floodplains, Surface Waters, Groundwater, and Wild and Scenic Rivers)

For each of the resources covered in this section, the following information is provided:

- Regulatory Setting
- Affected Environment
- Environmental Consequences

3.1 Resources Not Analyzed in Detail

This EA does not analyze potential impacts on the following environmental impact categories in detail, for the reasons explained below:

- **Air Quality and Climate** – The drone is battery-powered and will not generate criteria air pollutants or greenhouse gas emissions that could result in air quality impacts or climate impacts. Electricity used to support drone battery charging and DC operations is supplied by the

electrical grid and is expected to be minimal, especially for the limited scope of these operations. Electricity consumed for the proposed action is not expected to cause significant impacts to the electrical grid.

- **Coastal Resources** – The proposed action would take place in central Ohio, outside of the coastal zone and away from any shorelines. As a result, the proposed action would not be inconsistent with any National Oceanic and Atmospheric Administration (NOAA)-approved state Coastal Zone Management Plan (CZMP).

- **Farmlands** – The proposed action will not involve the development or disturbance of any land regardless of use, nor would it have the potential to convert any farmland to non-agricultural uses.

- **Hazardous Materials, Solid Waste, and Pollution Prevention** – The proposed action will not result in any construction or development or any physical disturbances of the ground. Therefore, the potential for impact in relation to hazardous materials, pollution prevention, and solid waste is not anticipated. Additionally, each Matternet UA is assembled from recoverable materials and will be properly managed and disposed of at the end of its operating life in accordance with 14 CFR Part 43. There are no Environmental Protection Agency (EPA) Superfund sites within the operating area.

- **Land Use** – The proposed action will not involve any changes to existing, planned, or future land uses within the area of operations.

- **Natural Resources and Energy Supply –** The proposed action will not require the need for unusual natural resources and materials, or those in short supply. The Matternet UA is battery-powered and would not require excessive fuel resources, given the planned low number of operations.

- **Socioeconomic Impacts and Children's Environmental Health and Safety Risks** – The proposed action will not involve acquisition of real estate, relocation of residents or community businesses, disruption of local traffic patterns, loss in community tax base, or changes to the fabric of the community. Executive Order (EO) 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, requires federal agencies to ensure that children do not suffer disproportionately from environmental or safety risks. The proposed action will not affect products or substances that a child would be likely to come into contact with, ingest, use, or be exposed to, and would not result in environmental health and safety risks that could disproportionately affect children. UPSFF's proposal includes avoiding operations near schools (Monday-Friday) during operational hours, which could help reduce any potential environmental health or safety impacts to children. The FAA identified one school, Metro Early College Middle and High School, in the study area. The school is approximately 0.9 miles from the Bus Depot DC. This distance is outside of Day-Night Average Sound Level (DNL) 45 dB noise exposure associated with operations at the DC.

- **Visual Effects (Light Emissions Only)** – The proposed action will not result in significant light emission impacts because flights will be limited to daytime flights only.

- **Water Resources (Wetlands, Floodplains, Groundwater, and Wild and Scenic Rivers)** – The proposed action will not result in the construction of facilities and would therefore not encroach upon areas designated as navigable waters or directly impact wetlands. The proposed action will not encroach upon areas designated as a 100-year flood event area as described by the Federal

Emergency Management Agency (FEMA). The proposed action will not result in any changes to existing discharges to water bodies, create a new discharge that would result in impacts to surface waters, or modify a water body. The proposed action does not involve land acquisition or ground disturbing activities that would withdraw groundwater from underground aquifers or reduce infiltration or recharge to ground water resources through the introduction of new impervious surfaces. The proposed action would not foreclose or downgrade the wild, scenic, or recreational status of a river or river segment included in the Wild and Scenic Rivers System (WSRS). There are no listed WSRS or Nationwide Rivers Inventory (NRI) river segments within the operating area. The nearest NRI river segment is the Scioto River, approximately 1.1 miles south of the operating area boundary. The nearest WSRS river segment is the Big and Little Darby Creeks, approximately 11.5 miles west of the operating area boundary.

3.2 Biological Resources (Including Fish, Wildlife and Plants)

3.2.1 Regulatory Setting

Biological resources include plant and animal species and their habitats, including special status species (federally listed or state-listed threatened or endangered species, species proposed for listing, species that are candidates for federal listing, marine mammals, and migratory birds) and environmentally sensitive or critical habitat. In addition to their intrinsic values, biological resources provide aesthetic, recreational, and economic benefits to society.

Threatened and Endangered Species

The Endangered Species Act (ESA) of 1973 [16 U.S.C. § 1531 et seq.] requires the evaluation of all federal actions to determine whether a proposed action is likely to jeopardize any proposed, threatened, or endangered species or proposed or designated critical habitat. Critical habitat includes areas that will contribute to the recovery or survival of a listed species. Federal agencies are responsible for determining if an action "may affect" listed species, which determines whether formal or informal consultation with the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service (NMFS) is needed. If the FAA determines that the action will have no effect on listed species, consultation is not required. If the FAA determines that the action may affect listed species, consultation with the USFWS must be initiated.

A significant impact to federally-listed threatened and endangered species would occur when the USFWS or NMFS determines that the proposed action would be likely to jeopardize the continued existence of a federally-listed threatened or endangered species, or would be likely to result in the destruction or adverse modification of federally-designated critical habitat. An action need not involve a threat of extinction to federally listed species to meet the NEPA standard of significance. Lesser impacts including impacts on non-listed or special status species could also constitute a significant impact.

Migratory Birds

The Migratory Bird Treaty Act (16 U.S.C. §§ 703-712) protects migratory birds, including their nests, eggs, and parts, from possession, sale, purchase, barter, transport, import, export, and take. The USFWS is the federal agency responsible for the management of migratory birds as they spend time in habitats of the U.S. For purposes of the Migratory Bird Treaty Act, "take" is defined as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" (50 CFR § 10.12). The Migratory Bird Treaty Act applies to migratory birds identified in 50 CFR § 10.13 (defined hereafter as "migratory birds").

Bald and Golden Eagles

The Bald and Golden Eagle Protection Act prohibits anyone from "taking" a bald or golden eagle, including their parts, nests, or eggs, without a permit issued by the USFWS. Implementing regulations (50 CFR § 22), and USFWS guidelines as published in the National Bald Eagle Management Guidelines, provide for additional protections against "disturbances." Similar to take, "disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, injury to an eagle or causes either a decrease in its productivity or nest abandonment due to a substantial interference with breeding, feeding, or sheltering. A permitting process provides limited exceptions to the Bald and Golden Eagle Protection Act's prohibitions. The USFWS has issued regulations for the permitting process in 50 CFR Part 22, which include permits for the incidental take of Bald Eagles. Such permits are only needed when avoidance of incidental take is not possible. According to federal and state guidelines, if

conservation measures can be implemented such that no aircraft are flown within 1,000 feet of a nest, incidental take of Bald Eagles is unlikely to occur and no permit is needed.[12]

3.2.2 Affected Environment

This section describes the existing biological environment of the operating area. The operating area in Columbus is in the Eastern Corn Belt Plains ecoregion of Ohio, characterized by rolling till plains with extensive corn, soybean, and livestock production.[13]

The proposed action would take place over rural, suburban, and commercially-developed properties. These areas provide habitat for many of the more common and ubiquitous bird and mammal species of the eastern U.S., including mammals such as white-tailed deer, raccoons, opossums, foxes, mice and squirrels, and many volant organisms including bats, songbirds, raptors, waterfowl, and insects.[14]

Special Status Species

Federally Listed Species

The potential for impacts to federally-listed species was assessed using the USFWS Information for Planning and Consultation (IPaC) map tool and reports, including the official species list. The study area covered the entire operating area outlined in red in Figures 1 and 2 of this EA. The official species list obtained using this tool is included in Appendix A.

Based on the official species list, there are two ESA-listed mammal species potentially occuring in the operating area: the Indiana Bat (*Myotis sodalis*), an endangered species, and the Northern Long-eared Bat (*Myotis septentrionalis*), a threatened species. The Monarch Butterfly (*Danaus plexippus*) is a candidate for federal listing and could occur in the operating area. There is no critical habitat within the operating area for any species identified in the official species list.

State Species of Concern

The Ohio Department of Natural Resources (ODNR) lists 112 species of mammals, birds, amphibians, reptiles, fish, mollusks, and crustaceans in Franklin County as endangered, threatened, species of concern, special interest, or extirpated.[15] Of the 112 species listed by ODNR in Franklin County, the FAA identified 66 species of mammals, birds, moths, butterflies, amphibians, and reptiles as having the potential to occur within the study area for at least part of the year. These species are identified in Table 3-1 below.

Table 3-1 Ohio State-listed Species

Common Name	Scientific Name	Group	State Status
Eastern Cricket Frog	*Acris crepitans crepitans*	Amphibian	Species of Concern
Four-toed Salamander	*Hemidactylium scutatum*	Amphibian	Species of Concern
Upland Sandpiper	*Bartramia longicauda*	Bird	Endangered
American Bittern	*Botaurus lentiginosus*	Bird	Endangered

[12] U.S. Fish and Wildlife Service. 2007. National Bald Eagle Management guidelines. Available: https://fws.gov/migratorybirds/pdf/management/nationalbaldeaglenanagementguidelines.pdf. Accessed: February 4, 2022.
[13] U.S. Geological Survey. Ecoregions of Indiana and Ohio. Available: https://store.usgs.gov/assets/MOD/StoreFiles/Ecoregion/21631_in_oh_front.pdf. Accessed September 30, 2022.
[14] iNaturalist. Ohio. Available: Ohio, US · iNaturalist. Accessed: September 30, 2022.
[15] State Listed Wildlife and Plant Species By County. Available: http://ohiodnr.gov/static/documents/wildlife/state-listed-species/franklin.pdf. Accessed: September 30, 2022.

Lark Sparrow	*Chondestes grammacus*	Bird	Endangered
Northern Harrier	*Circus hudsonius*	Bird	Endangered
Northern Shoveler	*Anas clypeata*	Bird	Special Interest
Green-winged Teal	*Anas crecca*	Bird	Special Interest
American Black Duck	*Anas rubripes*	Bird	Special Interest
Veery	*Catharus fuscescens*	Bird	Special Interest
Hermit Thrush	*Catharus guttatus*	Bird	Special Interest
Brown Creeper	*Certhia americana*	Bird	Special Interest
Least Flycatcher	*Empidonax minimus*	Bird	Special Interest
Wilson's Snipe	*Gallinago delicata*	Bird	Special Interest
Dark-eyed Junco	*Junco hyemalis*	Bird	Special Interest
Yellow-crowned Night-heron	*Nyctanassa violacea*	Bird	Special Interest
Nashville Warbler	*Oreothlypis ruficapilla*	Bird	Special Interest
Northern Waterthrush	*Parkesia noveboracensis*	Bird	Special Interest
Golden-crowned Kinglet	*Regulus satrapa*	Bird	Special Interest
Blackburnian Warbler	*Setophaga fusca*	Bird	Special Interest
Magnolia Warbler	*Setophaga magnolia*	Bird	Special Interest
Red-breasted Nuthatch	*Sitta canadensis*	Bird	Special Interest
Yellow-bellied Sapsucker	*Sphyrapicus varius*	Bird	Special Interest
Winter Wren	*Troglodytes hiemalis*	Bird	Special Interest
Golden-winged Warbler	*Vermivora chrysoptera*	Bird	Special Interest
Bell's Vireo	*Vireo bellii*	Bird	Special Interest
Sharp-shinned Hawk	*Accipiter striatus*	Bird	Species of Concern
Henslow's Sparrow	*Ammodramus henslowii*	Bird	Species of Concern
Grasshopper Sparrow	*Ammodramus savannarum*	Bird	Species of Concern
Great Egret	*Ardea alba*	Bird	Species of Concern
Common Nighthawk	*Chordeiles minor*	Bird	Species of Concern
Sedge Wren	*Cistothorus platensis*	Bird	Species of Concern
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Bird	Species of Concern
Northern Bobwhite	*Colinus virginianus*	Bird	Species of Concern
Bobolink	*Dolichonyx oryzivorus*	Bird	Species of Concern
American Coot	*Fulica americana*	Bird	Species of Concern
Common Gallinule	*Gallinula galeata*	Bird	Species of Concern
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Bird	Species of Concern
Vesper Sparrow	*Pooecetes gramineus*	Bird	Species of Concern
Sora Rail	*Porzana carolina*	Bird	Species of Concern
Prothonotary Warbler	*Protonotaria citrea*	Bird	Species of Concern
Cerulean Warbler	*Setophaga cerulea*	Bird	Species of Concern
Sandhill Crane	*Grus canadensis*	Bird	Threatened
Least Bittern	*Ixobrychus exilis*	Bird	Threatened

Black-crowned Night-Heron	*Nycticorax nycticorax*	Bird	Threatened
Barn Owl	*Tyto alba*	Bird	Threatened
Two-spotted Skipper	*Euphyes bimacula*	Butterfly	Species of Concern
Indiana Myotis	*Myotis sodalis*	Mammal	Endangered
Evening Bat	*Nycticeius humeralis*	Mammal	Special Interest
Star-nosed Mole	*Condylura cristata*	Mammal	Species of Concern
Big Brown Bat	*Eptesicus fuscus*	Mammal	Species of Concern
Red Bat	*Lasiurus borealis*	Mammal	Species of Concern
Hoary Bat	*Lasiurus cinereus*	Mammal	Species of Concern
Woodland Vole	*Microtus pinetorum*	Mammal	Species of Concern
Ermine	*Mustela erminea*	Mammal	Species of Concern
Little Brown Bat	*Myotis lucifugus*	Mammal	Species of Concern
Tri-colored Bat	*Perimyotis subflavus*	Mammal	Species of Concern
Deer Mouse	*Peromyscus maniculatus*	Mammal	Species of Concern
Smoky Shrew	*Sorex fumeus*	Mammal	Species of Concern
Southern Bog Lemming	*Synaptomys cooperi*	Mammal	Species of Concern
Common Gray Fox	*Urocyon cinereoargenteus*	Mammal	Species of Concern
Northern Long-eared Bat	*Myotis septentrionalis*	Mammal	Threatened
Slender Clearwing	*Hemaris gracilis*	Moth	Special Interest
none	*Agroperina lutosa*	Moth	Species of Concern
Precious Underwing	*Catocala pretiosa*	Moth	Species of Concern
Smooth Greensnake	*Opheodrys vernalis*	Reptile	Endangered

Migratory Birds

Migratory bird species found within the operating area will vary throughout the year. During certain weeks in the spring and fall, hundreds of species of songbirds, raptors, and waterfowl may potentially pass through the operating area. Additionally, several dozen species of birds may potentially nest in the operating area at certain times of the year. There are no Audubon Important Bird Areas within the operating area.[16]

The IPaC Report identifies Birds of Conservation Concern (BCC) that could occur in the operating area, along with information on the likelihood that they may be nesting in the area. The Bald Eagle (*Haliaeetus leucocephalus)* is not a BCC in the operating area; however, it could nest in forested areas near rivers and lakes in the area, and, as stated in the National Bald Eagle Management Guidelines,[17] aircraft should stay at least 1,000 feet from Bald Eagle nests during its breeding season unless the aircraft is operated by a trained wildlife biologist.

The Red-headed Woodpecker (*Melanerpes erythrocephalus*) is a BCC within the operating area. Red-headed Woodpeckers typically nest in tall, dead trees near marshes and open bodies of water. It is possible that Red-headed Woodpeckers may be nesting within the operating area. Throughout the Red-

[16] Available: https://library-audubon.hub.arcgis.com/datasets/audubon::important-bird-areas-polygon-public-view/explore?location=28.904150%2C-81.952677%2C12.55. Accessed: April 9, 2022.
[17] U.S. Fish and Wildlife Service. 2007. National Bald Eagle Management Guidelines. Available: https://www.fws.gov/northeast/ecologicalservices/pdf/NationalBaldEagleManagementGuidelines.pdf. Accessed: October 19, 2021.

headed Woodpecker species range, their population numbers are in decline. It is possible that drone operations in close proximity could affect its nesting sites during sensitive times in the Spring. Other BCC species may be nesting within the operating area at certain times of the year, including the Black-billed Cuckoo (*Coccyzus erythropthalmus*), Bobolink (*Dolichonyx oryzivo rus*), Cerulean Warbler (*Dendroica cerulea*), Eastern Whip-poor-will (*Antrostomus vociferus*), Kentucky Warbler (*Oporornis formosus*), Prothonotary Warbler (*Protonotaria citrea*), and Wood Thrush (*Hylocichla mustelina*), although these other BCC species would typically nest within forested areas or marshy habitat, and thus further away from human habitation where the UA may be ascending and descending.[18] Information on BCC species can be found in the IPaC report in Appendix B.

3.2.3 Environmental Consequences

There will be no ground construction or habitat modification associated with the proposed action. The DCs are in developed locations adjacent to established businesses. UPSFF's aircraft will not touch the ground in any other place than the DCs (except during emergency landings). The operations will be taking place within airspace, and typically well above the tree line and away from sensitive habitats. After launch, UPSFF's UA will rise to a typical cruising altitude of 250 feet AGL and follow a preplanned route to its delivery site. The aircraft may fly up to 400 feet AGL when needed. The pre-planned routes are optimized to avoid properties where large numbers of people may congregate outdoors, including schools and recreation areas. Aircraft will stay at a cruising altitude of approximately 250 AGL except when descending to land the aircraft. When the aircraft starts its initial descent, it will transition to hover and descend to 165 AGL and wait up to 90 seconds for an approval to land. After landing is approved, the aircraft will continue its descent to land, which lasts approximately 22 seconds. After landing, the package is retrieved. The FAA estimates that at typical operating altitude and speeds the UA en route would be observable for approximately six seconds by wildlife on the ground. The low number of daily operations at each DC and temporary nature of the flights are not expected to affect wildlife in the area.

Special Status Species

The Indiana Bat, an endangered bat species, and the Northern Long-eared Bat, a threatened bat species, are mammals that have the potential to occur within the operating area. While these bat species may occur within the operating area, they are unlikely to encounter the aircraft as UPSFF's proposed operations will only occur during daylight hours. Because UPSFF's flight operations are not expected to overlap with evening bat emergence or foraging activities, the FAA determined that the proposed action will cause *no effect* to listed bat species under the Endangered Species Act or impacts to state-listed bat species.

The Monarch Butterfly, a candidate for federal listing, has the potential to occur in the operating area. Insects could be struck by drones en route to delivery. Information regarding drone impacts on insects is limited and there have been no widespread negative impacts identified in the scientific literature. Therefore, based on the information available and the limited scale of operations, the action is not expected to have significant impacts to insect populations, including the Monarch Butterfly.

State-protected bird species may display disturbance behaviors towards drones, such as fleeing or attack maneuvers; however, due to the limited scale of operations and the altitude of overflights, no impacts to state-protected bird species are expected.

[18] The Cornell Lab of Ornithology. All About Birds. Available: https://www.allaboutbirds.org/guide/search. Accessed: August, 31, 2022.

Migratory Birds

UPSFF has stated to the FAA that it will monitor the operating area for any active Bald Eagle nests that may occur. Bald Eagle nests are typically very conspicuous, generally 4 to 5 feet wide and 2 to 4 feet deep. These nests can reach 10 feet across and can weigh thousands of pounds. Online resources such as iNaturalist may also be used to identify Bald and Golden Eagle nests that may be active in the operating area. If UPSFF identifies a Bald Eagle nest or is notified of the presence of a nest by a state regulator or naturalist group, UPSFF will establish an avoidance area such that there is a 1,000 feet vertical and horizontal separation distance between the vehicle's flight path and the nest. This avoidance area will be maintained until the end of the breeding season (October 15 through August 31 in Ohio)[19] or a qualified biologist indicates the nest has been vacated.

Red-headed Woodpecker nest locations should not be disturbed during the breeding period (May 10 to September 10)[20] so as to avoid any potential impacts to the nest activity, such as nest abandonment. If UPSFF learns of any active Red-headed Woodpecker nests within the operating area, it has indicated it would avoid identified nest sites during a breeding season or until a qualified biologist indicates the nest has been vacated. Other BCC species identified in the official species list are not as likely to be nesting out in the open and within close proximity to human presence as the Red-headed Woodpecker and Bald Eagle. These other BCC species typically nest within the forest canopy and in marshy habitat away from human presence, and thus are not as likely to encounter the UA at distances that could affect their nesting lifecycle.

Due to the limited operating area and proposed number of daily operations, occasional drone overflights at 250 feet AGL are not expected to impact critical lifecycles of wildlife species or their ability to survive.

Our analysis finds that the proposed action is not expected to cause any of the following impacts:

- A long-term or permanent loss of unlisted plant or wildlife species, i.e., extirpation of the species from a large project area;
- Adverse impacts to special status species (e.g., state species of concern, species proposed for listing, migratory birds, bald and golden eagles) or their habitats;
- Substantial loss, reduction, degradation, disturbance, or fragmentation of native species' habitats or their populations; or
- Adverse impacts on a species' reproductive success rates, natural mortality rates, non-natural mortality (e.g., road kills and hunting), or ability to sustain the minimum population levels required.

3.3 Department of Transportation Act, Section 4(f) Resources

3.3.1 Regulatory Setting

Section 4(f) of the Department of Transportation (DOT) Act [codified at 49 U.S.C. § 303(c)] protects significant publicly owned parks, recreational areas, wildlife and waterfowl refuges, and public and

[19] See Official Species List in Appendix A for Bald Eagle breeding dates in the study area.
[20] See Official Species List in Appendix A of this EA.

private historic sites. Section 4(f) states that, subject to exceptions for de minimis impacts[21]: "The Secretary may approve a transportation program or project requiring the use of [4(f) resources]…only if—(1) there is no prudent and feasible alternative to using that land; and (2) the program or project includes all possible planning to minimize harm to the park, recreation area, wildlife and waterfowl refuge, or historic site resulting from the use."

The term "use" includes both direct or physical and indirect or "constructive" impacts to Section 4(f) resources. Direct use is the physical occupation or alteration of a Section 4(f) property or any portion of a Section 4(f) property. A constructive use does not require direct physical impacts or occupation of a Section 4(f) resource. A constructive use would occur when a proposed action would result in substantial impairment of a resource to the degree that the protected activities, features, or attributes of the resource that contribute to its significance or enjoyment are substantially diminished. The determination of use must consider the entire property and not simply the portion of the property used for a proposed project.[22]

Section 4(f) resources where a quiet setting is a generally recognized feature or attribute receive special consideration. In assessing constructive use, FAA Order 1050.1F, Appendix B, page B-11, requires that the FAA "…must consult all appropriate federal, state, and local officials having jurisdiction over the affected Section 4(f) properties when determining whether project-related impacts would substantially impair the resources." Parks, recreation areas, and wildlife and waterfowl refuges that are privately owned are not subject to Section 4(f) provisions.

A significant impact would occur pursuant to NEPA when a proposed action either involves more than a minimal physical use of a section 4(f) property or is deemed a "constructive use" based on an FAA determination that the proposed action would substantially impair the 4(f) property, and mitigation measures do not eliminate or reduce the effects of the use below the threshold of significance.

3.3.2 Affected Environment

The FAA identified properties that could meet the definition of a Section 4(f) resource within the operating area. There are no state parks, national parks, or wildlife or waterfowl refuges in the operating area. However, there are several local parks and recreation areas that have the potential to be recognized as Section 4(f) resources. These properties include Harrison Park, Thomas Park, Tuttle Park, and Olentangy Trail.

The Ohio State Historic Preservation Office (SHPO) website lists four historic sites within the operating area that are listed or eligible for listing in the National Register of Historic Places, and nine sites as historical markers.[23] Additionally, as discussed in Section 3.4, *Historical, Architectural, Archaeological, and Cultural Resources*, the FAA conducted outreach with the Ohio SHPO and two tribes regarding

[21] The FAA may make a de minimis impact determination with respect to a physical use of Section 4(f) property if, after taking into account any measures to minimize harm, the result is either: (1) a determination that the project would not adversely affect the activities, features, or attributes qualifying a park, recreation area, or wildlife or waterfowl refuge for protection under Section 4(f); or (2) a Section 106 finding of no adverse effect or no historic properties affected. See 1050.1F Desk Reference, Paragraph 5.3.3.

[22] Federal Highway Administration (FHWA) Section 4(f) Policy Paper. (Note: FHWA regulations are not binding on the FAA; however, the FAA may use them as guidance to the extent relevant to aviation projects.) Available: https://www.environment.fhwa.dot.gov/legislation/section4f/4fpolicy.pdf. Accessed: February 2, 2021

[23] State Historic Preservation Office Online Mapping System. Available: https://www.ohiohistory.org/preserving-ohio/state-historic-preservation-office/online-mapping-system/. Accessed: September 26, 2022.

UPSFF's proposed operations to determine whether historic or traditional cultural properties would be affected by the proposed action.

3.3.3 Environmental Consequences

There will be no physical use of Section 4(f) resources because there will be no construction on any Section 4(f) resource. The FAA has determined that infrequent UAS overflights as described in the proposed action are not considered a constructive use of any Section 4(f) resource, and will not cause substantial impairment to any of the Section 4(f) resources in the operating area. As described in the Section 3.5, Noise and Noise-Compatible Land Use, and the Noise Analysis Report (Appendix C), the proposed operations will not result in significant noise levels at any location in the operating area. Noise and visual effects from UPSFF's occasional overflights are not expected to diminish the activities, features, or attributes of the resources that contribute to their significance or enjoyment.

Additionally, UPSFF indentifies properties such as public parks and wildlife refuges in its flight planning system. Areas where open air gatherings of people typically occur, such as recreation areas and school yards, will also be avoided through the use of UPSFF's route planning software, which prepares an optimized flight path from the each takeoff site to delivery site. The software ensures that each route integrates and respects all of the restrictions entered into the database, and that Section 4(f) properties can be automatically avoided based on the type of the resource, time of day, and other factors.

As discussed in Section 3.4, Historical, Architectural, Archaeological, and Cultural Resources, in August 2021, the FAA informed the Ohio SHPO of the FAA's determination of no historic properties affected, and received a response from the SHPO in September 2021 that concurred with this determination. The FAA's historic and tribal outreach letters for the proposed action are included as Appendix B.

The FAA has determined that there will be no significant impacts to Section 4(f) resources as a result of the proposed action.

3.4 Historical, Architectural, Archaeological, and Cultural Resources

3.4.1 Regulatory Setting

Section 106 of the National Historic Preservation Act (NHPA) of 1966 [54 U.S.C. § 306108] requires federal agencies to consider the effects of their undertakings on properties listed or eligible for listing in the National Register of Historic Places (NRHP). This includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization that meets the NRHP criteria. Regulations related to this process are contained in 36 CFR Part 800, Protection of Historic Properties. Compliance with Section 106 requires consultation with the State Historic Preservation Officer (SHPO) and applicable other parties, including Indian tribes.

Major steps in the Section 106 process include identifying the Area of Potential Effects (APE), identifying historic and cultural resources within the APE, consulting with the SHPO and any Tribal Historic Preservation Office (THPO) that is identified as potentially having traditional cultural interests in the area, and determining the potential impacts to historic properties as a result of the action.

The FAA has not established a significance threshold for this impact category; however, the FAA has identified a factor to consider when evaluating the context and intensity of potential environmental impacts for historical, architectural, archeological, and cultural resources. A factor to consider in assessing significant impact is whether an action would result in a finding of adverse effect through the

Section 106 process. However, under 36 CFR § 800.8(a), a finding of adverse effect on a historic property does not necessarily result in a significance finding under NEPA.

3.4.2 Affected Environment

The APE for the proposed action is the entire operating area where UPSFF is planning to conduct UA package deliveries, as shown in Figures 1 and 2 in this EA. The FAA identified historic properties and markers that were listed on the Ohio SHPO website, which includes NRHP-listed or eligible properties as well as other properties of interest to the state.[24] There are four properties listed on the NRHP within the operating area: Old Ohio Union, Ohio Stadium, Hayes & Orton Halls, and Near Northside Historic District.

3.4.3 Environmental Consequences

The nature of UA effects on historic properties is limited to non-physical, reversible impacts (i.e., the introduction of audible and/or visual elements). The number of daily delivery flights that UPSFF is proposing – a maximum of 28 delivery flights per operating day at the Ackerman DC and 28 delivery flights per operating day at the Bus Depot DC – means that any historic or cultural resource would be subject to only a limited number of overflights per day, if any.

In accordance with 36 CFR § 800.4(a)(1), in August 2021 the FAA consulted with the Ohio SHPO and with five THPOs that may potentially attach religious or cultural significance to resources in the APE. The five tribes are, respectively, the Delaware Nation of Oklahoma, Eastern Shawnee Tribe of Oklahoma, Seneca-Cayuga Nation, Shawnee Tribe, and the Miami Tribe of Oklahoma. In September 2021, the FAA received a response from the Ohio SHPO concurring with FAA's determination of no historic properties affected. The FAA did not receive any responses or objections from the tribes. The FAA's tribal and historic outreach letters can be found in Appendix B.

Additionally, the FAA's noise exposure analysis for the proposed action concluded that noise levels would not exceed DNL 45 dB in any location within the study area other than the DCs. Therefore, there would not be a reportable increase in noise exposure at any historic properties in the APE. Based on a review of the information available, and the FAA's knowledge with respect to the level of environmental impacts from UAS operations, the FAA has determined that there are no historic properties affected by this undertaking, in accordance with 36 CFR § 800.4(d)(1). Additionally, there would be no known effect on cultural resources from this action.

3.5 Noise and Noise-Compatible Land Use

3.5.1 Regulatory Setting

Aircraft noise is often the most noticeable environmental effect associated with any aviation project. Several federal laws, including the Aviation Safety and Noise Abatement Act of 1979, as amended (49 U.S.C. §§ 47501-47507) regulate aircraft noise. Through 14 CFR Part 36, the FAA regulates noise from aircraft.

FAA Order 1050.1F, Appendix B, Paragraph B-1.3 requires the FAA to identify the location and number of noise sensitive areas that could be significantly impacted by noise. As defined in Paragraph 11-5b of Order 1050.1F, page 11-3, a noise sensitive area is "[a]n area where noise interferes with normal activities associated with its use. Normally, noise sensitive areas include residential, educational, health,

[24] Ohio State Historic Preservation Office Online Mapping System. Available: https://www.ohiohistory.org/preserving-ohio/state-historic-preservation-office/online-mapping-system/. Accessed: September 26, 2022.

and religious structures and sites, and parks, recreational areas, areas with wilderness characteristics, wildlife refuges, and cultural and historical sites."

Sound is measured in terms of the decibel (dB), which is the ratio between the sound pressure of the sound source and 20 micropascals, which is nominally the threshold of human hearing. Various weighting schemes have been developed to collapse a frequency spectrum into a single dB value. The A-weighted decibel, or dBA, corresponds to human hearing accounting for the higher sensitivity in the mid-range frequencies.

To comply with NEPA requirements, the FAA has issued requirements for assessing aircraft noise in FAA Order 1050.1F, Appendix B. FAA's primary noise metric for aviation noise analysis is the yearly DNL metric. The DNL metric is a single value representing the logarithmic average of aircraft sound level at a location over a 24-hour period, with a 10 dB adjustment added to those noise events occuring from 10:00 p.m. and up to 7:00 a.m. the following morning. A significant noise impact is defined in Order 1050.1F as an increase in noise of DNL 1.5 dB or more at or above DNL 65 dB noise exposure or a noise exposure at or above the 65 dB level due to a DNL 1.5 dB or greater increase.

3.5.2 Affected Environment

The study area is approximately 3.77 square miles, and the estimated population within the area is roughly 25,117. The population density is approximately 6,595 persons per square mile.[25] There are no airports in the operating area. There is one helipad located at The Ohio State University Wexner Medical Center; however, it is not anticipated that existing aircraft noise would contribute to the assessment of UA noise.

3.5.3 Environmental Consequences

Human perception of noise depends on a number of factors, including overall noise level, number of noise events, the extent of audibility above the background ambient noise level, and acoustic frequency content (pitch). UA noise generally has high acoustic frequency content, which can often be more discernable from other typical noise sources.

To ensure that noise would not cause a significant impact to any residential land use or noise sensitive resource within the study area, the FAA initiated an analysis of the potential noise exposure in the area that could result from implementation of the proposed action.

Noise Exposure

Utilizing the operational projections described in Chapters 1 and 2, the noise analysis methodology detailed in Appendix C was then used to the estimate DNL levels for the proposed UPSFF Columbus operations. Noise levels were calculated for each flight phase and are presented in the following sub-sections:

- Noise Exposure for DC Operations
- Noise Exposure for En route Operations

Noise Exposure for DC Operations

Based on the anticipated average daily maximum number of deliveries provided by UPSFF, the extent of DNL 45, 50, 55, 60 and 65 dB noise exposure associated with operations at the Ackerman and Bus Depot

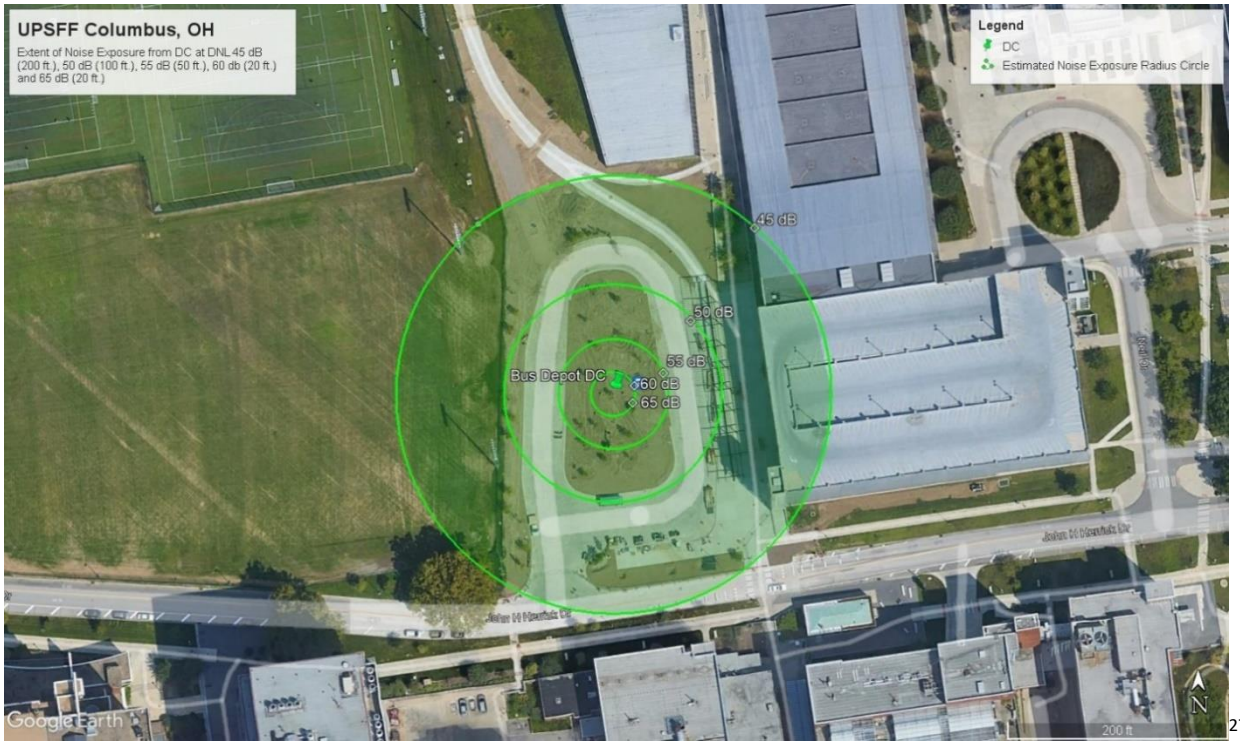
[25] Environmental Protection Agency's (EPA) Environmental Justice Screening Tool (EJSCREEN). Available: https://www.epa.gov/ejscreen. Accessed: September 26, 2022

DC's are shown in Figure 5 and Figure 6. This region was determined based on a review of the layout of Columbus DC locations and noise analyses results as presented in Table 4 of Appendix C.

[26]

Figure 5 *DNL Noise Exposure at Ackerman Distribution Center*

[26] Google Earth, as modified by the FAA



[27]

Figure 6 *DNL Noise Exposure at Bus Depot Distribution Center*

Noise Exposure for En route Operations

Based on the information provided by UPSFF, it is anticipated that the UA will cruise at approximately 250 feet AGL at an airspeed of 31 knots during en route flight. The en route noise exposure can be determined by referencing Table 5 of Appendix C. This analysis shows that en route noise levels would not exceed DNL 45 dB in any location within the operating area.

Total Noise Exposure Results

The maximum noise exposure levels within the study area will occur at the DC sites. At the Ackerman and Bus Depot DCs, noise levels at or above DNL 45 dB could extend up to 200 feet from the DC locations, with DNL levels at or above DNL 50 dB extending up to 100 feet, DNL levels of DNL 55 dB or greater extending up to 50 feet, and DNL levels of between 60 dB and 65 dB or greater extending up to 20 feet from the DC locations. At each of these sites, the extent of noise levels at or above DNL 55 dB would remain in the immediate vicinity of the DC infrastructure and be contained within the DC property boundaries. Noise levels between DNL 45 dB and DNL 55 dB may extend beyond the DC property boundaries, but are well below the threshold of DNL 65 dB for compatible land use.

3.6 Environmental Justice

3.6.1 Regulatory Setting

Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*, Section 1-101 requires all federal agencies to the greatest extent practicable and permitted by law, to make achieving environmental justice part of its mission by identifying and

[27] Google Earth, as modified by the FAA

addressing disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.

The DOT Order 5610.2C defines a minority person as a person who is Black; Hispanic or Latino; Asian American; American Indian and Alaskan Native; or Native Hawaiian and other Pacific Islander. A minority population is any readily identifiable group of minority persons who live in geographic proximity, and if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who will be similarly affected by a proposed DOT program, policy, or activity.

The DOT Order 5610.2C defines a low-income person as a person whose median household income is at or below the Department of Health and Human Services poverty guidelines. A low-income population is any readily identifiable group of low-income persons who live in geographic proximity, and, if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who will be similarly affected by a proposed DOT program, policy, or activity.

The FAA has not established a significance threshold for environmental justice. Exhibit 4-1 of FAA Order 1050.1F indicates that factors that the FAA should consider in evaluating significance include whether the action would have the potential to lead to a disproportionately high and adverse impact, on the environmental justice population (i.e., a low-income or minority population) due to: significant impacts in other environmental impact categories; or impacts on the physical or natural environment that affect an environmental justice population in a way that the FAA determines are unique to the environmental justice population and significant to that population. If a significant impact would affect low income or minority populations at a disproportionately higher level than it would other population segments, an environmental justice issue is likely.

A disproportionately high and adverse effect on minority or low-income populations means an adverse effect that:

1. Is predominately borne by a minority population and/or a low-income population; or
2. Will be suffered by the minority population and/or low-income population and is appreciable more severe or greater in magnitude than adverse effects that will be suffered by the non-minority population and/or low-income population.

3.6.2 Affected Environment

Minority and low-income populations were mapped at the Census Block Group level using 2020 American Community Survey (ACS) 5-year estimates from the U.S. Census Bureau. The analysis was performed using the Aviation Environmental Design Tool (AEDT). The FAA utilized a combination of the *fifty-percent analysis* and *meaningfully greater analysis* to complete the analysis for the study area. Low-income populations in the study area were identified by using *the low-income threshold criteria* analysis.

Minority Population Fifty-Percent Analysis

As depicted in Figure 7, there are three census block groups out of 31 in the study area that have minority populations at or above 50 percent. However, the total percentage of minority individuals residing within the study area at the census block level is below 50 percent at approximately 28.60 percent.

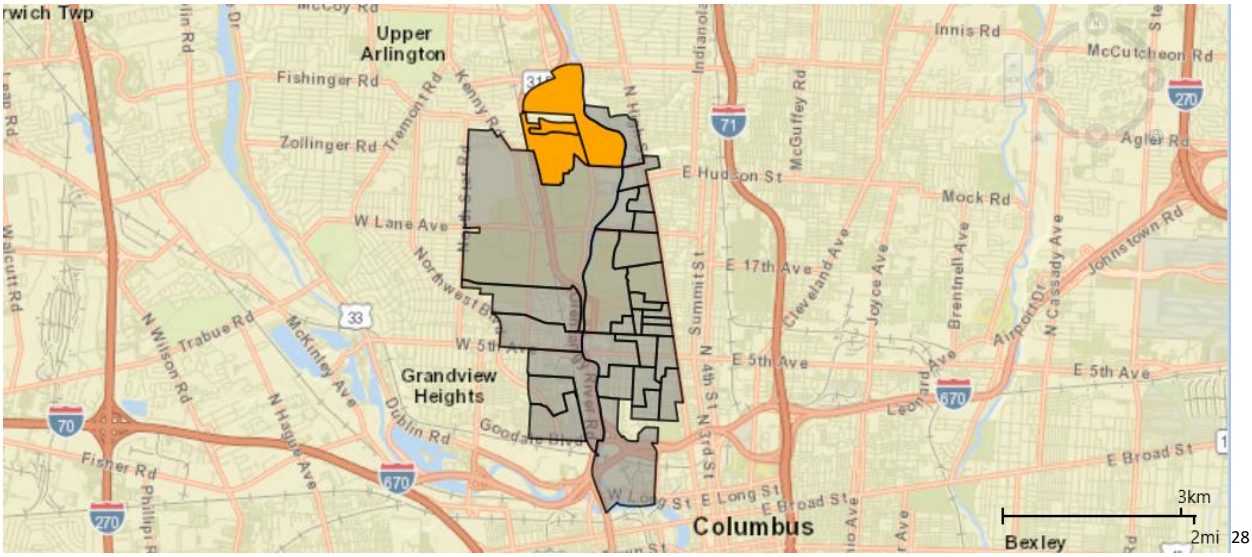


Figure 7 *Census Block Groups in the Study Area with Minority Populations ≥ 50 Percent*

Minority Population Meaningfully Greater Analysis

The minority population in the study area at the census block group level was compared to the reference community, which is the percentage of minority individuals residing within Franklin County. Because the study area is within part of Franklin County, the FAA determined that the county would be an appropriate geographical region for comparison.

The percentage of minority persons residing within the study area at the census block group level, approximately 28.60 percent, is lower than that of the reference community, at approximately 38.08 percent. Based on the analysis, the FAA determined that the percentage of minority persons residing within study area was not meaningfully greater than the percentage of minority persons residing within the reference community.

Low-Income Threshold Criteria Analysis

The low-income population in the study area at the census block group level was compared to the reference community, which is the percentage of low-income individuals residing Franklin County. Because the study area is within part of Franklin County, the FAA determined that the county would be an appropriate geographical region for comparison.

The percentage of low-income individuals residing within the study area at the census block group level is approximately 31 percent as compared to 17.04 percent in the reference community. Therefore, a low-income population was identified in the study area. The FAA's AEDT analysis data is included in Appendix F.

3.6.3 Environmental Consequences

The proposed action would not result in adverse or significant impacts in any environmental resource category. As noted in Section 3.5, *Noise and Noise-Compatible Land Use*, and the Noise Analysis Report in Appendix C, the drone's noise emissions could be perceptible in areas within the study area, but will stay well below the level determined to constitute a significant impact. Using the fifty percent analysis

[28] Image: AEDT, as modified by the FAA.

and meaningfully greater analysis, the FAA determined that there was not a minority population present. Since the percentage of low-income individuals was higher in the study area than the reference community, the FAA determined there was a low-income population present. However, the FAA is not aware of impacts that would uniquely affect these populations. UPSFF's operations will be happening throughout the study area and, due to the large size of the area, as well as the low number daily operations, it is unlikely that any environmental justice populations could be disparately impacted by the proposed action. Additionally, the UPSFF DCs are located in built-up campus settings where there are no populations, including environmental justice populations, nearby who would experience a reportable change in noise exposure as a result of the proposed action. Since the proposed action would not result in effects that would be predominately or uniquely born by an environmental justice population, the FAA determined the proposed action would not result in a disproportionately high and adverse effect on a low-income or a minority population.

3.7 Visual Effects (Visual Resources and Visual Character)

3.7.1 Regulatory Setting

Visual resources and visual character impacts deal with the extent to which the proposed action would result in visual impacts to resources in the operating area. Visual impacts can be difficult to define and evaluate because the analysis is generally subjective but are normally related to the extent that the proposed action would contrast with, or detract from, the visual resources and/or the visual character of the existing environment. In this case, visual effects would be limited to the introduction of a visual intrusion – a UA in flight – which could be out of character with the suburban or natural landscapes.

The FAA has not developed a visual effects threshold of significance similar to noise impacts. Factors the FAA considers in assessing significant impacts include the degree to which the action would have the potential to: (1) affect the nature of the visual character of the area, including the importance, uniqueness, and aesthetic value of the affected visual resources; (2) contrast with the visual resources and/or visual character in the study area; or (3) block or obstruct the views of visual resources, including whether these resources would still be viewable from other locations.

3.7.2 Affected Environment

The proposed action would take place over mostly suburban and commercially-developed properties. As noted in Section 3.3, *DOT Act Section 4(f) Resources*, there are some historic sites, public parks and recreation areas that could be valued for aesthetic attributes within the study area. However, UPSFF's proposal is to avoid overflights of areas where people typically congregate outdoors. The DCs are on private property and in developed commercial areas. The FAA estimates that at typical operating altitude and speeds the UA en route would be observable for approximately six seconds by an observer on the ground.

3.7.3 Environmental Consequences

The proposed action makes no changes to any landforms or land uses, thus there would be no effect to the visual character of the area. The proposed action involves airspace operations that could result in visual impacts on sensitive areas where the visual setting is an important resource of the property. However, the short duration that each drone flight could be seen from any resource in the operating area, approximately six seconds in total, and the low number of proposed flights per day, would minimize any potential for significant visual impacts. Any visual effects are expected to be similar to existing air traffic in the vicinity of the operating area.

3.8 Water Resources (Surface Waters)

3.8.1 Regulatory Setting

Surface water resources generally consist of oceans, wetlands, lakes, rivers, and streams. Surface water is important for its contribution to the economic, ecological, recreational, and human health of a community. The Clean Water Act established the National Pollutant Discharge Elimination System (NPDES) program, which regulates the discharge of point sources of water pollution into waters of the United States and requires a permit under Section 402 of the Clean Water Act. Waters of the United States are defined by the Clean Water Act and are protected by various regulations and permitting programs administered by the EPA and the U.S. Army Corps of Engineers. An action would be considered significant to surface waters when it would: (1) exceed water quality standards established by federal, state, local, and tribal regulatory agencies; or (2) contaminate public drinking water supply such that public health may be adversely affected.

3.8.2 Affected Environment

Approximately 0.13 square miles of surface waters occur within the operating area, or approximately three percent of the area, based on the Environmental Justice Screening and Mapping Tool (EJSCREEN) report for this proposed action (Appendix E). Surface waters include the Olentangy River, Chadwick Lake, and Mirror Lake, in addition to wetlands that are also protected by the Clean Water Act.

3.8.3 Environmental Consequences

UPSFF has conducted thousands of UAS flight operations in its existing operating areas, and the FAA does not anticipate any accidents or incidents under the proposed action. While it is highly unlikely for one of UPSFF's aircraft to crash, and even less likely for a crash to happen in a surface water, this EA considers the potential effects of a drone crashing into surface waters covered by the Clean Water Act.

UPSFF is a certificated air carrier and complies with all applicable regulatory requirements, including compliance with requirements to notify the FAA and/or National Transportation Safety Board (NTSB) in the event of an aircraft accident. Additionally, UPSFF's FAA-accepted checklists include procedures to notify local emergency services in the event of an accident or incident. In accordance with 14 CFR §135.23(d), UPSFF is required to locate and secure any downed aircraft pending guidance from the FAA or NTSB.

In the event of an in-flight malfunction or deviation, the remote pilot in command (RPIC) can initiate three commands: initiate a hold pattern, return to the DC, or terminate the flight via the emergency parachute system, which may also automatically deploy if the UA detects a critical failure necessitating a flight termination. In addition, the lithium-ion battery packs are well-secured within the aircraft, and are not expected to detach from the aircraft or become lost in the event of an incident.

There will be no construction activities associated with the proposed action. The proposed action would not have the potential to adversely affect natural and beneficial water resource values to a degree that substantially diminishes or destroys such values, or to adversely affect surface waters such that the beneficial uses and values of such waters are appreciably diminished or can no longer be maintained and such impairment cannot be avoided or satisfactorily mitigated. Therefore, the potential for impacts to surface waters is not significant.

3.9 Cumulative Impacts

Consideration of cumulative impacts applies to the impacts resulting from the implementation of the proposed action along with other actions. The CEQ regulations define cumulative impact as "effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time." (40 CFR § 1508.1(g)(3))

As discussed in Section 1.2, there are no airports, and only one heliport, in the study area, and existing aviation noise is not expected to be significant. Additionally, because these are the first commercial package delivery operations by drone within the operating area, and due to airspace safety constraints that will limit the number of package delivery drones operating within the same airspace without further safety and environmental reviews, the proposed action would not be anticipated to result in cumulative impacts to environmental resources within the operating area.

4.0 LIST OF PREPARERS and CONTRIBUTORS

Table 4-1 lists the principal preparers, reviewers, and contributors to this EA.

Table 4-1. List of Preparers and Contributors

Name and Affiliation	Years of Industry Experience	EA Responsibility
Mike Millard, Flight Standards, FAA Aviation Safety	41	Flight Standards Environmental Specialist and Document Review
Christopher Couture, FAA Aviation Safety	16	Program Management, Environmental Science, and Document Review
Shawna Barry, FAA Office of Environment and Energy	16	NEPA SME, Biological Resources, and Document Review
Susumu Shirayama, FAA Office of Environment and Energy	22	Noise Analysis and Document Review
Adam Scholten, FAA Office of Environment and Energy	12	Noise Analysis and Document Review
Contractor Contributors		
Jodi Jones, FAA Aviation Safety, PrimCorp, LLC.	13	NEPA SME, Research, and Document Review
Brad Thompson, FAA Aviation Safety, Science Applications International Corporation (SAIC)	8	NEPA SME, Research, and Document Review

5.0 LIST of AGENCIES CONSULTED

Federal Agencies

U.S. Fish and Wildlife Service, Ohio Ecological Services Field Office

State Agencies

Ohio State Historic Preservation Office

Tribes

The Delaware Nation of Oklahoma

Miami Tribe of Oklahoma

Eastern Shawnee Tribe of Oklahoma

Seneca-Cayuga Nation

Shawnee Tribe

Appendix A

Official Species List and IPaC Report

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ohio Ecological Services Field Office
4625 Morse Road, Suite 104
Columbus, OH 43230-8355
Phone: (614) 416-8993 Fax: (614) 416-8994

In Reply Refer To:
Project Code: 2022-0037449
Project Name: Columbus Ohio

April 29, 2022

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological

evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Ohio Ecological Services Field Office
4625 Morse Road, Suite 104
Columbus, OH 43230-8355
(614) 416-8993

Project Summary

Project Code: 2022-0037449
Event Code: None
Project Name: Columbus Ohio
Project Type: Drones - Use/Operation of Unmanned Aerial Systems
Project Description: Commercial drone delivery
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@39.99601725,-83.02312443616904,14z

Counties: Franklin County, Ohio

Endangered Species Act Species

There is a total of 3 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 1 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Indiana Bat *Myotis sodalis* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/5949	Endangered
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. This species only needs to be considered under the following conditions: ▪ Incidental take of the northern long-eared bat is not prohibited at this location. Federal action agencies may conclude consultation using the streamlined process described at https://www.fws.gov/midwest/endangered/mammals/nleb/s7.html Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

IPaC User Contact Information

Agency: Federal Aviation Administration
Name: Jodi Jones
Address: 800 Independence Ave SW
City: Washington
State: DC
Zip: 20591
Email jodi.a-ctr.jones@faa.gov
Phone: 2022670509

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Franklin County, Ohio

Local office

Ohio Ecological Services Field Office

(614) 416-8993
(614) 416-8994

4625 Morse Road, Suite 104
Columbus, OH 43230-8355

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS

Indiana Bat Myotis sodalis — Endangered
Wherever found
There is **final** critical habitat for this species. The location of the critical habitat is not available.
https://ecos.fws.gov/ecp/species/5949

Northern Long-eared Bat Myotis septentrionalis — Threatened
Wherever found
This species only needs to be considered if the following condition applies:
- Incidental take of the northern long-eared bat is not prohibited at this location. Federal action agencies may conclude consultation using the streamlined process described at https://www.fws.gov/midwest/endangered/mammals/nleb/s7.html

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/9045

Fishes

NAME	STATUS
Scioto Madtom Noturus trautmani	Endangered

Wherever found
No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/5395

Flowering Plants

NAME	STATUS
Running Buffalo Clover Trifolium stoloniferum	Endangered

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/2529

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)

Bald Eagle Haliaeetus leucocephalus — Breeds Oct 15 to Aug 31
This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1626

Black-billed Cuckoo Coccyzus erythropthalmus — Breeds May 15 to Oct 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9399

Bobolink Dolichonyx oryzivorus — Breeds May 20 to Jul 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Cerulean Warbler Dendroica cerulea — Breeds Apr 21 to Jul 20
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/2974

Eastern Whip-poor-will Antrostomus vociferus — Breeds May 1 to Aug 20
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Kentucky Warbler Oporornis formosus — Breeds Apr 20 to Aug 20
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Lesser Yellowlegs Tringa flavipes — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9679

Prothonotary Warbler Protonotaria citrea — Breeds Apr 1 to Jul 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Red-headed Woodpecker Melanerpes erythrocephalus — Breeds May 10 to Sep 10
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Ruddy Turnstone Arenaria interpres morinella — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Rusty Blackbird Euphagus carolinus — Breeds elsewhere
This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA

Wood Thrush Hylocichla mustelina — Breeds May 10 to Aug 31
This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

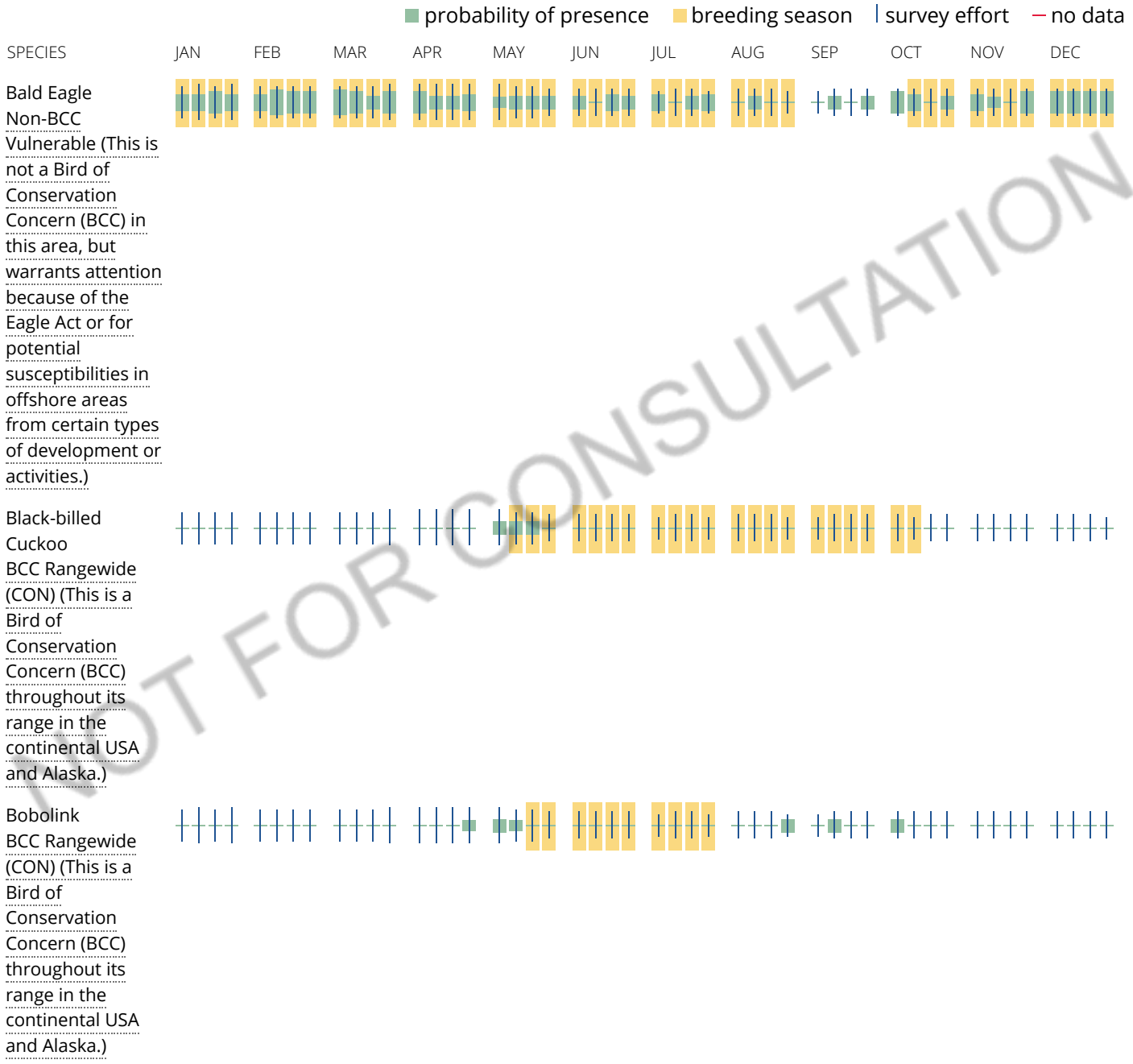
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

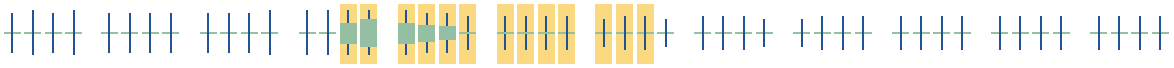
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

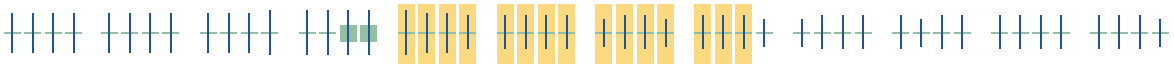
Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



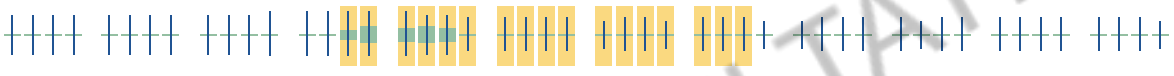
Cerulean Warbler BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Eastern Whip-poor-will BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

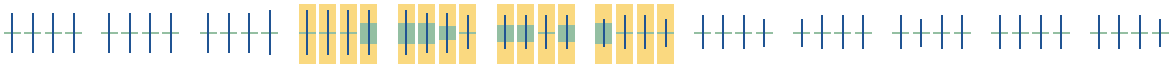


Kentucky Warbler BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

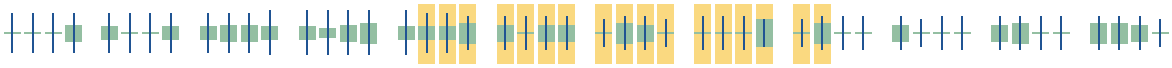


Lesser Yellowlegs BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)

Prothonotary Warbler BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



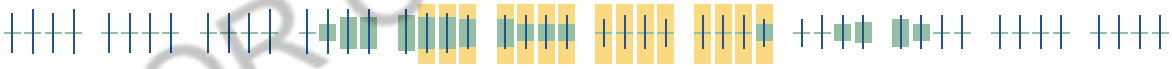
Red-headed Woodpecker BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Ruddy Turnstone BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)

Rusty Blackbird BCC - BCR (This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA)

Wood Thrush BCC Rangewide (CON) (This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.)



Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the AKN Phenology Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

WETLAND INFORMATION IS NOT AVAILABLE AT THIS TIME

This can happen when the National Wetlands Inventory (NWI) map service is unavailable, or for very large projects that intersect many wetland areas. Try again, or visit the NWI map to view wetlands at this location.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Appendix B

Historic and Tribal Outreach Letters

U.S. Department
of Transportation
**Federal Aviation
Administration**

Aviation Safety

800 Independence Ave., S.W.
Washington, DC 20591

State Historic Preservation Office
Resource Protection and Review Department
800 E. 17th Avenue
Columbus, OH 43211-2474

Via electronic submission to section106@ohiohistory.org

To whom it may concern:

The purpose of this letter is to inform you of a proposal under consideration by the Federal Aviation Administration (FAA) for the approval of a Certificate of Waiver and/or Exemption for a Matternet M2-V9 Unmanned Aircraft System (UAS) delivery operation in Columbus, OH. The FAA has determined that this proposed action is a Federal undertaking as defined in 36 CFR § 800.16 (y). Therefore, the FAA is initializing consultation with the State Historic Preservation Officer (SHPO) pursuant to § 800.11 (d).

Proposed Activity Description
The Federal Aviation Administration (FAA) has been asked to approve waivers and/or exemptions to aeronautical regulations, thereby approving the UAS operation in the area depicted below. FAA approval of the UAS operation in the area is an undertaking subject to regulations pursuant to the National Historic Preservation Act.

The UAS operation will be flown by a 29.1 lb. unmanned aircraft with a 4.4 lb. maximum payload, at approximately 300 feet Above Ground Level (AGL) in Columbus, OH (see attached operations area map). The unmanned aircraft will quickly rise to an approximate cruising altitude of 300 feet AGL, fly to the delivery location and descend to land. The purpose is for package delivery that may include medical samples/supplies, consisting of a maximum 150 flights per day for an estimated 12.5 hours of total flying time per day. Flights will occur primarily Mon-Fri, no holidays, with operating hours from 8 am until 5 pm, daylight hours. The dimension of the UAS area defines the Area of Potential Effect (APE). The UAS Delivery area will have a rectangular shape that is approximately 2.9 miles by 1.3 miles. According to the National Park Service online database of the National Register of Historic Places, there are no registered historical places within the proposed APE. The UAS operation will have no affects to the ground.

Conclusion
The FAA seeks concurrence from the SHPO of its no historic properties affected [§ 800.11 (d)] determination for the proposed APA waiver.

Your review over the next thirty days is appreciated. If you have any comments or questions or need additional information regarding the proposed project, please do not hesitate to contact Mr. Mike Millard, in writing at: FAA, AFS-800, 800 Independence Ave., S.W., Washington, D.C. 20591; by telephone: (202) 267-7906; or by email: 9-AWA-AVS-AFS-ENVIRONMENTAL@faa.gov.

Sincerely,

David M. Menzimer

Digitally signed by David M. Menzimer
Date: 2021.08.26 11:24:11 -07'00'

David Menzimer
Aviation Safety
Manager, General Aviation Operations Branch,
Flight Standards Service

Enclosure

September 24, 2021

In reply, please refer to:
2021-FRA-52467

David Menzimer
Aviation Safety
Manager, General Aviation Operations Branch,
Flight Standards Service
Federal Aviation Administration
800 Independence Avenue S.W.
Washington, DC 20591

RE: Certificate of Waiver and/or Exemption for a Matternet M2-V9 Unmanned Aircraft System
Columbus, Franklin County, Ohio

Dear Mr. Menzimer:

This letter is in response to correspondence received on August 26, 2021. Our comments are made pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, and the associated regulations at 36 CFR Part 800.

The Federal Aviation Administration (FAA) proposes the approval of a Certificate of Waiver and/or Exemption for a Matternet M2-V9 Unmanned Aircraft System (UAS) delivery operation in Columbus, Ohio. The UAS operation will be flown by a 29.1 lb. unmanned aircraft with a 4.4 lb. maximum payload, at approximately 300 feet Above Ground Level (AGL) in Columbus, Ohio. The unmanned aircraft will quickly rise to an approximate cruising altitude of 300 feet AGL, fly to the delivery location and descent to land. The flights will consist of a maximum of 150 flights per day for an estimated 12.5 hours of total flying time per day. The UAS delivery area will have a rectangular shape that is approximately 2.9 miles by 1.3 miles.

A check of our records confirms that there are no properties listed in the National Register of Historic Places within the UAS Area of Potential Effects. Therefore, our office agrees that the undertaking as proposed will have no effect on historic properties. No further coordination with this office is necessary, unless there is a change in the project.

If you have any questions, please do not hesitate to contact me at jwilliams@ohiohistory.org.
Thank you for your cooperation.

Sincerely,

Joy Williams

Joy Williams, Project Reviews Manager
Resource Protection and Review

"Please be advised that this is a Section 106 decision. This review decision may not extend to other SHPO programs."

RPR Serial No: 1089867

U.S. Department
of Transportation
**Federal Aviation
Administration**

Aviation Safety

800 Independence Ave., S.W.
Washington, DC 20591

President Deborah Dotson
Delaware Nation, Oklahoma
P.O. Box 825
Anadarko, OK 73005

Dear President Dotson:

The purpose of this letter is to initiate formal government-to-government consultation regarding a proposal under consideration by the Federal Aviation Administration (FAA) for the approval of a Certificate of Waiver and/or Exemption for an Unmanned Aircraft System (UAS) delivery operation in Columbus, OH. We wish to solicit your views regarding potential effects on tribal interests in the area.

Proposed Activity Description
The Federal Aviation Administration (FAA) has been asked to approve waivers and/or exemptions to aeronautical regulations, thereby approving the UAS operation in the area depicted below. FAA approval of the UAS operations in the area is an undertaking subject to regulations pursuant to the National Historic Preservation Act.

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Consultation
The FAA is soliciting the opinion of the tribe(s) concerning any tribal lands, or sites of religious or cultural significance that may be affected by the proposed operation area. Your response over the next 30 days will greatly assist us in incorporating your concerns into our environmental review of the operation.

If you have any comments or questions or need additional information regarding the proposed project, please do not hesitate to contact Mr. Mike Millard, in writing at: FAA, AFS-800, 800 Independence Ave., S.W., Washington, D.C. 20591; by telephone: (202) 267-7906; or by email: 9-AWA-AVS-AFS-ENVIRONMENTAL@faa.gov.

Sincerely,

David M. Menzimer

Digitally signed by David M. Menzimer
Date: 2021.08.26 11:21:30 -07'00'

David Menzimer
Aviation Safety
Manager, General Aviation Operations Branch,
Flight Standards Service

Enclosure

U.S. Department
of Transportation
**Federal Aviation
Administration**

Aviation Safety

800 Independence Ave., S.W.
Washington, DC 20591

Chief Glenna Wallace
Eastern Shawnee Tribe of Oklahoma
P.O. Box 350
Seneca, MO 64865

Dear Chief Wallace:

The purpose of this letter is to initiate formal government-to-government consultation regarding a proposal under consideration by the Federal Aviation Administration (FAA) for the approval of a Certificate of Waiver and/or Exemption for an Unmanned Aircraft System (UAS) delivery operation in Columbus, OH. We wish to solicit your views regarding potential effects on tribal interests in the area.

Proposed Activity Description
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Consultation
The FAA is soliciting the opinion of the tribe(s) concerning any tribal lands, or sites of religious or cultural significance that may be affected by the proposed operation area. Your response over the next 30 days will greatly assist us in incorporating your concerns into our environmental review of the operation.

If you have any comments or questions or need additional information regarding the proposed project, please do not hesitate to contact Mr. Mike Millard, in writing at: FAA, AFS-800, 800 Independence Ave., S.W., Washington, D.C. 20591; by telephone: (202) 267-7906; or by email: 9-AWA-AVS-AFS-ENVIRONMENTAL@faa.gov.

Sincerely,

David M. Menzimer

Digitally signed by David M. Menzimer
Date: 2021.08.26 11:25:38 -07'00'

David Menzimer
Aviation Safety
Manager, General Aviation Operations Branch,
Flight Standards Service

Enclosure

U.S. Department
of Transportation
**Federal Aviation
Administration**

Aviation Safety

800 Independence Ave., S.W.
Washington, DC 20591

Chief Douglas Lankford
Miami Tribe of Oklahoma
P.O. Box 1326
Miami, OK 74355

Dear Chief Lankford:

The purpose of this letter is to initiate formal government-to-government consultation regarding a proposal under consideration by the Federal Aviation Administration (FAA) for the approval of a Certificate of Waiver and/or Exemption for an Unmanned Aircraft System (UAS) delivery operation in Columbus, OH. We wish to solicit your views regarding potential effects on tribal interests in the area.

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Sincerely,

David M. Menzimer

Digitally signed by David M. Menzimer
Date: 2021.08.26 11:22:13 -07'00'

David Menzimer
Aviation Safety
Manager, General Aviation Operations Branch,
Flight Standards Service

Enclosure

U.S. Department
of Transportation
**Federal Aviation
Administration**

Aviation Safety

800 Independence Ave., S.W.
Washington, DC 20591

Chief William Fisher
Seneca-Cayuga Nation
P.O. Box 453220
Grove, OK 74345-3220

Dear Chief Fisher:

The purpose of this letter is to initiate formal government-to-government consultation regarding a proposal under consideration by the Federal Aviation Administration (FAA) for the approval of a Certificate of Waiver and/or Exemption for an Unmanned Aircraft System (UAS) delivery operation in Columbus, OH. We wish to solicit your views regarding potential effects on tribal interests in the area.

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If you have any comments or questions or need additional information regarding the proposed project, please do not hesitate to contact Mr. Mike Millard, in writing at: FAA, AFS-800, 800 Independence Ave., S.W., Washington, D.C. 20591; by telephone: (202) 267-7906; or by email: 9-AWA-AVS-AFS-ENVIRONMENTAL@faa.gov.

Sincerely,

David M. Menzimer

Digitally signed by David M. Menzimer
Date: 2021.08.26 11:24:56 -07'00'

David Menzimer
Aviation Safety
Manager, General Aviation Operations Branch,
Flight Standards Service

Enclosure

U.S. Department
of Transportation
**Federal Aviation
Administration**

Aviation Safety

800 Independence Ave., S.W.
Washington, DC 20591

Chief Benjamin Barnes
Shawnee Tribe
29 Sough Highway 69A
Miami, OK 74355

Dear Chief Barnes:

The purpose of this letter is to initiate formal government-to-government consultation regarding a proposal under consideration by the Federal Aviation Administration (FAA) for the approval of a Certificate of Waiver and/or Exemption for an Unmanned Aircraft System (UAS) delivery operation in Columbus, OH. We wish to solicit your views regarding potential effects on tribal interests in the area.

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Sincerely,

David M. Menzimer

Digitally signed by David M. Menzimer
Date: 2021.08.26 11:23:03 -07'00'

David Menzimer
Aviation Safety
Manager, General Aviation Operations Branch,
Flight Standards Service

Enclosure

Appendix C

Noise Analysis Report

Noise Assessment for UPS Flight Forward Inc. Proposed Package Delivery Operations with Matternet Model M2 Unmanned Aircraft

In support of U.S. Code of Federal Regulations Title 14, Part 135

Final

HMMH Report No. 309990.003-6

May 18, 2022

Prepared for:

JD RoVolus, LLC
121 Pearl Street
Ypsilanti, MI 48197

Federal Aviation Administration
Aviation Safety, Flight Standards Service
Office of Environment and Energy
Policy, Engineering, Analysis, and Research (PEARS II)
693KA9-18-D-00005

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Noise Assessment for UPS Flight Forward Inc. Proposed Package Delivery Operations with Matternet Model M2 Unmanned Aircraft

In support of U.S. Code of Federal Regulations Title 14, Part 135

Final

HMMH Report No. 309990.003-6

May 18, 2022

Prepared for:

JD RoVolus, LLC
121 Pearl Street
Ypsilanti, MI 48197

Federal Aviation Administration
Aviation Safety, Flight Standards Service
Office of Environment and Energy
Policy, Engineering, Analysis, and Research (PEARS II)
693KA9-18-D-00005

Prepared by:

David Crandall
Paul Krusell
Brandon Robinette

HMMH
700 District Avenue, Suite 800
Burlington, MA 01803
T 781.229.0707

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Contents

Figures

Tables

1 Introduction and Background

This document presents the methodology and estimation of noise exposure related to proposed Unmanned Aircraft (UA) package delivery operations conducted by UPS Flight Forward (UPS-FF), a wholly owned subsidiary of United Parcel Service, as a commercial operator under the provisions of 14 CFR Part 135. UPS-FF is proposing to perform small package delivery operations at multiple potential locations in the continental United States.

UPS-FF is proposing operations with the Matternet Model M2 UA. This UA features a multi-rotor design with four propellers mounted on equally spaced arms extending horizontally from a center frame. The system's computers and package containers are located on the underside of the airframe. According to data provided by UPS-FF, the maximum allowable takeoff weight of the UA is 29.1 pounds, an empty weight (including battery) of 24.7 pounds, and the maximum allowable package weight is 4.4 pounds.

Figure 1 depicts the UA considered in this report.

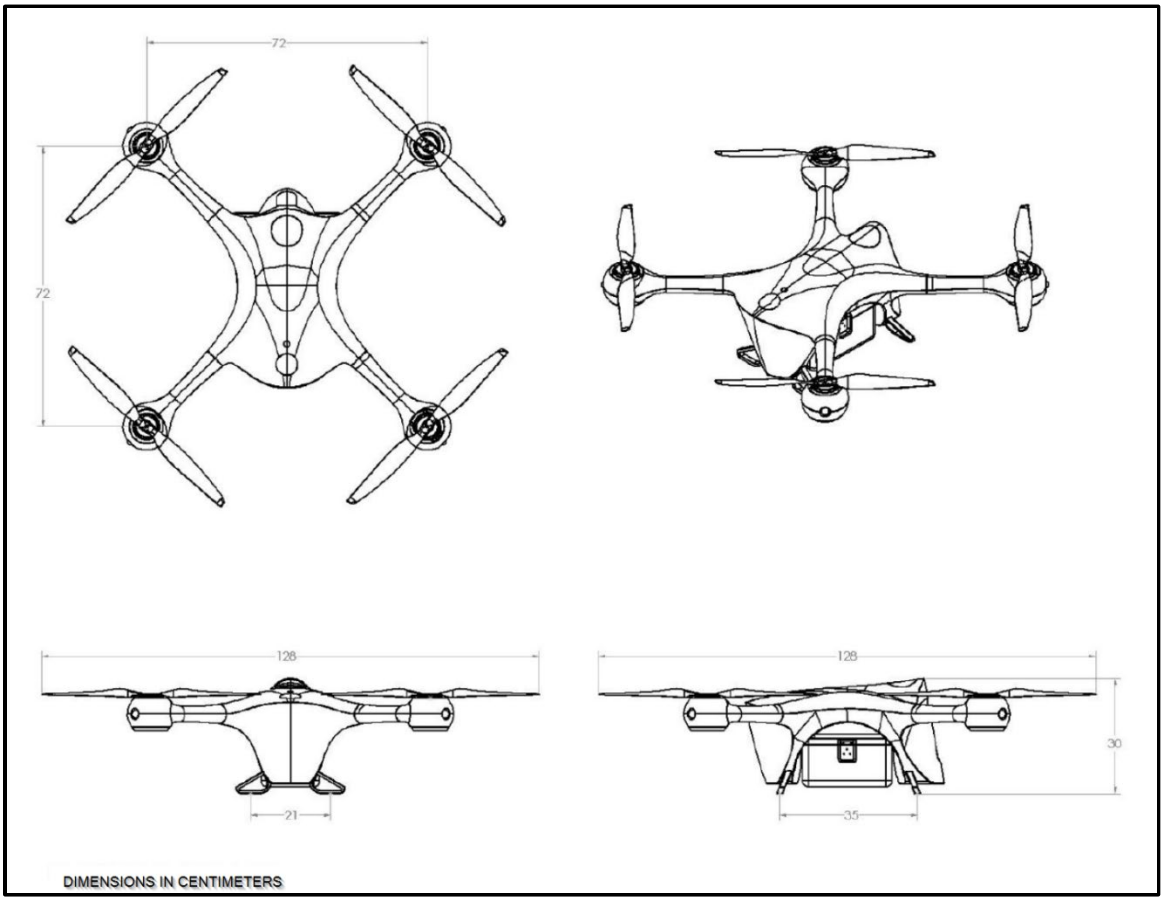

Figure 1: Matternet Model M2 Unmanned Aircraft

Source: UPS-FF

UPS-FF's takeoff/landing sites and distribution sites are largely determined by working collaboratively with UPS-FF customers to identify potential use cases. UPS-FF has internal procedures for developing routes that consider various factors such as obstructions, contingency landings sites, population density, and other aviation facilities.[1]

With a multirotor design, the UA can takeoff and descend vertically as well as hover. Airspeeds during normal cruise are expected to be approximately 31 knots. Typical flights begin with the UA ascending vertically from a landing pad at ground level to cruise altitude of 250 feet Above Ground Level (AGL). The UA then flies a pre-assigned route at 250 feet AGL and 31 knots to a selected delivery point where it performs a series of vertical and horizontal flight segments to descend to the ground. When it reaches the ground, it powers off and an operator removes and/or attaches a package. The UA's return flight departs using the same departure procedure as before and follows a predefined track to return to its original landing pad. When the UA arrives back at the landing pad, it performs a series of vertical and horizontal flight segments to descend to the ground, lands on the landing pad and then powers off and is unloaded (if carrying a package on the return trip). It is then either serviced or prepared for the next delivery.

The methodology proposed in this document provides quantitative guidance to FAA Environmental Specialists to inform environmental decision making on UA noise exposure from proposed UPS-FF package delivery operations. The methods presented here are suitable for review of Federal actions under the requirements of the National Environmental Policy Act (NEPA) and other applicable environmental special purpose laws or other federal environmental review requirements at the discretion and approval of the FAA. In particular, this report is intended to function as a non-standard equivalent methodology under FAA Order 1050.1F, and as such, would require prior written approval from FAA's Office of Environment and Energy (AEE) for each individual project for which a NEPA determination is sought. [2]

The methodology has been developed with data provided by UPS-FF and FAA to date and therefore is limited to UPS-FF operations with the Matternet Model M2 UA and the flight phases and maneuvers described herein. The noise analysis methodology and estimated noise levels of the proposed activity levels are based upon noise measurement data provided by the FAA.[3] Results of the noise analysis are presented in terms of the Day-Night Average Sound Level (DNL) based on varying levels of operations for areas at ground level below each phase of the flight.[4]

Section 2 of this document describes the relevant noise and operations data provided by UPS-FF and FAA. Section 3 describes the methodology to develop noise exposure estimates for the various UA flight phases associated with typical operations using available data. Section 4 presents the estimated DNL levels for various flight phases based on varying levels of typical operations as described by UPS-FF to date.

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[1] Summary examples of UPS-FF materials dated February 15, 2022. Further discussion provided in Section 2.1.2.

[2] Discussion of the use of "another equivalent methodology" is discussed in FAA Order 1050.1F, July 16, 2015, Appendix B, Section B-1.2, available online at https://www.faa.gov/documentlibrary/media/order/faa_order_1050_1f.pdf#page=113

[3] FAA's Memorandum, "Estimated Noise Levels for Matternet Model M2 UA," dated May 13, 2022.

[4] Discussion of modification of this process for use of the Community Noise Equivalent Level metric (CNEL) is discussed in Section 3.1.

2 Unmanned Aircraft Delivery Operations and Noise Measurement Data Set Descriptions

Five data sets form the basis of the noise assessment for the proposed UPS-FF delivery operations. The data sets include three UPS-FF provided documents titled "Winston-Salem, NC Environmental RFI, rev. 2", "The Villages, FL Environmental RFI, rev.2", and "Columbus, OH Environmental RFI, rev. 2", all dated February 15, 2022. UPS-FF provided emails dated March 15, 2022 and May 13, 2022, with supplementary information. The FAA's Memorandum, "Estimated Noise Levels for Matternet Model M2 UA," dated May 13, 2022, was also used in support of the noise assessment and is provided with this report as Attachment A.[5]

2.1 Operations, Flight Paths, and Flight Profile Data

Operations and flight profile data for the UA provided by UPS-FF and FAA were reviewed to determine the characteristics of typical operations for a proposed operating area. Based on this review, the following subsections describe the assumptions made about the operations and flight profiles that were used to inform the development of the estimated noise exposure and the methodology for the noise analysis.

2.1.1 Operations

The methodology presented in this report can be used to assess UA noise over a range of proposed activity levels; however, FAA review and approval of its use at specified activity levels is required. The activity ranges shown below in Section 4 represent what FAA considers low to moderate activity levels and anticipates as being appropriate for consideration with this methodology. At higher activity levels, this methodology may not be sufficient to inform an environmental determination and further consideration or refinements at the discretion of the FAA may be needed.

Note that DNL noise levels presented in this report are all shown consistent with effective daytime (7 AM to 10 PM) operations levels. For consideration of nighttime (10 PM to 7 AM) noise levels, a ten times operational weighting (equivalent to DNL 10 dB increase) should be applied. Section 3.1 provides techniques to apply the operational weighting necessary to calculate effective operations for analysis with the DNL metric.

2.1.2 Flight Paths and Profiles

The UA will fly a predefined flight path between sites chosen by UPS-FF. UPS-FF's takeoff/landing sites and distribution sites are largely determined by working collaboratively with UPS-FF customers to identify potential use cases. Route delivery locations are entirely customer driven. UPS-FF has internal procedures for developing routes that consider various factors such as obstructions (examples of

[5] Most of these documents have various markings indicating that the contents are "Confidential & Proprietary". Only elements required to support the noise analysis methodology have been disclosed in this report.

obstructions include trees, power lines, light poles, buildings), contingency landings sites, population density, and other aviation facilities. Routes and operating locations may change over time due to factors such as construction projects or the presence of endangered species, especially during breeding season.[6]

The UA takeoff and landing sites consist of a square pad with dimensions of 39.7 inches by 39.7 inches[7] surrounded by a safety radius of 20 feet, which will be coned off to keep non-participants out. The UA will take off and land from this single pad. Figure 2 presents a diagram of the landing pad. Figure 3 presents a landing pad with the alternate landing area located as close as possible to the landing pad. The alternate landing area will be used in the event of multiple unsuccessful landing attempts at the landing pad.

Figure 4 shows an example of a proposed route.

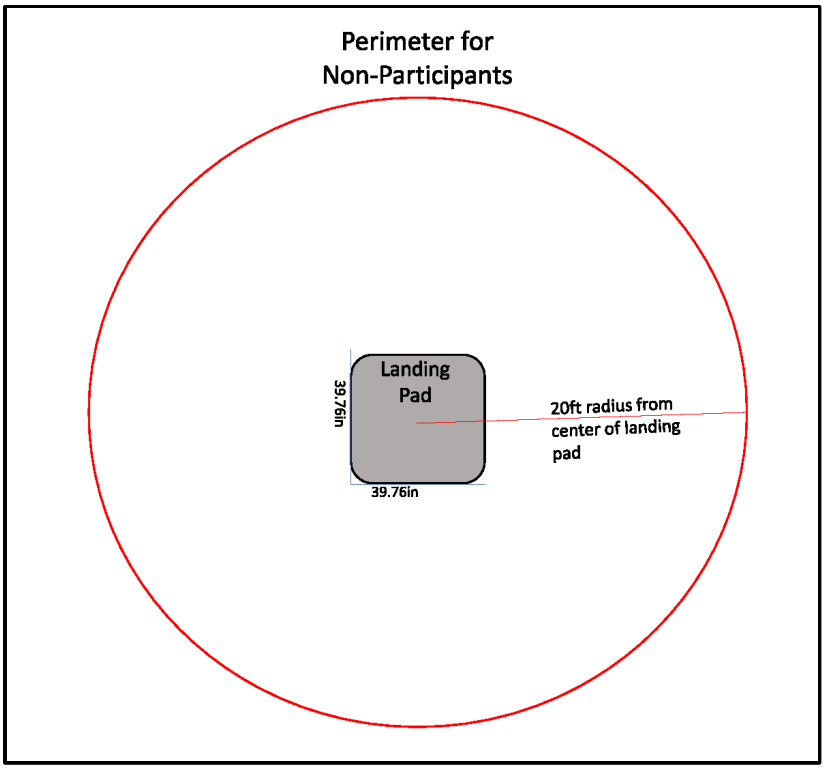

Figure 2: Takeoff and Landing Site Plan for the Proposed Operations.

Source: UPS-FF email dated March 15, 2022

[6] Summary examples of UPS-FF materials dated February 15, 2022.

[7] The dimensions of the landing pad are provided as a 1-meter square.

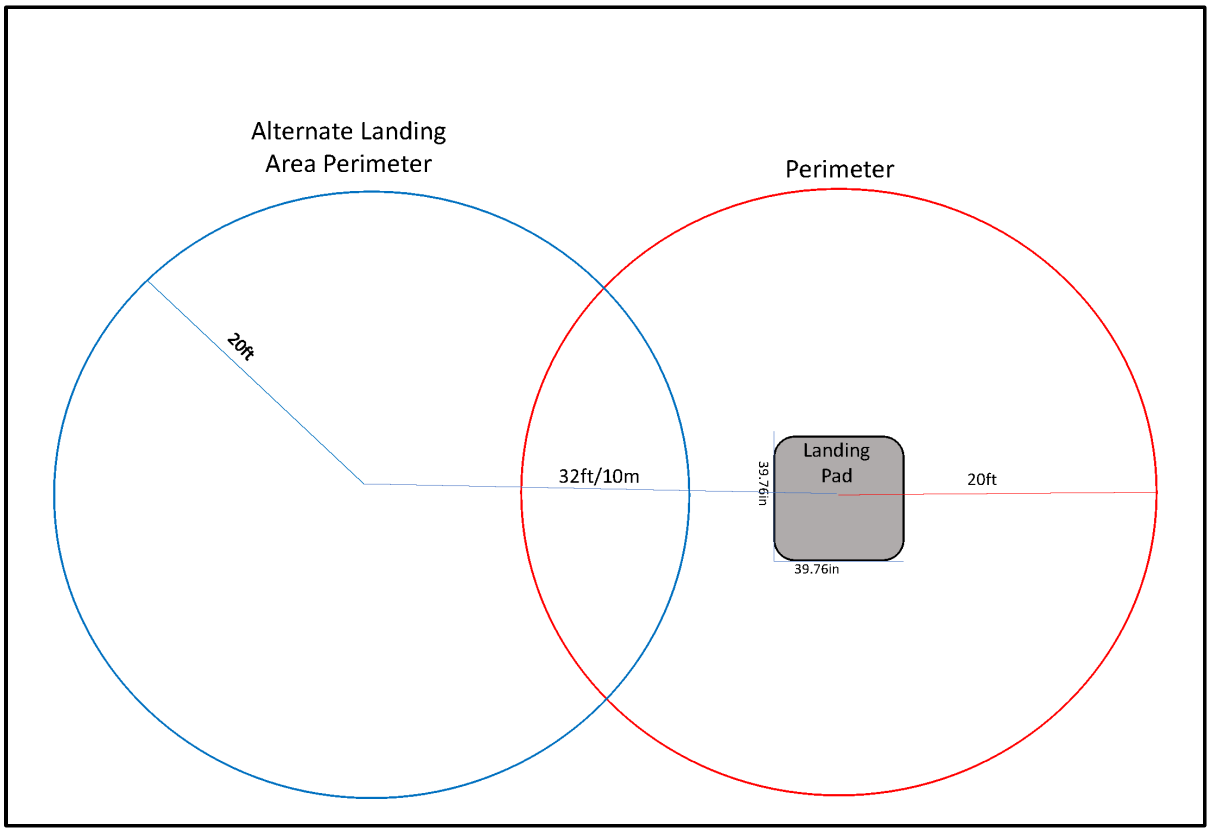

Figure 3: Takeoff Area and Landing Site Plan with Alternate Landing Area for Proposed Operations.

Source: UPS-FF email dated March 15, 2022

Figure 4: Visualization of a Route System

Source: UPS-FF, February 15, 2022

Analysis of flight profile data provided by UPS-FF and the FAA describes that a typical operation profile of the UA can be broken into four discrete flight phases:

1. Takeoff and Climb
2. En Route Outbound
3. Descent, Landing, and Delivery
4. En Route Inbound

These phases are shown in Figure 5 and Table 1 and are representative of the typical flight profile that UPS-FF is expected to use for delivery operations. The subsections that follow provide a narrative description of each of the four flight phases.

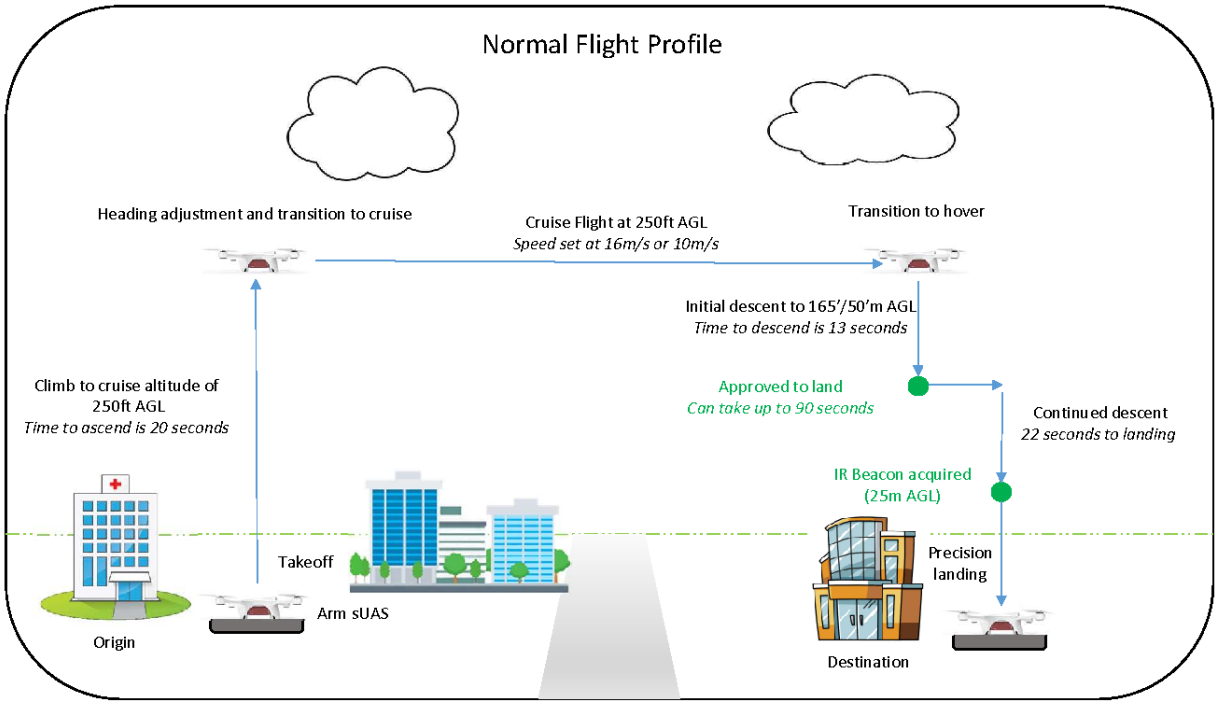

Figure 5: Graphical Depiction of the Proposed Matternet Model M2 Flight Profile to a Destination

Source: UPS-FF, May 13, 2022

Table 1. Matternet Model M2 Typical Flight Profiles

Source: FAA May 13, 2022 (Attachment A)

Phase	Description	Altitude (ft AGL)	Duration (s)
Takeoff and Climb	Vertical ascent to cruise altitude	Ascend from 0 to 250'	20
En Route Outbound	Flying at operational altitude (250 feet AGL) and speed (31 kts) to delivery point	250'	Variable
Descent, Landing, and Delivery	Vertical descent to 165'	Descend from 250' to 165'	13
	Hover for approval to land	Hover at 165'	Up to 90
	Move to center of landing pad	Move 16' feet laterally	3
	Vertical descent to 33'	Descend from 165' to 33'	18
	Vertical descent to land	Descend from 33' to 0'	25
	UA powered off for unloading the delivery package. After unloading, the UA is prepared for its next trip.	0'	Variable
En Route Inbound	Flying at operational altitude (250 feet AGL) and speed (31 kts) to landing pad	250'	Variable

2.1.2.1 Takeoff and Climb

The takeoff and climb phase is defined as the portion of flight in which the UA takes off from its pad and climbs vertically to 250 feet AGL over 20 seconds. Since some of the cases involve two-way package delivery, we will assume that the UA is always at maximum weight of 29.1 pounds when taking off.

2.1.2.2 En Route Outbound

The en route phase is the part of flight in which the UA transits from the takeoff/landing site to a distribution site on a pre-defined network of flight paths. During this flight phase, the UA will typically operate at an altitude of 250 feet AGL and a typical airspeed of 31 knots.[8] The UA is expected to have a package on the outbound flight.

2.1.2.3 Descent, Landing, and Delivery

When the aircraft nears the landing pad, it descends vertically from the en route altitude to 165 feet AGL. The UA then hovers at 165 feet AGL and waits for up to 90 seconds for approval to land. Upon approval, the UA moves sideways until it's centered over the landing pad. Once the UA is over the landing pad, it descends vertically to 33 feet AGL over 18 seconds, then reduces speed and descends the final 33 feet vertically over 25 seconds. When the UA powers down, an attendant collects its package and potentially attaches a new one. The UA then departs following the takeoff and climb profile described in Section 2.1.2.1.

[8] UPS-FF has specified the speed as "31 kts (16 m/s)." Speed in this memorandum is converted to knots.

2.1.2.4 En Route Inbound

En route inbound follows the same procedure as en route outbound. In some cases, the UA will be loaded with another package to return to its starting point. For the purpose of noise analysis, the UA will be loaded for en route inbound unless otherwise noted.

2.2 Acoustical Data

Noise measurements of the Matternet Model M2 UA were collected at Ells Field Airport near Willits, California in June 2021. The FAA then processed and analyzed the measurement data to calculate estimated noise levels for each of the four flight phases (takeoff and climb, en route outbound, descent, landing, and delivery, and en route inbound) described in Section 2.1.2. FAA analyzed the measurement data and summarized the acoustical data used in this report, which is included as Attachment A. The following tables show the A-weighted Sound Exposure Levels (SELs) used for this analysis as detailed in Attachment A, which can be matched to each flight phase detailed in Table 1.

Table 2 presents the estimated SELs at takeoff and landing areas as a function of distance from the landing pad to the receiver. The noise levels presented in Table 2 include all activity where the Phase in Table 1 is noted as “Takeoff and Climb” and “Descent, Landing, and Delivery”. As such, the levels in Table 2 represent the combined noise resulting from the UA ascending vertically off the landing pad on the ground to en route altitude, as well as descending vertically from en route altitude to 165 ft AGL, hovering, moving horizontally to the center of the landing pad, and descending vertically to the ground. It should be noted that the noise estimates presented in Table 2 represent the UA at the maximum weights since the UA may carry a package for both inbound and outbound phases. Therefore, the levels in Table 2 are also applicable to both takeoff/landing sites and distribution sites, as the takeoff and landing procedures performed by the UA are identical at both ends of the route.

The levels presented in Table 2 exclude noise generated by the UA during inbound or outbound en route flight.

Table 3 presents the en route sound exposure levels for maximum weight and empty weight. The maximum weight SEL is applicable for the UA carrying a package while the empty weight SEL is applicable when the UA is not carrying a package. For the purpose of this noise analysis, the maximum weight SEL value will be used for en route outbound and inbound since the UA may pick up a package at a distribution site and fly back to the takeoff/landing site. This will be a conservative assumption since the maximum weight generates more noise. The estimates are based on measurements of the UA passing 250 feet above the microphone. FAA recommends that while the parameters for en route operation of the UA are typically at a speed of 31 knots and altitude of 250 feet AGL, the estimates derived from measurements at 250 feet AGL suggest that they should be used as is for the basis of any calculations.

Table 2. Estimate of SEL for "Takeoff and Climb" and "Descent, Landing, and Delivery" Operations

Source: FAA, May 13, 2022 (Attachment A)

Distance between Landing Pad and Receiver (ft) [a]	SEL (dB)	Distance between Landing Pad and Receiver (ft) [a]	SEL (dB)	Distance between Landing Pad and Receiver (ft) [a]	SEL (dB)	Distance between Landing Pad and Receiver (ft) [a]	SEL (dB)
20	90.1	900	65.6	1800	59.6	2700	56.1
50	84.7	950	65.2	1850	59.4	2750	56.0
100	81.1	1000	64.7	1900	59.2	2800	55.8
150	79.0	1050	64.3	1950	59.0	2850	55.7
200	77.3	1100	63.9	2000	58.7	2900	55.5
250	75.8	1150	63.5	2050	58.5	2950	55.4
300	74.5	1200	63.2	2100	58.3	3000	55.2
350	73.4	1250	62.8	2150	58.1	3050	55.1
400	72.3	1300	62.5	2200	57.9	3100	54.9
450	71.4	1350	62.1	2250	57.7	3150	54.8
500	70.5	1400	61.8	2300	57.5	3200	54.6
550	69.8	1450	61.5	2350	57.3	3250	54.5
600	69.0	1500	61.2	2400	57.1	3300	54.4
650	68.4	1550	60.9	2450	57.0	3350	54.2
700	67.8	1600	60.7	2500	56.8	3400	54.1
750	67.2	1650	60.4	2550	56.6	3450	54.0
800	66.6	1700	60.1	2600	56.5	3500	53.9
850	66.1	1750	59.9	2650	56.3		

Notes:
a) Takeoff starts at the landing pad. Distance is along ground from landing pad to receiver.

Table 3. Estimates of En Route SEL

Source: FAA May 13, 2022 (Attachment A)

Aircraft Config	Reference air speed (KTS)	Reference Altitude (ft AGL)	SEL (dB)
Max Weight	35.1	250	67.8
Empty Weight	35.1	250	65.3

3 Methodology for Data Analysis

The previously described data sets were used to develop a method to estimate community noise exposure that could result from UPS-FF delivery operations. These would be operations originating at a single location within each proposed area of operations and occurring weekdays (Monday through Friday) between the hours of 7:00 AM and 10:00 PM. Numbers of daily and equivalent annual delivery operations would vary for different operating areas. There are currently no standardized tools or processes in place to conduct a noise assessment for the proposed operational scenario and UA. HMMH, with detailed technical guidance from the FAA Office of Environment and Energy, developed a customized noise exposure prediction process based on the available data to conduct this analysis. The process was developed around FAA's understanding of typical use of the UA by UPS-FF. The following subsections describe the noise analysis methodology.

3.1 Application of Operations

The DNL metric applies a 10 dB weighting for operations between 10 PM and 7 AM. The 10 dB weighing is mathematically equivalent to 10 times the number of operations. Therefore, the operations near point *i* can be weighted to develop a daytime equivalent number of operations ($N_{equiv,i}$). The generalized form is expressed in Equation (1).[9]

$$N_{Equiv,i} = W_{Day} \times N_{Day,i} + W_{Eve} \times N_{Eve,i} + W_{Night} \times N_{Night,i} \quad (1)$$

Where:

- $N_{Day,i}$ is the number of user-specified operations between 7 AM and 7 PM local time
- $N_{Eve,i}$ is the number of user-specified operations between 7 PM and 10 PM local time
- $N_{Night,i}$ is the number of user-specified operations between 10 PM and 7 AM local time
- W_{Day} is the day-time weighting factor, which is 1 operation for DNL
- W_{Eve} is the evening weighting factor, which is 1 operation for DNL
- W_{Night} is the night-time weighting factor, which is 10 operations for DNL

For the DNL metric, the number of DNL daytime equivalent operations, $N_{DNL,i}$ simplifies to

$$N_{DNL,i} = N_{Day,i} + N_{Eve,i} + 10 \times N_{Night,i} \quad (2)$$

In practice, Equation (2) can be further simplified by defining the user-defined operations between 7 AM and 10 PM as a single value, rather than tracking $N_{Day,i}$ and $N_{Eve,i}$ separately.

[9] Equation (1) includes the three time periods of day, evening, night for consistency with other FAA documents that discuss the development of time averaging metrics such as DNL from individual SELs. Presentation of Equation (1) also allows the practitioner to modify this process for the CNEL metric for use in California.

For the Community Noise Equivalent Level (CNEL) metric, which may be used in California, the number of CNEL daytime equivalent operations, $N_{CNEL,i}$ simplifies to:

$$N_{CNEL,i} = N_{Day,i} + 3 \times N_{Eve,i} + 10 \times N_{Night,i} \quad (3)$$

3.2 Landing pad Infrastructure

As noted in Section 1 and Section 2.1.2, UPS-FF operates UAs from a central landing pad. This landing pad shall be a square with side lengths of 39.7 inches and have a protective radius of at least 20 feet extending out from its center. 34.2 feet away from the landing pad will be an alternate landing site. This landing site will have a 20-foot circle extending out from its center, like the landing pad. For the purpose of this noise analysis methodology, the landing pad extents depicted in Figure 2 and Figure 3 refer to the portion of the property in which the takeoff and landing pads could be positioned depending on the frequency of UA operations, as appropriate. The landing pad extents for the noise analysis shall be a rectangle, circle, or other polygon that includes all the possible locations for the takeoff and landing pads.

3.3 Application of Acoustical Data

The Day-Night Average Sound Levels (DNLs) can be estimated with a summation of the SELs. SEL values for the UA and UPS-FF operations covered in this report are detailed in FAA's May 13, 2022 Memorandum and provided with this report as Attachment A.

For calculating SEL, three specific activities are considered:

- The UA taking off from the landing pad;
- En route travel of the UA between the landing pad and the distribution site; and
- The UA landing at the landing pad.

3.3.1 General Assumptions

This analysis is based on the tables presented in Section 2.2. Table 2 and Table 3 present noise exposure values at discrete 50-foot increments relative to the UA's vertical profile from 20 to 3,500 feet. If additional values between 20 to 3,500 feet are needed, then SEL values at intermediary distances can be approximated by linear interpolation. In most cases, this should yield more conservative values compared to tested results. SEL values at distances less than 20 feet for takeoff or landing should not be extrapolated from the values in the tables because the deviation of the method of estimation from the linearly extrapolated value increases closer to the source and tends to infinity at the source.

3.3.2 Takeoff and Climb and Descent, Landing, and Delivery

The measured sound exposure levels for a takeoff, climb, descent, landing, and delivery combination as described in Section 2.1.2.1 and Section 2.1.2.3 are presented in Section 2.2 and specifically in Table 2. Since the proposed delivery operations include a descent and landing and power down, and then later a

separate takeoff and climb, the discussion here is applicable to both takeoff/landing sites and distribution sites.

The SEL values provided only include the maneuvers associated with takeoff from the ground through climb to en route altitude, and descent from en route altitude to the landing on the ground. The SEL values provided do not include horizontal en route movement before the descent, or after the ascent associated with en route flight. As noted in Section 3.1, the values in Table 2 should only be used for distances between the landing pad and the receiver for distances of 20 feet to 3,500 feet. As noted in Section 3.3.1, the values in Table 2 should only be used for estimating sound levels between 20 and 3,500 feet from the landing pad.

Application of the SEL should be based on the position of the landing pad. If the exact location of the landing pad is not known, then using an outer boundary of the landing pad would be slightly conservative.

3.3.3 En Route

Flight of the aircraft in still air is anticipated to be typically 31 knots, with a typical cruise altitude of 250 feet AGL. Sound exposure level for a given point i (SEL_i) with the aircraft flying directly overhead at altitude (Alt_i) in feet and a ground speed (V_i) in knots, will be calculated based on the guidance in *14 CFR Part 36 Appendix J, Section J36.205 Detailed Data Correction Procedures*.[10] It should be noted that the equations presented in this section are only applicable for an aircraft that is moving relative to a stationary receptor. The discussion of the variables are presented in the context of the application of this methodology.

In particular, the sound exposure level adjustment for the altitude of a moving aircraft, is presented here as Equation (4).

$$\Delta J_1 = 12.5 \times \log_{10}\left(\frac{H_A}{H_T}\right), \; dB \qquad (4)$$

where ΔJ_1 is the quantity in decibels that must be algebraically added to the measured SEL in order to estimate the SEL for a level flight path at an altitude differing from the altitude corresponding to the measured SEL; H_A is the reference height, in feet, corresponding to the measured SEL; H_T is the altitude at which an estimate of the SEL is being made, and the constant (12.5) accounts for the effects on spherical spreading and duration from the off-reference altitude. The value of ΔJ_1 is 0 if H_T is equal to H_A and can be negative if H_T is greater than (higher altitude) than H_A.

The sound exposure level adjustment for speed is presented here as Equation (5).

$$\Delta J_3 = 10 \times \log_{10}\left(\frac{V_R}{V_{RA}}\right), \; dB \qquad (5)$$

Where ΔJ_3 is the quantity in decibels that must be algebraically added to the measured SEL noise level to estimate the SEL of the vehicle at speed V_{RA} when the measured SEL corresponds to the vehicle

[10] 14 CFR Part 36 Noise Standards: Aircraft Type and Airworthiness Certification available at https://www.ecfr.gov/current/title-14/chapter-I/subchapter-C/part-36

traveling at a reference speed V_R. This adjustment represents the influence of the different speed on the duration of the overflight at the stationary receptor. If the vehicle is to be estimated at a speed V_{RA} that is greater than the reference speed V_R of the measured SEL, then the correction ΔJ_3 will be negative. The value of ΔJ_3 is 0 if V_R is equal to V_{RA}. Conversely, if the estimated speed is less than the reference speed, the estimated SEL will be greater than the measured SEL. This stands to reason because a slower moving aircraft will result in a greater time exposure of its emitted noise at a stationary receptor on the ground.

As shown in Table 3, the SEL is 67.8 dB when the vehicle is at maximum weight, at 250 feet from the ground receiver and traveling at approximately 35.1 knots; therefore, adapting that to the maximum weight (outbound) en route condition when the UA is flying at an altitude of Alt_i feet AGL and ground speed of V_i knots can be made using Equation (6) to arrive at an estimate $SEL_{maximum\ weight}$ dB for that respective phase of flight.

$$SEL_{maximum\ weight} = 67.8 + 12.5 \times \log_{10}\left(\frac{250}{Alt_i}\right) + 10 \times \log_{10}\left(\frac{35.1}{V_i}\right),\ dB \quad (6)$$

As noted in Section 2.1.2.2 and Section 2.1.2.4, the UA could be carrying a package at any time, and Table 3 indicates that the UA is louder at maximum weight. Therefore, for the purpose of noise analysis, it should be assumed that Equation (6) is applicable for all en route activity. This will be a conservative assumption since the UA would generate louder noise with the maximum weight.

Equation (7) presents the calculation for en route conditions at empty weight calculated using the values in Table 3 for instances in which dedicated empty en route paths are identified.

$$SEL_{empty\ weight} = 65.3 + 12.5 \times \log_{10}\left(\frac{250}{Alt_i}\right) + 10 \times \log_{10}\left(\frac{35.1}{V_i}\right),\ dB \quad (7)$$

3.4 Proposed DNL Estimation Methodology

The number of operations overflying a particular receiver's location on the ground will vary based on the proposed operating area and demand. For a given receiver location *i*, and a single instance of sound source *A*, the SEL for that sound source SEL_{iA} is (energy) summed for the average annual daily number of DNL daytime equivalent operations ($N_{DNL,iA}$) to compute the DNL, or equivalently, by Equation (8).

$$DNL_{iA} = SEL_{iA} + 10 \times \log_{10}\left(N_{DNL,iA}\right) - 49.4,\ (dB) \quad (8)$$

The above equation applies to an SEL value representing one noise source such as a UA takeoff or a UA landing. For cases where a particular receiver would be exposed to multiple sound sources (A through Z), the complete DNL at that point would be calculated with Equation (9).

$$DNL_i = 10 \times \log_{10}\left(10^{\left(\frac{DNL_{iA}}{10}\right)} + 10^{\left(\frac{DNL_{iB}}{10}\right)} + \cdots + 10^{\left(\frac{DNL_{iZ}}{10}\right)}\right),\ (dB) \quad (9)$$

For each of the conditions presented below, results will be presented in tabular format with the estimated DNL.

3.4.1 DNL for Landing Pad

The takeoff and landing operations are anticipated to occur at the same location. Therefore, the results for both will be calculated for a single set of receptors.

The noise around the landing pad will be represented by three sound levels. The first is the Takeoff-landing noise. The other two elements are the en route inbound noise and en route outbound noise at the landing pad. These sources will be added together with Equation (9).

3.4.2 DNL for En Route

En route includes the UA flying to and from the landing pad to destinations as discussed in Sections 2.1.2.2 and 2.1.2.4. A representative receiver will be positioned directly under the flight path, and the DNL will be calculated based on the altitude and speed-adjusted delivery SEL calculated in Section 3.3.3. Operations will be based on representative numbers defined in relevant materials and assume that a receiver under the flight path will be overflown by the UA at maximum weight for both outbound and inbound for a single delivery. The en route outbound noise level and the en route inbound noise level will be added together with Equation (9).

3.4.3 DNL for Delivery Points

Delivery operations will be represented by a single sound level consisting of the UA descending from en route altitude to the ground using the descent procedure described in Table 1, and then ascending vertically over the delivery point returning to en route altitude.

Use of the DNL Delivery, by itself, does not include the en route horizontal flight as the UA approaches the delivery point with the package or the horizontal flight as the UA leaves the delivery point after releasing the package. The FAA envisions that the user will add the DNL Delivery to the appropriate en route DNL values with Equation (9). To assist simple conservative analyses, the results of DNL Delivery will also be presented with conservative en route approaches and departures from the delivery point.

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4 Noise Exposure Estimate Results

This section presents the estimated noise exposure for UPS-FF's proposed operations for a given set of average annual day (AAD) deliveries. The values presented are in tabular format and use of the table requires estimating the number of DNL Equivalent deliveries associated with the landing pad. One delivery includes the outbound takeoff and inbound landing and is representative of two operations. The DNL Equivalent deliveries, $N_{DNL,i}$ as described in 3.1, is presented below as Equation (10).

$$Deliveries_{DNL,i} = Deliveries_{Day} + 10 \times Deliveries_{Night} \quad (10)$$

$Deliveries_{Day}$ are between 7 AM and 10 PM and $Deliveries_{Night}$ are between 10 PM and 7 AM.[11] If a portion of a delivery occurs in the nighttime hours (either takeoff or landing) then it should be counted within $Deliveries_{Night}$.

For estimating noise exposure, the noise levels for each flight phase should be considered separate based on the level of proposed operations for a given location. If a particular location is at the transition of different flight phases, the cumulative noise should then be determined by adding the noise from each phase. For example, a typical mission profile will include noise from multiple flight phases:

1. UA departure from and return to a landing pad
2. En route flight at a defined altitude to and from a landing pad to a delivery point and
3. Descent from en route flight to complete a delivery at the delivery point and ascent back to en route altitude for return to the landing pad.

The cumulative noise from the UA is then determined by adding the noise from each of these phases.

4.1 Noise Exposure for Operations at the Landing pad

For operations at the landing pad, the UA-related noises include the takeoff and landing. To provide a conservative view, all operations are assumed to be on the same flight path operating in opposite directions.

Table 4 presents data for a given number of daily average DNL Equivalent deliveries (including the takeoff and climb, en route outbound, en route inbound, and descent and landing as detailed in Section 2.1.2), the estimated extent of DNL 45 dB, 50 dB, 55 dB, 60 dB, and 65 dB contours under the flight path for a landing pad extents as described in Section 3.2. The analyses presented in Table 4 were rounded up conservatively to the nearest interval available from the data from Section 2.2, out to 3,500 feet. The actual noise levels, should they be calculated with greater precision or measured, are anticipated to be within the estimated extents depicted.[12]

[11] Discussion of modification of this process for use in California with the CNEL metric is discussed in Section 3.1.

[12] The calculation of the equations presented in Section 3 require that distance is provided. The DNL levels were calculated at 20 feet and then 50-foot intervals from 50 to 3,500 ft as provided in Section 2.2. The intervals were the same as those intervals in which measurement data was available for the UA.

Table 4. Estimated Extent of Noise Exposure from Landing pad per Number of Deliveries

Number of DNL Equivalent Deliveries Served by landing pad		Estimated Extents, feet, for				
Average Daily	Annual	DNL 45 dB	DNL 50 dB	DNL 55 dB	DNL 60 dB	DNL 65 dB
<= 1	<= 365	20	20	20	20	20
<= 5	<= 1,825	50	20	20	20	20
<= 10	<= 3,650	100	50	20	20	20
<= 15	<= 5,475	100	50	20	20	20
<= 20	<= 7,300	150	50	20	20	20
<= 40	<= 14,600	200	100	50	20	20
<= 60	<= 21,900	300	100	50	20	20
<= 80	<= 29,200	400	150	50	20	20
<= 100	<= 36,500	500	200	100	50	20
<= 120	<= 43,800	600	200	100	50	20
<= 140	<= 51,100	750	250	100	50	20
<= 160	<= 58,400	950	250	100	50	20
<= 180	<= 65,700	1400	300	100	50	20
<= 200	<= 73,000	Note c	300	150	50	20
<= 220	<= 80,300	Note c	350	150	50	20
<= 240	<= 87,600	Note c	350	150	50	20
<= 260	<= 94,900	Note c	400	150	50	20
<= 280	<= 102,200	Note c	400	150	100	50
<= 300	<= 109,500	Note c	450	200	100	50
<= 340	<= 124,100	Note c	500	200	100	50
<= 360	<= 131,400	Note c	550	200	100	50
<= 380	<= 138,700	Note c	600	200	100	50
<= 400	<= 146,000	Note c	600	200	100	50
<= 420	<= 153,300	Note c	650	250	100	50
<= 440	<= 160,600	Note c	750	250	100	50
<= 460	<= 167,900	Note c	800	250	100	50
<= 480	<= 175,200	Note c	850	250	100	50
<= 500	<= 182,500	Note c	900	250	100	50

Notes:
a) One delivery includes the outbound takeoff and inbound landing and is representative of two operations.
b) If a value for deliveries is not specifically defined in this table, use the next highest value. For example, if there are 50 average daily DNL Equivalent deliveries, use the entry for 60 average daily DNL Equivalent deliveries.
c) The DNL noise level noted extends more than 3,150 feet from the landing pad based on the level of operations specified as the aircraft continues along its en route flight path. En route results in Section 4.2 may be more applicable in these instances for determining noise levels.

4.2 Noise Exposure under En Route Paths

For en route conditions, the UA is expected to fly the same outbound flight path between the landing pad and the delivery point and inbound flight path back to the landing pad (Section 3.4.3). Therefore, each location under the en route path would be overflown twice for each delivery served by the respective overhead en route path.

Table 5 provides the estimated DNL for a location on the ground directly under an en route path for various counts of daily average DNL Equivalent deliveries. The en route noise calculated for each delivery includes both the inbound and outbound traversal of the en route path.

Table 5. Estimated DNL Directly Under En Route Flight Paths

Number of DNL Equivalent Deliveries Served by Route		DNL
Average Daily	Annual	
<= 1	<= 365	22.0
<= 5	<= 1,825	29.0
<= 10	<= 3,650	32.0
<= 15	<= 5,475	33.7
<= 20	<= 7,300	35.0
<= 40	<= 14,600	38.0
<= 60	<= 21,900	39.8
<= 80	<= 29,200	41.0
<= 100	<= 36,500	42.0
<= 120	<= 43,800	42.8
<= 140	<= 51,100	43.4
<= 160	<= 58,400	44.0
<= 180	<= 65,700	44.5
<= 200	<= 73,000	45.0
<= 220	<= 80,300	45.4
<= 240	<= 87,600	45.8
<= 260	<= 94,900	46.1
<= 280	<= 102,200	46.5
<= 300	<= 109,500	46.8
<= 340	<= 124,100	47.3
<= 360	<= 131,400	47.5
<= 380	<= 138,700	47.8
<= 400	<= 146,000	48.0
<= 420	<= 153,300	48.2
<= 440	<= 160,600	48.4
<= 460	<= 167,900	48.6
<= 480	<= 175,200	48.8
<= 500	<= 182,500	49.0

In some instances, the UA may overfly locations at operations levels that may differ from both an inbound and outbound traversal of the en route path by the UA as described above and presented in Table 5. For these circumstances, Table 6 presents the equations for calculating the estimated DNL for a receiver directly under a specified given number of DNL Equivalent average daily individual overflights, defined as N_o.

Table 6. Estimates DNL Directly Under Overflights, Maximum and Empty Weight

Altitude and configuration of Overflight and of Delivery		SEL for 1 Overflight (dB)	DNL for 1 Overflight between 7 AM and 10 PM (dB)	DNL equation for the number of DNL Equivalent Overflights
Altitude	Weight			
250 feet AGL	Empty	65.8	16.5	$10 \times \log_{10}(N_o) + 16.5$
250 feet AGL	Maximum	68.3	19.0	$10 \times \log_{10}(N_o) + 19.0$

Notes:
a) The DNL value for a given number of average DNL Equivalent Operations, N_o, can be found by using the equations associated with operation of the UA at a specified altitude and speed interval. In this case, one operation represents a single overflight.
b) All values in this table are for level flight at 31 knots

4.3 Noise Exposure for Operations at Delivery Point

Table 7 presents the estimated DNL values for a range of potential daily average DNL Equivalent delivery counts at a delivery point. Also included in Table 7 is the equation for calculating the estimated DNL for a specific number of daily average DNL Equivalent delivery counts at a delivery point, defined as N_d, for instances where the number of deliveries may fall between the range of presented delivery count intervals.

Figure 6 presents the minimum listener distance used for the development of Table 7. The minimum listener distance is 20 feet from the landing pad at the delivery point and corresponds to the "Perimeter for Non-Participants" identified by UPS-FF and reproduced in this report as Figure 2 and Figure 3.

Only the partial DNL values associated with the delivery vertical flight maneuvers are presented. In anticipated use, the value from Table 7 would be added using Equation (9) to the appropriate values for a UA flying to and from the delivery point at en route altitude, along with any other nearby en route operations.

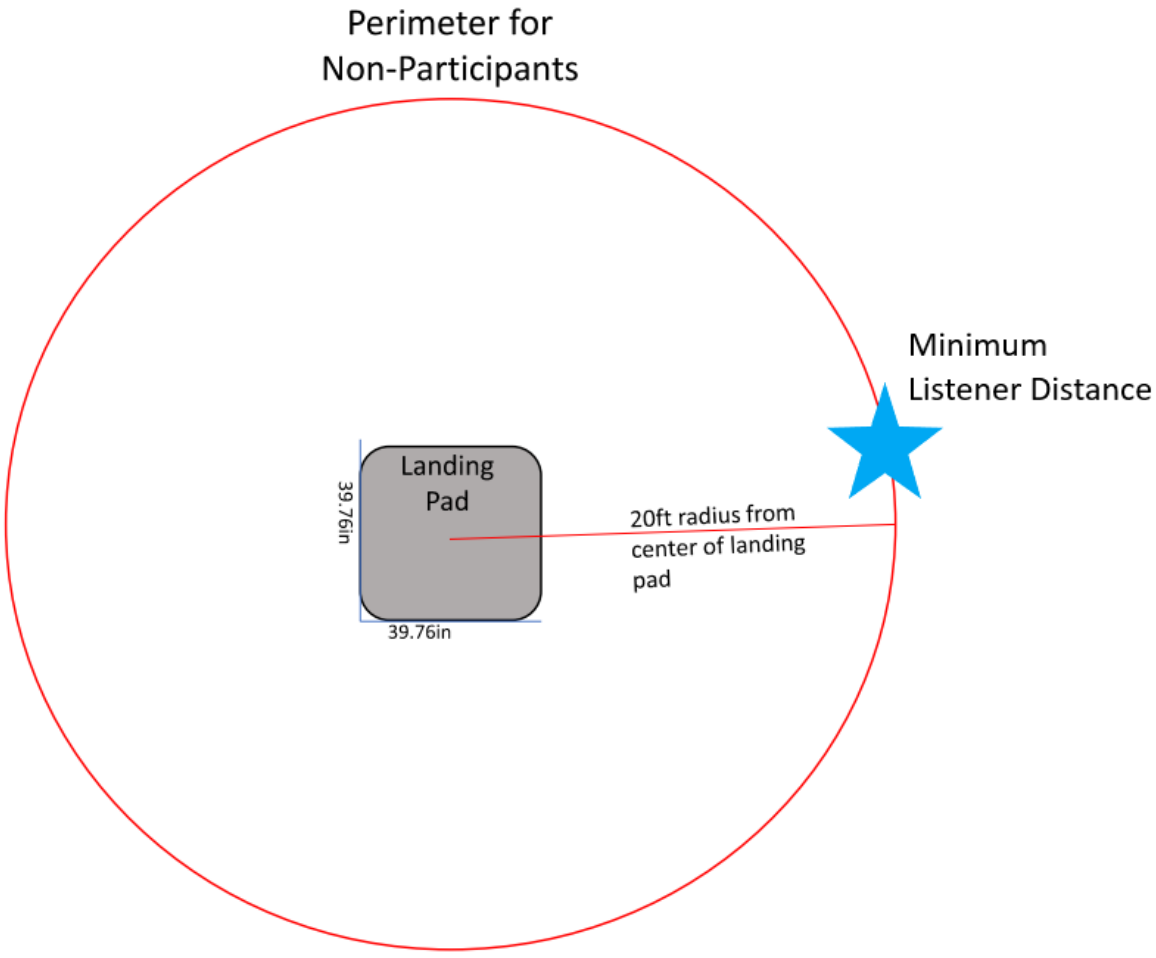


Figure 6: Representative Minimum Listener Distance Location Used for Table 7

Table 7. DNL at Delivery Point for Vertical Maneuvers

Number of DNL Equivalent Deliveries		Partial Estimated Delivery DNL of Vertical Maneuvers at Minimum Listener Distance
Average Daily	Annual	
<= 1	<= 365	40.7
<= 5	<= 1,825	47.7
<= 10	<= 3,650	50.7
<= 15	<= 5,475	52.5
<= 20	<= 7,300	53.7
<= 40	<= 14,600	56.8
<= 60	<= 21,900	58.5
<= 80	<= 29,200	59.8
<= 100	<= 36,500	60.7
<= 120	<= 43,800	61.5
<= 140	<= 51,100	62.2
<= 160	<= 58,400	62.8
<= 180	<= 65,700	63.3
<= 200	<= 73,000	63.7
<= 220	<= 80,300	64.2
<= 240	<= 87,600	64.5
<= 260	<= 94,900	64.9
<= 280	<= 102,200	65.2
<= 300	<= 109,500	65.5
<= 340	<= 124,100	66.0
<= 360	<= 131,400	66.3
<= 380	<= 138,700	66.5
<= 400	<= 146,000	66.8
<= 420	<= 153,300	67.0
<= 440	<= 160,600	67.2
<= 460	<= 167,900	67.4
<= 480	<= 175,200	67.5
<= 500	<= 182,500	67.7
N_d	N_d x 365	$10 \times \log_{10}(N_d) + 40.7$

Notes:
a) The DNL values presented in this table only reflect the UA conducting descent and climb flight maneuvers associated with a delivery. DNL values associated with en route flight to and from a landing pad to a delivery point associated with a delivery, or nearby en route overflights, should be added to these values utilizing the DNL levels presented in Table 5.
b) If a value for deliveries is not specifically defined in this table, use the next highest value. For example, if there are 50 average daily DNL Equivalent deliveries, use the entry for 60 average daily DNL Equivalent deliveries.
c) Partial Estimate DNL based on an assumed minimum listener distance of 20 feet from the landing pad. See Figure 6.

Attachment A

Federal Aviation Administration

Memorandum

Date: May 13, 2022

To: Donald Scata, Manager, Noise Division, Office of Environment and Energy (AEE-100)

From: Susumu Shirayama and Chris Hobbs, Noise Division, Office of Environment and Energy (AEE-100)

Subject: Estimated Noise Levels for Matternet Model M2 UA

This document presents an analysis of noise measurements of the Matternet Model M2 Unmanned Aircraft (UA) by J R Engineering (JRE), measured on June 2021 at Ells Field Airport near Willits, California. The purpose of the analysis is to provide estimates of expected sound exposure levels resulting from typical operations of the Model M2 UA[1] by Matternet, Inc. and provides the methods used to create the noise estimates.

1. Flight Profile and Segment Noise

The phases of a typical flight profile from takeoff to landing with an included delivery are listed in Table 1 for the Model M2 UA. Because the noise level of the UA for a given speed varies with weight, the aircraft configuration lists the vehicle weight for each phase of flight. The noise measurements at Willits were made with the UA at its maximum takeoff weight (29.1 lbs/13.2 kg) and empty weight (24.7 lbs/11.2 kg) while in level flyover. The vehicle was only measured hovering at maximum takeoff weight. The measurements showed that noise from the vehicle was greatest at maximum takeoff weight during level flyover; thus, using the maximum weight for all phases of flight where the UA is carrying a package is a conservative estimate of the vehicle noise as compared to the same flight phases with the UA carrying a lighter package.

As shown below, the takeoff and landing area at the UA's point of origin and delivery location will have the same estimated noise as a function of distance from the landing pads (LPs).

Table 1. Phases of Flight for Typical Flight Profile of Model M2 UA

Phase of Flight	Description	Configuration
Takeoff	Launch from ground to operational altitude (250 ft)	Max weight (carrying package for delivery)
En Route Outbound	Flying at operational altitude and cruise speed (31 kts)	Max weight
Descent, Landing, and Delivery	Vertical descent from operational altitude to the ground; Full stop to deliver a package; Vertical ascent to operational altitude	Max weight on descent/empty weight on ascent
En Route Inbound	Flying at operational altitude and cruise speed	Empty weight
Landing	Land by vertical descent from operational altitude	Empty weight

The method used to estimate the noise on the ground during each phase of flight is listed below followed by suggestions on how to combine noise levels to represent noise for the entire flight. The methodology presented for estimating the noise for each flight phase uses the best available information from the certification data for the Model M2 UA and represents a conservative estimate of the noise levels resulting from operations of this UA.

1.1. Takeoff and Landing Area Noise

There are two flight activities that generate noise in the vicinity of the takeoff and landing areas. The Model M2 will climb from the ground vertically to an operational altitude of 250 feet above ground level (AGL) in 20 seconds, then begin transit to the delivery location. After completing delivery, the UA returns from the delivery location at 250 feet AGL and descends vertically to the ground at the LP. During landing, the UA approaches to the edge of LP approximately 16 feet from the center of the LP, descends vertically to 165 feet AGL in 13 seconds and waits for approval to land. Once landing approval is received, the UA moves horizontally to the center of LP at 165 feet AGL descends vertically from 165 feet to 33 feet AGL in 18 seconds, and lands on the ground from 33 feet AGL in 25 seconds. Table 2 details the complete takeoff and landing procedures.

Table 2. Model M2 UA Takeoff and Landing Profile Details

Flight Segment	Flight Description	Altitude (ft AGL)	Ground Speed (kts)	Duration (s)
Takeoff	Ascent to cruise altitude	0 ascend to 250	0	20
Landing	Descent for landing	250 descend to 165	0	13
Landing	Holding for approval to land	Hover at 165	0	Up to 90
Landing	Move to the center of LP	Lateral move of 16 ft	<4	3
Landing	Descent	165 descent to 33	0	18
Landing	Descent to land	33 descent to 0	0	25

To estimate the sound exposure level (L_{AE}) at takeoff and landing areas, measurements of the noise emissions of the Model M2 UA were made when it was at maximum weight and hovering at 16.5 feet

AGL and 20 feet laterally from the microphone positions shown in Fig. 1. Each recording lasted for approximately 30 seconds and began after the UA was in a steady condition.

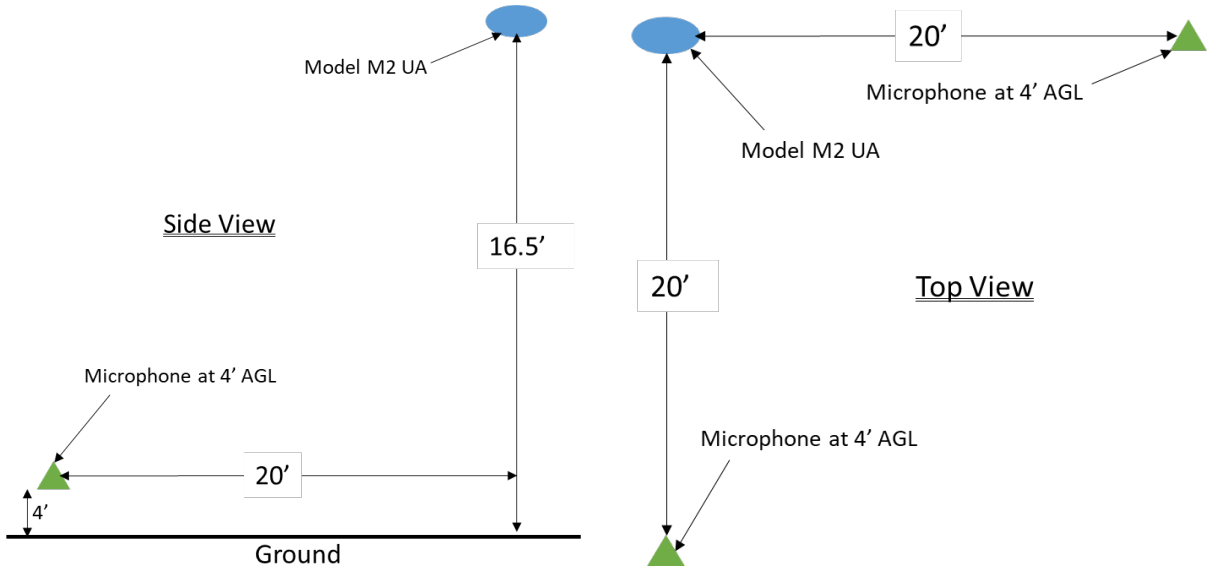


Figure 1. Microphone locations for hover measurements shown in green when Model M2 UA hovered above the ground

The average sound pressure level was calculated at the microphone for two separate recordings. The Model M2 UA rotated by 180 degrees between the recordings so that the two microphones captured the noise emissions from the cardinal points around the vehicle (0 and 90 degrees for the first recording; 180 and 270 degrees for the second recording). The average sound pressure level was normalized to a distance of 70.7 ft using spherical spreading from the actual distances from the Model M2 UA to each microphone for each recording. The results from the four recordings were averaged together to generate the result presented in Table 3. It is important to note that these measurements are all at the same relative angle from the bottom of the UA. It is expected that this is a conservative estimate of the noise due to the fact that broadband noise from the rotors is being captured; whereas, the noise emitted closer to the plane of the rotors would be dominated by blade passage frequency which is lower than the broadband frequency range and would consequently have a lower A-weighted sound level.

Table 3. Average Sound Pressure Level of Model M2 UA while Hovering

Sound Pressure Level (dBA)	Distance (ft)	Aircraft Configuration
65.3	70.7	Maximum Weight

In order to estimate the noise levels from the UA, the following assumptions have been made.

Sound transmission between the noise source and the receiver is solely a function of distance with no additional atmospheric attenuation or ground effects.

In this analysis, the level in Table 3 represents a reference sound pressure level calculated for the reference distance based on an average of the measurements. This reference level will be adjusted for spherical spreading to develop the levels at other distances for each configuration of the UA. For a

stationary point source, the spherical spreading relationship of the sound pressure level (L_i) at distance D_i from the reference sound pressure level (L_R) measured at a reference distance D_R is given by Equation 1.

$$L_i = L_R + 20 \log_{10}\left(\frac{D_R}{D_i}\right), \; dB \tag{1}$$

Sound transmits equally in all directions.

The level in Table 3 is based on the measurement locations depicted in Figure 1 while the UA was hovering at approximately 16.5 ft AGL. The assumption that the UA is an omnidirectional sound source implies that the same sound levels would have been measured at any point on the surface of a sphere centered on the UA.

To estimate the sound exposure level at the takeoff and landing areas including the takeoff and landing for a single flight, each vertical segment is evenly divided into stations (blue ovals) as illustrated in Figure 2. The hover noise level noted in Table 3 is spherically spread from each station to a point on the ground a fixed distance from the LP. Using the appropriate durations from Table 2, the sound exposure level is calculated assuming the UA spent equal amounts of time at each station (blue oval) along the segment. The translation at 165 ft AGL of the UA during delivery from the offset (16 feet) to directly above the LP was represented by a single station midway on the horizontal segment with a duration of 3 seconds.

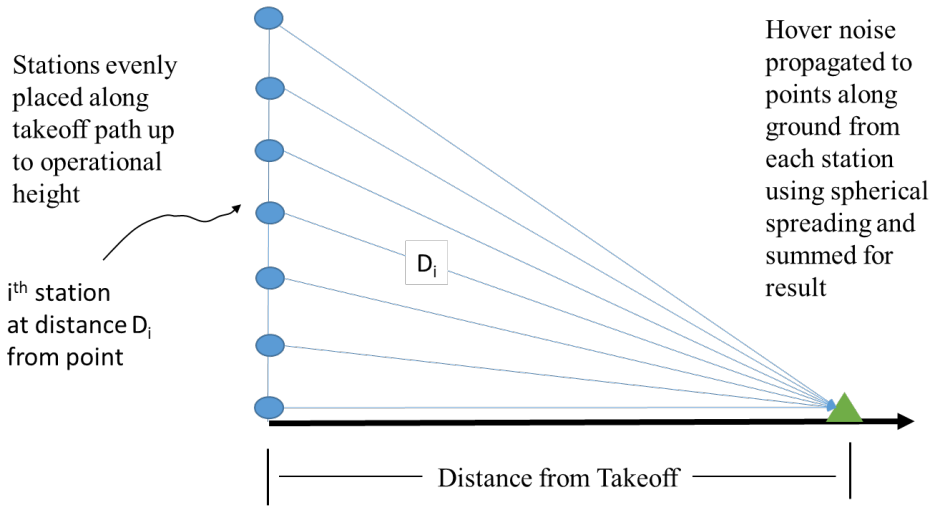


Figure 2. Graphical representation of how hover noise is used to simulate takeoff noise.

The estimates of the sound exposure level for the landing assumes the initial descent by the UA occurred when the UA arrives at the edge of the LP, which is 16 feet from the center of the LP as shown in Figure 3. Note that the UA will be 16 feet closer to the receiver for the initial descent. Estimating the noise levels in this manner is conservative as the entire flight segment will be closer to representative receiver points on the ground.

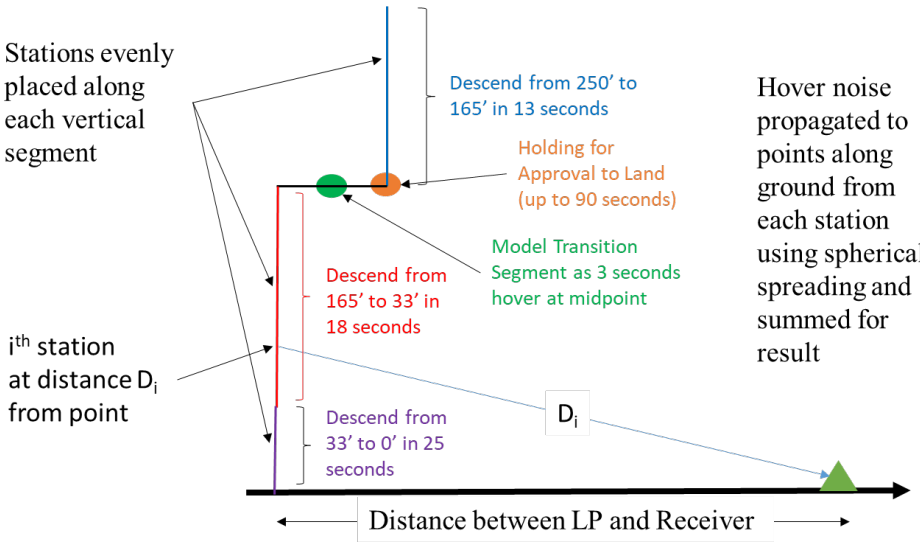


Figure 3. Graphical representation of how hover noise is used to simulate landing noise

The sound exposure level ($L_{AEi}(D_i)$) as a function of distance (D_i), from the UA at the ith station shown in Fig. 2 is the product of the Sound Pressure Level (L_i) spherically spread to a distance D_i and the time the UA was at the ith station (dt) using Equation 2:

$$L_{AEi}\left(D_i\right) = 10\log_{10}\left(10^{\left(.1L_i\right)}dt\right),\ dB \tag{2}$$

To calculate the sound exposure level for the flight activities at the takeoff and landing areas, at the distance r as the distance between LP and receiver, one needs only sum the levels calculated from each station according to Equation 3.

$$L_{AE}\left(r\right) = 10\log_{10}\left(\sum_{i}^{n} 10^{.1L_{AEi}(r)}\right),\ dB \tag{3}$$

Where n = number of stations used to simulate the vertical segments.

The UA landing and takeoff profiles are the same at both the delivery location and the point of origin; furthermore, the noise estimate being used is independent of whether the UA is at maximum or empty weight. As such, the noise estimate at distances from the takeoff and landing phases of the flight profile are the same at both origin and delivery locations. Table 4 contains the combined noise estimates of takeoff and landing phases of the flight profile as a function of distance from the landing pad.

Table 4. Estimate of Sound Exposure Level at the Takeoff and Landing areas for Matternet Model M2 UA

Distance from Takeoff (ft)	L_{AE} (dBA)	Distance from Takeoff (ft)	L_{AE} (dBA)	Distance from Takeoff (ft)	L_{AE} (dBA)	Distance from Takeoff (ft)	L_{AE} (dBA)
20	90.1	900	65.6	1800	59.6	2700	56.1
50	84.7	950	65.2	1850	59.4	2750	56.0
100	81.1	1000	64.7	1900	59.2	2800	55.8
150	79.0	1050	64.3	1950	59.0	2850	55.7
200	77.3	1100	63.9	2000	58.7	2900	55.5
250	75.8	1150	63.5	2050	58.5	2950	55.4
300	74.5	1200	63.2	2100	58.3	3000	55.2
350	73.4	1250	62.8	2150	58.1	3050	55.1
400	72.3	1300	62.5	2200	57.9	3100	54.9
450	71.4	1350	62.1	2250	57.7	3150	54.8
500	70.5	1400	61.8	2300	57.5	3200	54.6
550	69.8	1450	61.5	2350	57.3	3250	54.5
600	69.0	1500	61.2	2400	57.1	3300	54.4
650	68.4	1550	60.9	2450	57.0	3350	54.2
700	67.8	1600	60.7	2500	56.8	3400	54.1
750	67.2	1650	60.4	2550	56.6	3450	54.0
800	66.6	1700	60.1	2600	56.5	3500	53.9
850	66.1	1750	59.9	2650	56.3		

Note:
The distance of 20 feet represents a minimum clearance distance at a landing site.

1.2. En Route Noise at Maximum and Empty Weights

The Model M2 UA was measured in level overflights at max weight and empty weight over a microphone. The L_{AE} for each pass was normalized to the reference altitude and airspeed listed in Table 5. In particular, the sound exposure level adjustment for the altitude defined in 14 CFR Part 36 for a moving aircraft, is presented here as Equation 4.

$$\Delta J_1 = 12.5 \times \log_{10}\left(\frac{H_A}{H_T}\right), dB \quad (4)$$

Where ΔJ_1 is the quantity in decibels that must be algebraically added to the measured L_{AE} to adjust for a level flight path at an altitude differing from the measured altitude; H_A is the height, in feet, of the vehicle when directly over the noise measurement point; H_T is reference height; and the constant (12.5) accounts for the effects on spherical spreading and duration from the off-reference altitude.

The sound exposure level adjustment for speed, as defined in 14 CFR Part 36, is presented here as Equation 5.

$$\Delta J_3 = 10 \times \log_{10}\left(\frac{V_{RA}}{V_R}\right), \; dB \tag{5}$$

Where ΔJ_3 is the quantity in decibels that must be algebraically added to the measured L_{AE} noise level to correct for the influence of the adjustment to the reference speed on the duration of the measured flyover event as perceived at the microphone, V_R is the reference speed, and V_{RA} is the measured speed.

Table 5. Estimates of En Route Noise of Model M2 UA

Aircraft Configuration	Reference Air Speed (kts)	Reference Altitude (ft AGL)	L_{AE} (dBA)
Max Weight	35.1	250	67.8
Empty Weight	35.1	250	65.3

1.3. Delivery Noise

The parameters for the delivery portion of a typical flight profile for the Model M2 UA are the same as the flight profiles presented in Table 2. The difference would be the landing profile comes first and the takeoff profile to follow. The sound exposure levels presented in Table 4 would be applicable to delivery noise.

2. Conclusion

The information and noise levels presented in this document represent conservative estimates of the noise made by the Matternet Model M2 UA during each segment of typical flight profiles. In order to estimate the sound exposure level at any point on the ground, a calculation of the contributions from each flight segment should be combined to arrive at a final estimate of cumulative noise exposure. In order to calculate the maximum sound level from the takeoff, delivery, or landing portions of the flight profile, it is recommended that the sound pressure level from the appropriate aircraft configuration be used at the lowest altitude of the flight segment. Due to the directivity of the UA source noise and the excessive attenuation of ground to ground propagation, this estimate of the sound exposure level will most likely be an over estimate. However, it is FAA's position that this approach is conservative and appropriate for use in estimating noise exposure to inform Federal actions related to UA operations where relatively low levels of UA operations are expected.

Appendix D

Non-Standard Noise Methodology Memos

Federal Aviation Administration

Memorandum

Date: January 5, 2023

To: Don Scata, Noise Division Manager, Office of Environment and Energy (AEE-100)

MICHAEL JAY MILLARD Digitally signed by MICHAEL JAY MILLARD Date: 2023.01.05 10:04:25 -05'00'

From: Mike Millard, Flight Standards (AFS), General Aviation Operations Branch, AFS-830

Subject: Environmental Assessment (EA) Noise Methodology Approval Request for Matternet Model M2 UA Part 135 Operations at Columbus, OH

FAA Office of Flight Standards (AFS) requests FAA Office of Environmental and Energy, Noise Division (AEE-100) approval of the noise methodology to be used for the Environmental Assessment (EA) for UPS Flight Forward (UPSFF) operations using the Matternet Model M2 unmanned aircraft (UA) in Columbus, OH to provide package delivery services as a 14 CFR Part 135 operator as described below.

As required under the National Environmental Policy Act (NEPA), the FAA must consider the potential for environmental impacts in informing the agency's decision to approving Federal actions, including the potential for noise impacts as detailed in FAA Order 1050.1F.

As the FAA does not currently have a standard approved noise model for UA, this memo serves as a request for written approval from AEE-100 to use the methodology proposed in the following sections to support the noise analysis for this EA.

Description of Aircraft and Proposed Operations

AFS is evaluating UPSFF's proposed commercial package delivery operations using the Model M2 UA for commercial package delivery operations within a 3.77-square mile operating area located in Columbus, OH. UPSFF proposes to begin operations in Columbus, OH at two distribution centers (DCs) (Ackerman and Bus Depot). UPSFF projects operating a maximum of 28 delivery flights per operating day at the Ackerman DC and 28 delivery flights per day at the Bus Depot DC. Approval of a Federal Action providing UPSFF air carrier Operations Specifications (OpSpecs) is required before these operations can occur.

UPSFF is proposing to perform package delivery operations from the sites within the proposed operating area to transport packages to delivery sites in the area.

The Model M2 UA is a multi-rotor design with four propellers mounted on equally spaced arms extending horizontally from a center frame. The system's computers and package containers are located on the underside of the airframe. The maximum allowable takeoff weight of the UA is 29.1 pounds, an empty weight (including battery) of 24.7 pounds, and the maximum allowable package weight is 4.4 pounds. The UA can takeoff and descend vertically as well as hover. Airspeeds during normal cruise are expected to be approximately 31 knots. Typical flights begin with the UA ascending vertically from a landing pad at ground level to a cruise altitude of 250 feet Above Ground Level (AGL). The UA then flies a pre-assigned route at 250 feet AGL and 31 knots to a selected delivery point where it performs a series of vertical and horizontal flight segments to descend to the ground. When the UA reaches the ground, it powers off and an operator removes and/or attaches a package. The UA's return flight departs using the same departure procedure as before and follows a predefined track to return to its original landing pad. When the UA arrives back at the landing pad, it performs a series of vertical and horizontal flight segments to descend to the ground, lands on the landing pad, and then powers off and is unloaded (if carrying a package on the return trip).

UPSFF projects operating a maximum of 56 delivery operations per day during daytime hours (7 AM to 10 PM) from Columbus, OH sites as detailed in Table 1 under the scope of this proposed action.

Table 1. Maximum Anticipated Daily UA Delivery Operations per site

Operating Area/Takeoff and Landing Sites	**Maximum Daily Delivery Operations**
Ackerman DC	28 operations
Bus Depot DC	28 operations
Columbus, OH Operating Area	**56 (total)**

Noise Analysis Methodology

AFS requests use of the noise analysis methodology described in HMMH Report No. 309990.003-6 for the "Noise Assessment for UPS Flight Forward Inc. Proposed Package Delivery Operations with Matternet Model M2 Unmanned Aircraft" dated May 18, 2022.

Federal Aviation Administration

Memorandum

Date: January 11, 2023

To: Mike Millard, Flight Standards (AFS), General Aviation Operations Branch, AFS-830

From: Don Scata, Manager, Noise Division, Office of Environment and Energy (AEE-100)

Digitally signed by DONALD S SCATA
Date: 2023.01.13 08:23:43 -05'00'

Subject: Environmental Assessment (EA) Noise Methodology Approval Request for UPS Flight Forward Commercial Package Delivery Operations with the Matternet M2 UA from Columbus, Ohio

The Office of Environment and Energy (AEE) has reviewed the proposed non-standard noise modeling methodology to be used for UPS Flight Forward (UPSFF) operations using the Matternet Model M2 unmanned aircraft (UA) from Columbus, Ohio. This request is in support of an Environmental Assessment (EA) for UPSFF to provide package delivery services as a 14 CFR Part 135 operator in Columbus and a surrounding operating area.

The Proposed Action is to use the Model M2 UA to deliver packages between two takeoff and landing sites (Ackerman and Bus Depot) within a proposed operating area in Columbus. Typical operations of the UA will consist of departure from a takeoff pad at one of the sites followed by a vertical climb to a typical en route altitude of 250 feet above ground level (AGL). The UA will then navigate along a defined path between the takeoff site and landing site at 250 feet AGL at a cruise speed of 31 knots. Approaching the landing site, the UA will perform a series of vertical and horizontal flight segments to descend to the ground at a designated landing pad at the landing site. When the UA reaches the ground, it powers off and an operator removes and/or attaches a package. Following landing, the UA will vertically climb back to en route altitude, fly along a defined path between the landing site and takeoff site, and conduct a series of vertical and horizontal maneuvers to land back at a landing pad at the takeoff site.

UPSFF projects operating a maximum of 56 delivery flight operations per day during daytime hours (7 AM to 10 PM) from Columbus under the scope of this proposed action. UPSFF anticipates daily delivery operations will be distributed among the two takeoff and landing sites as presented in Table 1 of the proposed non-standard noise modeling methodology request, “Environmental Assessment (EA) Noise Methodology Approval Request for Matternet Model M2 UA Part 135 Operations at Columbus, OH” dated January 5, 2023.

As the FAA does not currently have a standard approved noise model for assessing UA, and in accordance with FAA Order 1050.1F, all non-standard noise analysis in support of the noise impact analysis for the National Environmental Policy Act (NEPA) must be approved by AEE. This letter serves as AEE's response to the method developed in in HMMH Report No. 309990.003-6 for the "Noise Assessment for UPS Flight Forward Inc. Proposed Package Delivery Operations with Matternet Model M2 Unmanned Aircraft" dated May 18, 2022.

The proposed methodology appears to be adequate for this analysis; therefore, AEE concurs with the methodology proposed for this project. Please understand that this approval is limited to this particular Environmental Review, location, vehicle, and circumstances. Any additional projects using this or other methodologies or variations in the vehicle will require separate approval.

Appendix E

EJSCREEN Report

EJScreen Report (Version 2.0)

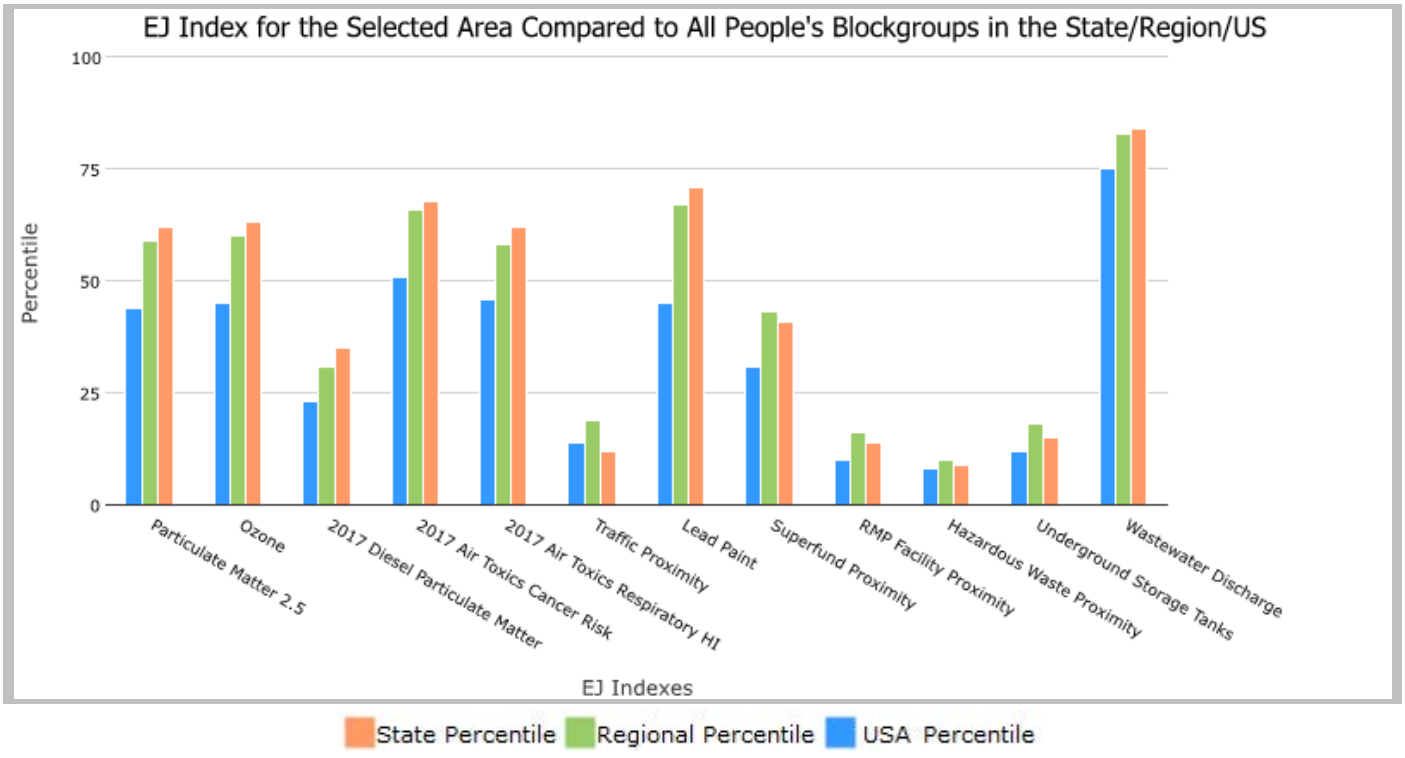
the User Specified Area, OHIO, EPA Region 5

Approximate Population: 25,117

Input Area (sq. miles): 3.77

Columbus Operating Area

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
Environmental Justice Indexes			
EJ Index for Particulate Matter 2.5	62	59	44
EJ Index for Ozone	63	60	45
EJ Index for 2017 Diesel Particulate Matter*	35	31	23
EJ Index for 2017 Air Toxics Cancer Risk*	68	66	51
EJ Index for 2017 Air Toxics Respiratory HI*	62	58	46
EJ Index for Traffic Proximity	12	19	14
EJ Index for Lead Paint	71	67	45
EJ Index for Superfund Proximity	41	43	31
EJ Index for RMP Facility Proximity	14	16	10
EJ Index for Hazardous Waste Proximity	9	10	8
EJ Index for Underground Storage Tanks	15	18	12
EJ Index for Wastewater Discharge	84	83	75



This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

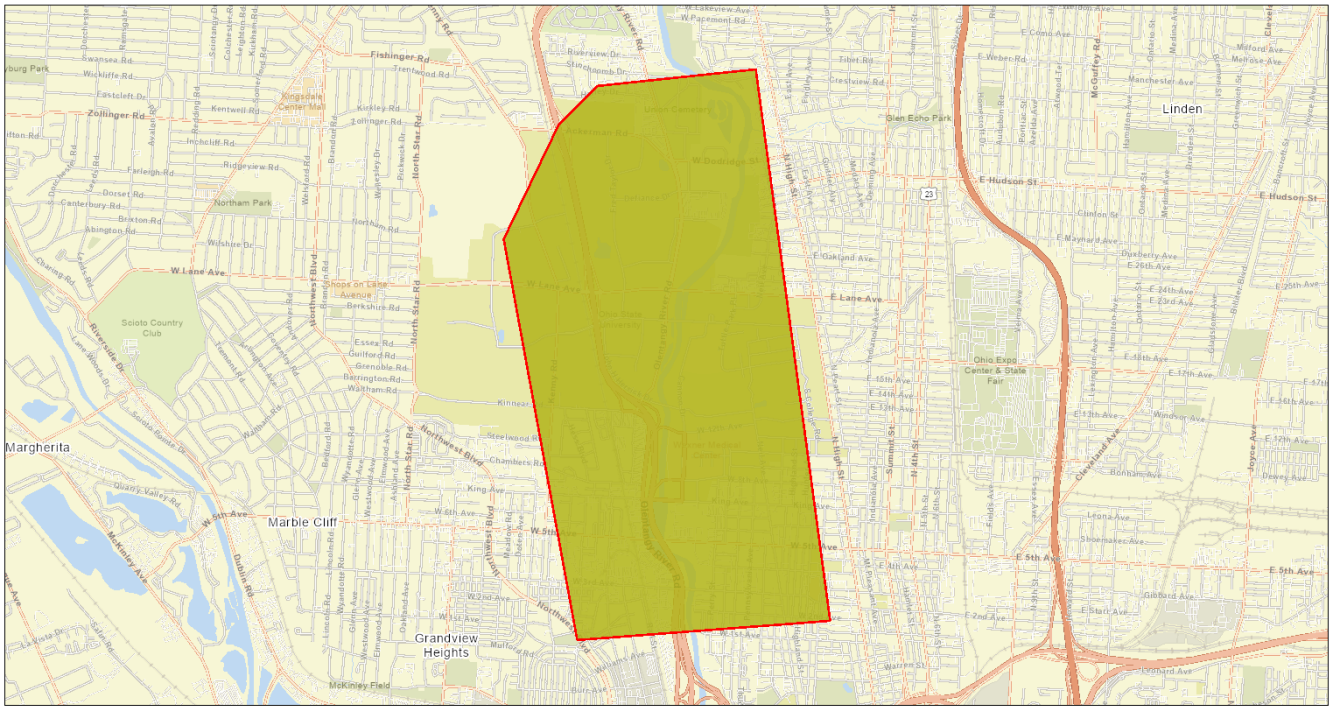
EJScreen Report (Version 2.0)

the User Specified Area, OHIO, EPA Region 5

Approximate Population: 25,117

Input Area (sq. miles): 3.77

Columbus Operating Area



Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	6

EJScreen Report (Version 2.0)

the User Specified Area, OHIO, EPA Region 5

Approximate Population: 25,117

Input Area (sq. miles): 3.77

Columbus Operating Area

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Pollution and Sources							
Particulate Matter 2.5 (µg/m^3)	9.52	9.13	84	8.96	70	8.74	75
Ozone (ppb)	44.8	44.5	55	43.5	62	42.6	73
2017 Diesel Particulate Matter* (µg/m^3)	0.506	0.273	96	0.279	90-95th	0.295	80-90th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	26	24	86	24	80-90th	29	60-70th
2017 Air Toxics Respiratory HI*	0.33	0.3	92	0.3	80-90th	0.36	50-60th
Traffic Proximity (daily traffic count/distance to road)	580	370	83	610	72	710	72
Lead Paint (% Pre-1960 Housing)	0.5	0.4	66	0.37	68	0.28	77
Superfund Proximity (site count/km distance)	0.09	0.095	72	0.13	66	0.13	63
RMP Facility Proximity (facility count/km distance)	1.9	0.72	90	0.83	88	0.75	90
Hazardous Waste Proximity (facility count/km distance)	8.4	1.5	98	1.8	97	2.2	94
Underground Storage Tanks (count/km^2)	3.9	2.6	78	4.8	68	3.9	73
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.0033	0.33	55	9	55	12	60
Socioeconomic Indicators							
Demographic Index	36%	26%	76	28%	74	36%	58
People of Color	26%	21%	73	26%	66	40%	44
Low Income	51%	31%	80	29%	83	31%	81
Unemployment Rate	7%	5%	72	5%	74	5%	71
Linguistically Isolated	4%	1%	89	2%	82	5%	68
Less Than High School Education	2%	10%	17	10%	18	12%	15
Under Age 5	1%	6%	8	6%	6	6%	7
Over Age 64	2%	17%	1	16%	1	16%	2

*Diesel particular matter, air toxics cancer risk, and air toxics respiratory hazard index are from the EPA's 2017 Air Toxics Data Update, which is the Agency's ongoing, comprehensive evaluation of air toxics in the United States. This effort aims to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that the air toxics data presented here provide broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. Cancer risks and hazard indices from the Air Toxics Data Update are reported to one significant figure and any additional significant figures here are due to rounding. More information on the Air Toxics Data Update can be found at: https://www.epa.gov/haps/air-toxics-data-update.

For additional information, see: www.epa.gov/environmentaljustice

EJSCREEN ACS Summary Report

Location: User-specified polygonal location
Ring (buffer): 0-miles radius
Description: Columbus Operating Area

Summary of ACS Estimates	2015 - 2019
Population	25,117
Population Density (per sq. mile)	6,595
People of Color Population	6,648
% People of Color Population	26%
Households	6,341
Housing Units	7,314
Housing Units Built Before 1950	2,717
Per Capita Income	25,973
Land Area (sq. miles) (Source: SF1)	3.81
% Land Area	97%
Water Area (sq. miles) (Source: SF1)	0.13
% Water Area	3%

	2015 - 2019 ACS Estimates	Percent	MOE (±)
Population by Race			
Total	25,117	100%	975
Population Reporting One Race	24,429	97%	1,665
White	19,203	76%	823
Black	1,592	6%	345
American Indian	77	0%	40
Asian	3,386	13%	328
Pacific Islander	10	0%	16
Some Other Race	162	1%	113
Population Reporting Two or More Races	688	3%	120
Total Hispanic Population	945	4%	126
Total Non-Hispanic Population	24,172		
White Alone	18,468	74%	791
Black Alone	1,566	6%	345
American Indian Alone	57	0%	31
Non-Hispanic Asian Alone	3,386	13%	328
Pacific Islander Alone	10	0%	16
Other Race Alone	14	0%	40
Two or More Races Alone	672	3%	120
Population by Sex			
Male	12,882	51%	516
Female	12,235	49%	483
Population by Age			
Age 0-4	288	1%	103
Age 0-17	865	3%	131
Age 18+	24,252	97%	539
Age 65+	484	2%	74

Data Note: Detail may not sum to totals due to rounding. Hispanic population can be of any race.
N/A means not available. **Source:** U.S. Census Bureau, American Community Survey (ACS) 2015 - 2019 .

EJSCREEN ACS Summary Report

Location: User-specified polygonal location
Ring (buffer): 0-miles radius
Description: Columbus Operating Area

	2015 - 2019 ACS Estimates	Percent	MOE (±)
Population 25+ by Educational Attainment			
Total	7,770	100%	255
Less than 9th Grade	96	1%	108
9th - 12th Grade, No Diploma	96	1%	59
High School Graduate	557	7%	115
Some College, No Degree	977	13%	139
Associate Degree	369	5%	67
Bachelor's Degree or more	5,674	73%	256
Population Age 5+ Years by Ability to Speak English			
Total	24,829	100%	975
Speak only English	20,944	84%	854
Non-English at Home[1+2+3+4]	3,885	16%	287
[1]Speak English "very well"	2,448	10%	192
[2]Speak English "well"	1,263	5%	196
[3]Speak English "not well"	174	1%	82
[4]Speak English "not at all"	0	0%	87
[3+4]Speak English "less than well"	174	1%	107
[2+3+4]Speak English "less than very well"	1,437	6%	203
Linguistically Isolated Households*			
Total	284	100%	108
Speak Spanish	29	10%	81
Speak Other Indo-European Languages	70	25%	74
Speak Asian-Pacific Island Languages	170	60%	75
Speak Other Languages	15	5%	65
Households by Household Income			
Household Income Base	6,341	100%	134
< $15,000	1,269	20%	110
$15,000 - $25,000	821	13%	109
$25,000 - $50,000	1,355	21%	117
$50,000 - $75,000	977	15%	102
$75,000 +	1,918	30%	141
Occupied Housing Units by Tenure			
Total	6,341	100%	134
Owner Occupied	1,355	21%	95
Renter Occupied	4,986	79%	134
Employed Population Age 16+ Years			
Total	24,315	100%	975
In Labor Force	14,060	58%	440
Civilian Unemployed in Labor Force	974	4%	129
Not In Labor Force	10,255	42%	593

Data Note: Datail may not sum to totals due to rounding. Hispanic population can be of anyrace.
N/A means not available. **Source:** U.S. Census Bureau, American Community Survey (ACS)
*Households in which no one 14 and over speaks English "very well" or speaks English only.

EJSCREEN ACS Summary Report

Location: User-specified polygonal location
Ring (buffer): 0-miles radius
Description: Columbus Operating Area

	2015 - 2019 ACS Estimates	Percent	MOE (±)
Population by Language Spoken at Home*			
Total (persons age 5 and above)	27,466	100%	1,055
English	23,521	86%	972
Spanish	619	2%	124
French	124	0%	205
French Creole	N/A	N/A	N/A
Italian	N/A	N/A	N/A
Portuguese	N/A	N/A	N/A
German	72	0%	70
Yiddish	N/A	N/A	N/A
Other West Germanic	N/A	N/A	N/A
Scandinavian	N/A	N/A	N/A
Greek	N/A	N/A	N/A
Russian	N/A	N/A	N/A
Polish	N/A	N/A	N/A
Serbo-Croatian	N/A	N/A	N/A
Other Slavic	N/A	N/A	N/A
Armenian	N/A	N/A	N/A
Persian	N/A	N/A	N/A
Gujarathi	N/A	N/A	N/A
Hindi	N/A	N/A	N/A
Urdu	N/A	N/A	N/A
Other Indic	N/A	N/A	N/A
Other Indo-European	644	2%	332
Chinese	1,622	6%	209
Japanese	N/A	N/A	N/A
Korean	195	1%	96
Mon-Khmer, Cambodian	N/A	N/A	N/A
Hmong	N/A	N/A	N/A
Thai	N/A	N/A	N/A
Laotian	N/A	N/A	N/A
Vietnamese	72	0%	74
Other Asian	189	1%	86
Tagalog	14	0%	45
Other Pacific Island	N/A	N/A	N/A
Navajo	N/A	N/A	N/A
Other Native American	N/A	N/A	N/A
Hungarian	N/A	N/A	N/A
Arabic	169	1%	361
Hebrew	N/A	N/A	N/A
African	N/A	N/A	N/A
Other and non-specified	90	0%	114
Total Non-English	3,945	14%	1,435

Data Note: Detail may not sum to totals due to rounding. Hispanic popultion can be of any race.
N/A meansnot available. **Source:** U.S. Census Bureau, American Community Survey (ACS) 2015 - 2019.
*Population by Language Spoken at Home is available at the census tract summary level and up.

Appendix F

AEDT Census Block Group Data

Study Area Block Group ACS 2020 5-Year Estimate Data

STATE	COUNTY	NAME	Population Total	Population Minority	Percent Minority	Population Low Income	Percent Low Income
OH	Franklin County	Block Group 1, Census Tract 11.21, Franklin County, Ohio	5204	1158	22.3	0	0
OH	Franklin County	Block Group 3, Census Tract 19.01, Franklin County, Ohio	897	191	21.3	177	20
OH	Franklin County	Block Group 2, Census Tract 18.10, Franklin County, Ohio	736	191	26	568	77
OH	Franklin County	Block Group 4, Census Tract 6, Franklin County, Ohio	562	142	25.3	95	17
OH	Franklin County	Block Group 3, Census Tract 18.20, Franklin County, Ohio	770	165	21.4	83	11
OH	Franklin County	Block Group 1, Census Tract 11.22, Franklin County, Ohio	1193	420	35.2	376	33
OH	Franklin County	Block Group 5, Census Tract 18.10, Franklin County, Ohio	1318	606	46	382	45
OH	Franklin County	Block Group 2, Census Tract 78.20, Franklin County, Ohio	1756	1206	68.7	530	30
OH	Franklin County	Block Group 2, Census Tract 85, Franklin County, Ohio	1815	256	14.1	265	15
OH	Franklin County	Block Group 2, Census Tract 20, Franklin County, Ohio	827	3	0.4	5	1
OH	Franklin County	Block Group 1, Census Tract 20, Franklin County, Ohio	858	110	12.8	43	5
OH	Franklin County	Block Group 1, Census Tract 21, Franklin County, Ohio	1721	362	21	199	12
OH	Franklin County	Block Group 3, Census Tract 20, Franklin County, Ohio	1594	465	29.2	292	18
OH	Franklin County	Block Group 1, Census Tract 78.20, Franklin County, Ohio	461	348	75.5	308	67
OH	Franklin County	Block Group 4, Census Tract 5, Franklin County, Ohio	999	321	32.1	242	24
OH	Franklin County	Block Group 1, Census Tract 11.10, Franklin County, Ohio	987	384	38.9	477	48
OH	Franklin County	Block Group 2, Census Tract 18.20, Franklin County, Ohio	899	163	18.1	138	15
OH	Franklin County	Block Group 4, Census Tract 78.20, Franklin County, Ohio	847	611	72.1	576	68
OH	Franklin County	Block Group 2, Census Tract 32, Franklin County, Ohio	1541	218	14.1	108	8
OH	Franklin County	Block Group 3, Census Tract 11.21, Franklin County, Ohio	1982	478	24.1	18	36
OH	Franklin County	Block Group 4, Census Tract 18.10, Franklin County, Ohio	722	164	22.7	410	57
OH	Franklin County	Block Group 3, Census Tract 11.10, Franklin County, Ohio	1036	314	30.3	359	65
OH	Franklin County	Block Group 1, Census Tract 85, Franklin County, Ohio	732	60	8.2	17	2
OH	Franklin County	Block Group 2, Census Tract 78.30, Franklin County, Ohio	2028	767	37.8	442	22
OH	Franklin County	Block Group 1, Census Tract 18.10, Franklin County, Ohio	795	179	22.5	467	59
OH	Franklin County	Block Group 2, Census Tract 11.10, Franklin County, Ohio	889	174	19.6	695	78
OH	Franklin County	Block Group 2, Census Tract 11.22, Franklin County, Ohio	1807	770	42.6	8	24
OH	Franklin County	Block Group 1, Census Tract 19.01, Franklin County, Ohio	1192	252	21.1	182	15
OH	Franklin County	Block Group 1, Census Tract 18.20, Franklin County, Ohio	711	210	29.5	60	8
OH	Franklin County	Block Group 2, Census Tract 11.21, Franklin County, Ohio	3187	678	21.3	0	0
OH	Franklin County	Block Group 3, Census Tract 18.10, Franklin County, Ohio	490	61	12.4	256	56

Franklin County Block Group ACS 2020 5- Year Estimate Data

STATE	COUNTY	NAME	Population Total	Population Minor	Percent Minority	Population Low Income	Percent Low Income
OH	Franklin County	Block Group 3, Census Tract 18.10, Franklin County, Ohio	490	61	12.4	256	55.5
OH	Franklin County	Block Group 1, Census Tract 54.10, Franklin County, Ohio	1600	1384	86.5	658	41.1
OH	Franklin County	Block Group 3, Census Tract 8.10, Franklin County, Ohio	1064	350	32.9	124	11.7
OH	Franklin County	Block Group 6, Census Tract 69.32, Franklin County, Ohio	1729	1547	89.5	145	8.4
OH	Franklin County	Block Group 3, Census Tract 57, Franklin County, Ohio	1320	19	1.4	58	4.4
OH	Franklin County	Block Group 1, Census Tract 93.84, Franklin County, Ohio	1578	693	43.9	174	11
OH	Franklin County	Block Group 5, Census Tract 10, Franklin County, Ohio	1003	219	21.8	423	42.2
OH	Franklin County	Block Group 3, Census Tract 67.22, Franklin County, Ohio	620	23	3.7	23	4.5
OH	Franklin County	Block Group 4, Census Tract 77.21, Franklin County, Ohio	1420	1211	85.3	447	31.7
OH	Franklin County	Block Group 3, Census Tract 93.34, Franklin County, Ohio	1038	989	95.3	81	7.8
OH	Franklin County	Block Group 1, Census Tract 97.52, Franklin County, Ohio	799	49	6.1	0	0
OH	Franklin County	Block Group 1, Census Tract 87.10, Franklin County, Ohio	615	471	76.6	0	0
OH	Franklin County	Block Group 1, Census Tract 93.11, Franklin County, Ohio	886	535	60.4	439	49.5
OH	Franklin County	Block Group 2, Census Tract 75.53, Franklin County, Ohio	2472	2105	85.2	709	28.7
OH	Franklin County	Block Group 2, Census Tract 6, Franklin County, Ohio	1229	315	25.6	456	37.1
OH	Franklin County	Block Group 2, Census Tract 79.59, Franklin County, Ohio	673	0	0	0	0
OH	Franklin County	Block Group 1, Census Tract 89, Franklin County, Ohio	1327	224	16.9	23	1.7
OH	Franklin County	Block Group 1, Census Tract 27.60, Franklin County, Ohio	1055	228	21.6	6	0.6
OH	Franklin County	Block Group 2, Census Tract 27.80, Franklin County, Ohio	1079	304	28.2	62	6.6
OH	Franklin County	Block Group 4, Census Tract 2.10, Franklin County, Ohio	1263	137	10.8	59	4.7
OH	Franklin County	Block Group 2, Census Tract 81.68, Franklin County, Ohio	2291	841	36.7	349	15.2
OH	Franklin County	Block Group 4, Census Tract 45, Franklin County, Ohio	637	171	26.8	295	46.3
OH	Franklin County	Block Group 2, Census Tract 93.12, Franklin County, Ohio	642	465	72.4	68	10.6
OH	Franklin County	Block Group 3, Census Tract 49, Franklin County, Ohio	1733	347	20	657	38.2
OH	Franklin County	Block Group 3, Census Tract 104.02, Franklin County, Ohio	1653	393	23.8	0	0
OH	Franklin County	Block Group 3, Census Tract 55, Franklin County, Ohio	1075	914	85	375	34.9
OH	Franklin County	Block Group 3, Census Tract 93.93, Franklin County, Ohio	1235	1069	86.6	364	29.5
OH	Franklin County	Block Group 3, Census Tract 95.20, Franklin County, Ohio	1704	443	26	154	9
OH	Franklin County	Block Group 1, Census Tract 79.41, Franklin County, Ohio	902	116	12.9	84	9.3
OH	Franklin County	Block Group 2, Census Tract 94.03, Franklin County, Ohio	1815	1377	75.9	93	5.1
OH	Franklin County	Block Group 2, Census Tract 70.48, Franklin County, Ohio	1462	510	34.9	32	2.2
OH	Franklin County	Block Group 1, Census Tract 64.10, Franklin County, Ohio	768	59	7.7	0	0
OH	Franklin County	Block Group 1, Census Tract 38, Franklin County, Ohio	684	169	24.7	156	26.5
OH	Franklin County	Block Group 2, Census Tract 92.51, Franklin County, Ohio	701	583	83.2	371	52.9
OH	Franklin County	Block Group 3, Census Tract 17, Franklin County, Ohio	867	262	30.2	200	23.1
OH	Franklin County	Block Group 5, Census Tract 69.31, Franklin County, Ohio	2792	2354	84.3	944	36.5
OH	Franklin County	Block Group 3, Census Tract 90, Franklin County, Ohio	645	75	11.6	0	0
OH	Franklin County	Block Group 4, Census Tract 62.37, Franklin County, Ohio	1124	337	30	132	11.7
OH	Franklin County	Block Group 4, Census Tract 63.10, Franklin County, Ohio	990	169	17.1	0	0
OH	Franklin County	Block Group 2, Census Tract 71.02, Franklin County, Ohio	1617	247	15.3	191	12.9
OH	Franklin County	Block Group 1, Census Tract 63.94, Franklin County, Ohio	1111	203	18.3	61	5.5
OH	Franklin County	Block Group 4, Census Tract 74.24, Franklin County, Ohio	1408	755	53.6	22	1.6
OH	Franklin County	Block Group 1, Census Tract 92.30, Franklin County, Ohio	1157	794	68.6	145	13.9
OH	Franklin County	Block Group 1, Census Tract 4.20, Franklin County, Ohio	843	94	11.2	14	1.7
OH	Franklin County	Block Group 1, Census Tract 93.61, Franklin County, Ohio	738	397	53.8	106	14.4
OH	Franklin County	Block Group 3, Census Tract 63.87, Franklin County, Ohio	889	86	9.7	0	0
OH	Franklin County	Block Group 3, Census Tract 75.20, Franklin County, Ohio	800	745	93.1	85	10.9
OH	Franklin County	Block Group 4, Census Tract 7.30, Franklin County, Ohio	1058	1009	95.4	549	51.9
OH	Franklin County	Block Group 1, Census Tract 19.01, Franklin County, Ohio	1192	252	21.1	182	15.3
OH	Franklin County	Block Group 2, Census Tract 96, Franklin County, Ohio	915	130	14.2	172	18.8
OH	Franklin County	Block Group 2, Census Tract 11.22, Franklin County, Ohio	1807	770	42.6	8	24.2
OH	Franklin County	Block Group 1, Census Tract 63.97, Franklin County, Ohio	1639	771	47	148	9.4
OH	Franklin County	Block Group 1, Census Tract 88.21, Franklin County, Ohio	807	120	14.9	151	18.8
OH	Franklin County	Block Group 4, Census Tract 63.30, Franklin County, Ohio	998	282	28.3	0	0
OH	Franklin County	Block Group 3, Census Tract 70.20, Franklin County, Ohio	1944	829	42.6	0	0
OH	Franklin County	Block Group 1, Census Tract 1.20, Franklin County, Ohio	827	56	6.8	13	1.6
OH	Franklin County	Block Group 4, Census Tract 64.30, Franklin County, Ohio	1063	372	35	49	4.6
OH	Franklin County	Block Group 3, Census Tract 84, Franklin County, Ohio	837	157	18.8	30	3.6
OH	Franklin County	Block Group 3, Census Tract 5, Franklin County, Ohio	606	0	0	0	0
OH	Franklin County	Block Group 1, Census Tract 68.21, Franklin County, Ohio	1884	605	32.1	804	42.7
OH	Franklin County	Block Group 2, Census Tract 77.22, Franklin County, Ohio	1330	473	35.6	268	20.2
OH	Franklin County	Block Group 1, Census Tract 81.66, Franklin County, Ohio	1624	407	25.1	91	5.6
OH	Franklin County	Block Group 3, Census Tract 97.52, Franklin County, Ohio	2812	528	18.8	66	2.3
OH	Franklin County	Block Group 3, Census Tract 93.90, Franklin County, Ohio	953	544	57.1	0	0
OH	Franklin County	Block Group 1, Census Tract 73.06, Franklin County, Ohio	2158	864	40	0	0
OH	Franklin County	Block Group 1, Census Tract 79.63, Franklin County, Ohio	3535	701	19.8	393	11.1
OH	Franklin County	Block Group 3, Census Tract 48.10, Franklin County, Ohio	1440	220	15.3	196	13.6
OH	Franklin County	Block Group 3, Census Tract 58.10, Franklin County, Ohio	1641	371	22.6	191	11.6
OH	Franklin County	Block Group 2, Census Tract 93.25, Franklin County, Ohio	570	359	63	48	10.1
OH	Franklin County	Block Group 1, Census Tract 83.11, Franklin County, Ohio	1369	821	60	764	55.8
OH	Franklin County	Block Group 2, Census Tract 26, Franklin County, Ohio	952	615	64.6	60	7.4
OH	Franklin County	Block Group 2, Census Tract 63.51, Franklin County, Ohio	1258	294	23.4	52	4.3
OH	Franklin County	Block Group 3, Census Tract 71.99, Franklin County, Ohio	2288	1335	58.3	176	7.7
OH	Franklin County	Block Group 2, Census Tract 94.10, Franklin County, Ohio	2164	770	35.6	225	10.5
OH	Franklin County	Block Group 2, Census Tract 11.10, Franklin County, Ohio	889	174	19.6	695	78.2
OH	Franklin County	Block Group 2, Census Tract 40.01, Franklin County, Ohio	557	171	30.7	124	22.3
OH	Franklin County	Block Group 2, Census Tract 63.02, Franklin County, Ohio	1492	297	19.9	155	10.4
OH	Franklin County	Block Group 1, Census Tract 73.03, Franklin County, Ohio	1516	360	23.7	0	0
OH	Franklin County	Block Group 3, Census Tract 47, Franklin County, Ohio	718	469	65.3	382	53.2
OH	Franklin County	Block Group 1, Census Tract 60, Franklin County, Ohio	372	17	4.6	157	42.2
OH	Franklin County	Block Group 2, Census Tract 63.72, Franklin County, Ohio	1027	208	20.3	69	6.7
OH	Franklin County	Block Group 5, Census Tract 6, Franklin County, Ohio	479	141	29.4	116	24.2

OH	Franklin County	Block Group 1, Census Tract 83.30, Franklin County, Ohio	853	49	5.7	149	17.6
OH	Franklin County	Block Group 2, Census Tract 102.04, Franklin County, Ohio	1976	1507	76.3	0	0
OH	Franklin County	Block Group 2, Census Tract 9.20, Franklin County, Ohio	1832	1555	84.9	870	47.5
OH	Franklin County	Block Group 1, Census Tract 82.30, Franklin County, Ohio	844	632	74.9	327	44.5
OH	Franklin County	Block Group 2, Census Tract 97.52, Franklin County, Ohio	1049	111	10.6	30	2.9
OH	Franklin County	Block Group 2, Census Tract 87.10, Franklin County, Ohio	349	326	93.4	139	39.8
OH	Franklin County	Block Group 2, Census Tract 43.01, Franklin County, Ohio	732	27	3.7	100	13.7
OH	Franklin County	Block Group 1, Census Tract 79.60, Franklin County, Ohio	1742	915	52.5	246	15.2
OH	Franklin County	Block Group 1, Census Tract 79.62, Franklin County, Ohio	4947	1246	25.2	961	19.4
OH	Franklin County	Block Group 2, Census Tract 27.60, Franklin County, Ohio	1161	610	52.5	128	11
OH	Franklin County	Block Group 1, Census Tract 57, Franklin County, Ohio	633	130	20.5	31	4.9
OH	Franklin County	Block Group 2, Census Tract 81.66, Franklin County, Ohio	2542	613	24.1	96	3.8
OH	Franklin County	Block Group 2, Census Tract 38, Franklin County, Ohio	1668	433	26	233	14.5
OH	Franklin County	Block Group 6, Census Tract 49, Franklin County, Ohio	349	147	42.1	128	36.7
OH	Franklin County	Block Group 1, Census Tract 21, Franklin County, Ohio	1721	362	21	199	11.6
OH	Franklin County	Block Group 2, Census Tract 83.21, Franklin County, Ohio	946	307	32.5	95	10
OH	Franklin County	Block Group 2, Census Tract 7.20, Franklin County, Ohio	842	657	78	377	44.8
OH	Franklin County	Block Group 3, Census Tract 70.48, Franklin County, Ohio	1707	659	38.6	97	5.7
OH	Franklin County	Block Group 1, Census Tract 105.01, Franklin County, Ohio	2390	348	14.6	0	0
OH	Franklin County	Block Group 2, Census Tract 64.10, Franklin County, Ohio	1156	52	4.5	24	2.1
OH	Franklin County	Block Group 1, Census Tract 92.52, Franklin County, Ohio	2265	1952	86.2	316	14.2
OH	Franklin County	Block Group 1, Census Tract 95.90, Franklin County, Ohio	781	0	0	83	10.6
OH	Franklin County	Block Group 4, Census Tract 78.12, Franklin County, Ohio	1098	606	55.2	417	38
OH	Franklin County	Block Group 1, Census Tract 18.10, Franklin County, Ohio	795	179	22.5	467	58.7
OH	Franklin County	Block Group 1, Census Tract 81.10, Franklin County, Ohio	2145	574	26.8	135	6.3
OH	Franklin County	Block Group 1, Census Tract 94.04, Franklin County, Ohio	2433	482	19.8	171	7.6
OH	Franklin County	Block Group 2, Census Tract 74.26, Franklin County, Ohio	1523	160	10.5	22	1.4
OH	Franklin County	Block Group 3, Census Tract 75.53, Franklin County, Ohio	2570	2318	90.2	1870	72.8
OH	Franklin County	Block Group 1, Census Tract 69.32, Franklin County, Ohio	845	679	80.4	181	21.4
OH	Franklin County	Block Group 2, Census Tract 19.02, Franklin County, Ohio	2070	303	14.6	111	5.4
OH	Franklin County	Block Group 1, Census Tract 93.50, Franklin County, Ohio	2257	1663	73.7	402	17.8
OH	Franklin County	Block Group 1, Census Tract 63.92, Franklin County, Ohio	1974	127	6.4	26	1.3
OH	Franklin County	Block Group 1, Census Tract 37, Franklin County, Ohio	784	535	68.2	299	38.1
OH	Franklin County	Block Group 1, Census Tract 71.12, Franklin County, Ohio	2808	2081	74.1	476	17
OH	Franklin County	Block Group 2, Census Tract 53, Franklin County, Ohio	833	547	65.7	220	26.4
OH	Franklin County	Block Group 1, Census Tract 62.38, Franklin County, Ohio	1976	427	21.6	55	2.8
OH	Franklin County	Block Group 2, Census Tract 78.30, Franklin County, Ohio	2028	767	37.8	442	21.8
OH	Franklin County	Block Group 1, Census Tract 83.81, Franklin County, Ohio	2506	422	16.8	120	4.9
OH	Franklin County	Block Group 1, Census Tract 54.20, Franklin County, Ohio	420	328	78.1	79	18.8
OH	Franklin County	Block Group 3, Census Tract 91, Franklin County, Ohio	680	0	0	16	2.4
OH	Franklin County	Block Group 2, Census Tract 69.24, Franklin County, Ohio	2173	1419	65.3	431	19.8
OH	Franklin County	Block Group 2, Census Tract 93.61, Franklin County, Ohio	928	795	85.7	112	12.1
OH	Franklin County	Block Group 1, Census Tract 75.31, Franklin County, Ohio	1365	796	58.3	273	20
OH	Franklin County	Block Group 4, Census Tract 63.87, Franklin County, Ohio	1693	435	25.7	40	2.4
OH	Franklin County	Block Group 2, Census Tract 27.10, Franklin County, Ohio	610	405	66.4	251	41.1
OH	Franklin County	Block Group 1, Census Tract 8.10, Franklin County, Ohio	781	148	19	300	38.4
OH	Franklin County	Block Group 1, Census Tract 93.86, Franklin County, Ohio	1102	747	67.8	74	6.7
OH	Franklin County	Block Group 5, Census Tract 64.30, Franklin County, Ohio	849	305	35.9	51	6.1
OH	Franklin County	Block Group 1, Census Tract 98.01, Franklin County, Ohio	1989	155	7.8	53	2.7
OH	Franklin County	Block Group 3, Census Tract 52, Franklin County, Ohio	927	157	16.9	45	4.9
OH	Franklin County	Block Group 2, Census Tract 88.21, Franklin County, Ohio	744	43	5.8	226	30.4
OH	Franklin County	Block Group 2, Census Tract 92.30, Franklin County, Ohio	1470	968	65.9	172	11.9
OH	Franklin County	Block Group 2, Census Tract 4.20, Franklin County, Ohio	1426	104	7.3	30	2.1
OH	Franklin County	Block Group 1, Census Tract 93.91, Franklin County, Ohio	1998	1700	85.1	142	7.1
OH	Franklin County	Block Group 2, Census Tract 63.97, Franklin County, Ohio	1535	264	17.2	72	4.7
OH	Franklin County	Block Group 1, Census Tract 93.93, Franklin County, Ohio	1261	1130	89.6	245	19.4
OH	Franklin County	Block Group 2, Census Tract 69.43, Franklin County, Ohio	1237	700	56.6	267	21.6
OH	Franklin County	Block Group 5, Census Tract 63.30, Franklin County, Ohio	630	50	7.9	25	4
OH	Franklin County	Block Group 2, Census Tract 68.21, Franklin County, Ohio	1550	133	8.6	111	7.5
OH	Franklin County	Block Group 2, Census Tract 1.20, Franklin County, Ohio	1705	144	8.4	66	3.9
OH	Franklin County	Block Group 5, Census Tract 74.24, Franklin County, Ohio	539	0	0	0	0
OH	Franklin County	Block Group 1, Census Tract 94.98, Franklin County, Ohio	428	13	3	15	3.5
OH	Franklin County	Block Group 2, Census Tract 81.32, Franklin County, Ohio	2023	371	18.3	225	11.1
OH	Franklin County	Block Group 1, Census Tract 85, Franklin County, Ohio	732	60	8.2	17	2.3
OH	Franklin County	Block Group 1, Census Tract 27.50, Franklin County, Ohio	1314	1165	88.7	619	47.1
OH	Franklin County	Block Group 1, Census Tract 93.83, Franklin County, Ohio	1007	108	10.7	231	23.4
OH	Franklin County	Block Group 1, Census Tract 73.01, Franklin County, Ohio	2001	933	46.6	0	0
OH	Franklin County	Block Group 1, Census Tract 46.20, Franklin County, Ohio	694	336	48.4	242	35.2
OH	Franklin County	Block Group 1, Census Tract 48.20, Franklin County, Ohio	709	398	56.1	155	21.9
OH	Franklin County	Block Group 2, Census Tract 73.94, Franklin County, Ohio	488	63	12.9	0	0
OH	Franklin County	Block Group 3, Census Tract 77.22, Franklin County, Ohio	2089	1015	48.6	418	20
OH	Franklin County	Block Group 3, Census Tract 25.10, Franklin County, Ohio	1256	1110	88.4	319	25.7
OH	Franklin County	Block Group 1, Census Tract 70.10, Franklin County, Ohio	904	375	41.5	53	6
OH	Franklin County	Block Group 4, Census Tract 69.44, Franklin County, Ohio	1035	330	31.9	36	3.5
OH	Franklin County	Block Group 4, Census Tract 63.53, Franklin County, Ohio	993	166	16.7	13	1.3
OH	Franklin County	Block Group 2, Census Tract 60, Franklin County, Ohio	891	321	36	243	27.3
OH	Franklin County	Block Group 1, Census Tract 58.20, Franklin County, Ohio	948	136	14.3	194	20.5
OH	Franklin County	Block Group 1, Census Tract 93.23, Franklin County, Ohio	732	581	79.4	268	36.6
OH	Franklin County	Block Group 3, Census Tract 93.25, Franklin County, Ohio	1532	1341	87.5	746	48.7
OH	Franklin County	Block Group 3, Census Tract 63.51, Franklin County, Ohio	1030	108	10.5	29	2.8
OH	Franklin County	Block Group 2, Census Tract 21, Franklin County, Ohio	632	77	12.2	56	8.9
OH	Franklin County	Block Group 1, Census Tract 40.02, Franklin County, Ohio	652	403	61.8	304	46.6
OH	Franklin County	Block Group 1, Census Tract 67.10, Franklin County, Ohio	1664	529	31.8	159	9.6
OH	Franklin County	Block Group 4, Census Tract 47, Franklin County, Ohio	627	381	60.8	184	29.3
OH	Franklin County	Block Group 1, Census Tract 97.55, Franklin County, Ohio	5576	439	7.9	75	1.3
OH	Franklin County	Block Group 1, Census Tract 3.30, Franklin County, Ohio	533	118	22.1	105	19.7
OH	Franklin County	Block Group 3, Census Tract 11.10, Franklin County, Ohio	1036	314	30.3	359	65

OH	Franklin County	Block Group 2, Census Tract 82.41, Franklin County, Ohio	1598	571	35.7	455	28.7
OH	Franklin County	Block Group 2, Census Tract 27.70, Franklin County, Ohio	1536	1207	78.6	415	27.3
OH	Franklin County	Block Group 3, Census Tract 69.45, Franklin County, Ohio	405	272	67.2	62	15.3
OH	Franklin County	Block Group 4, Census Tract 79.60, Franklin County, Ohio	1580	666	42.2	360	22.8
OH	Franklin County	Block Group 2, Census Tract 56.20, Franklin County, Ohio	341	80	23.5	89	26.1
OH	Franklin County	Block Group 2, Census Tract 75.52, Franklin County, Ohio	2740	2195	80.1	760	28
OH	Franklin County	Block Group 3, Census Tract 69.31, Franklin County, Ohio	863	719	83.3	322	37.3
OH	Franklin County	Block Group 2, Census Tract 23, Franklin County, Ohio	1000	829	82.9	221	22.1
OH	Franklin County	Block Group 3, Census Tract 77.10, Franklin County, Ohio	846	399	47.2	150	18.5
OH	Franklin County	Block Group 1, Census Tract 67.22, Franklin County, Ohio	1365	160	11.7	16	1.3
OH	Franklin County	Block Group 2, Census Tract 94.40, Franklin County, Ohio	1433	147	10.3	67	4.7
OH	Franklin County	Block Group 1, Census Tract 72.14, Franklin County, Ohio	3004	949	31.6	141	4.7
OH	Franklin County	Block Group 3, Census Tract 78.20, Franklin County, Ohio	539	290	53.8	302	57.5
OH	Franklin County	Block Group 1, Census Tract 17, Franklin County, Ohio	1365	397	29.1	761	60.5
OH	Franklin County	Block Group 1, Census Tract 102.03, Franklin County, Ohio	1344	299	22.2	75	5.7
OH	Franklin County	Block Group 3, Census Tract 69.92, Franklin County, Ohio	1621	894	55.2	297	18.3
OH	Franklin County	Block Group 3, Census Tract 63.96, Franklin County, Ohio	1213	225	18.5	28	2.3
OH	Franklin County	Block Group 3, Census Tract 10, Franklin County, Ohio	697	104	14.9	197	28.3
OH	Franklin County	Block Group 3, Census Tract 97.12, Franklin County, Ohio	1982	154	7.8	227	11.5
OH	Franklin County	Block Group 2, Census Tract 63.84, Franklin County, Ohio	1213	211	17.4	24	2
OH	Franklin County	Block Group 2, Census Tract 83.22, Franklin County, Ohio	1694	340	20.1	314	18.5
OH	Franklin County	Block Group 4, Census Tract 85, Franklin County, Ohio	850	17	2	0	0
OH	Franklin County	Block Group 3, Census Tract 93.11, Franklin County, Ohio	797	696	87.3	39	4.9
OH	Franklin County	Block Group 1, Census Tract 95.20, Franklin County, Ohio	2131	441	20.7	191	9
OH	Franklin County	Block Group 2, Census Tract 2.10, Franklin County, Ohio	596	225	37.8	31	5.2
OH	Franklin County	Block Group 2, Census Tract 14, Franklin County, Ohio	983	799	81.3	330	34.3
OH	Franklin County	Block Group 3, Census Tract 88.25, Franklin County, Ohio	2624	357	13.6	128	4.9
OH	Franklin County	Block Group 2, Census Tract 92.50, Franklin County, Ohio	748	413	55.2	35	4.7
OH	Franklin County	Block Group 2, Census Tract 100, Franklin County, Ohio	1125	323	28.7	90	8
OH	Franklin County	Block Group 3, Census Tract 9.10, Franklin County, Ohio	860	777	90.3	282	32.8
OH	Franklin County	Block Group 2, Census Tract 45, Franklin County, Ohio	678	137	20.2	382	56.3
OH	Franklin County	Block Group 2, Census Tract 81.67, Franklin County, Ohio	1522	738	48.5	35	2.3
OH	Franklin County	Block Group 3, Census Tract 79.58, Franklin County, Ohio	892	33	3.7	0	0
OH	Franklin County	Block Group 4, Census Tract 93.37, Franklin County, Ohio	977	977	100	174	17.8
OH	Franklin County	Block Group 1, Census Tract 75.12, Franklin County, Ohio	1513	1499	99.1	231	15.3
OH	Franklin County	Block Group 3, Census Tract 79.22, Franklin County, Ohio	2730	833	30.5	198	7.3
OH	Franklin County	Block Group 3, Census Tract 94.01, Franklin County, Ohio	2192	591	27	266	12.1
OH	Franklin County	Block Group 3, Census Tract 69.23, Franklin County, Ohio	1538	690	44.9	47	3.1
OH	Franklin County	Block Group 1, Census Tract 20, Franklin County, Ohio	858	110	12.8	43	5
OH	Franklin County	Block Group 4, Census Tract 71.15, Franklin County, Ohio	804	400	49.8	0	0
OH	Franklin County	Block Group 2, Census Tract 83.82, Franklin County, Ohio	1727	325	18.8	30	1.7
OH	Franklin County	Block Group 4, Census Tract 37, Franklin County, Ohio	878	442	50.3	210	24.3
OH	Franklin County	Block Group 2, Census Tract 70.47, Franklin County, Ohio	986	261	26.5	71	7.2
OH	Franklin County	Block Group 1, Census Tract 52, Franklin County, Ohio	1596	252	15.8	30	1.9
OH	Franklin County	Block Group 1, Census Tract 93.72, Franklin County, Ohio	1126	842	74.8	124	11.2
OH	Franklin County	Block Group 3, Census Tract 7.10, Franklin County, Ohio	1177	519	44.1	246	21.3
OH	Franklin County	Block Group 2, Census Tract 7.30, Franklin County, Ohio	978	960	98.2	804	82.2
OH	Franklin County	Block Group 2, Census Tract 83.40, Franklin County, Ohio	2223	394	17.7	106	4.8
OH	Franklin County	Block Group 1, Census Tract 92.20, Franklin County, Ohio	1001	542	54.1	272	27.4
OH	Franklin County	Block Group 1, Census Tract 55, Franklin County, Ohio	1100	1086	98.7	300	27.3
OH	Franklin County	Block Group 1, Census Tract 30, Franklin County, Ohio	660	161	24.4	53	8
OH	Franklin County	Block Group 1, Census Tract 79.31, Franklin County, Ohio	2221	221	10	198	8.9
OH	Franklin County	Block Group 2, Census Tract 63.10, Franklin County, Ohio	1242	173	13.9	18	1.4
OH	Franklin County	Block Group 4, Census Tract 18.10, Franklin County, Ohio	722	164	22.7	410	56.8
OH	Franklin County	Block Group 1, Census Tract 104.02, Franklin County, Ohio	1942	551	28.4	0	0
OH	Franklin County	Block Group 2, Census Tract 71.01, Franklin County, Ohio	1816	438	24.1	205	12.1
OH	Franklin County	Block Group 1, Census Tract 71.13, Franklin County, Ohio	4359	3105	71.2	983	22.7
OH	Franklin County	Block Group 3, Census Tract 63.91, Franklin County, Ohio	1198	357	29.8	48	4
OH	Franklin County	Block Group 1, Census Tract 93.92, Franklin County, Ohio	703	516	73.4	272	38.7
OH	Franklin County	Block Group 2, Census Tract 59, Franklin County, Ohio	594	520	87.5	325	54.7
OH	Franklin County	Block Group 2, Census Tract 94.05, Franklin County, Ohio	2040	271	13.3	14	0.7
OH	Franklin County	Block Group 1, Census Tract 71.03, Franklin County, Ohio	1690	232	13.7	81	4.8
OH	Franklin County	Block Group 1, Census Tract 77.40, Franklin County, Ohio	1662	345	20.8	271	16.3
OH	Franklin County	Block Group 3, Census Tract 11.21, Franklin County, Ohio	1982	478	24.1	18	36
OH	Franklin County	Block Group 2, Census Tract 62.37, Franklin County, Ohio	2802	584	20.8	86	3.1
OH	Franklin County	Block Group 1, Census Tract 88.13, Franklin County, Ohio	1035	986	95.3	79	7.6
OH	Franklin County	Block Group 3, Census Tract 1.10, Franklin County, Ohio	687	86	12.5	19	2.8
OH	Franklin County	Block Group 2, Census Tract 63.40, Franklin County, Ohio	1639	369	22.5	46	2.8
OH	Franklin County	Block Group 2, Census Tract 13.02, Franklin County, Ohio	722	98	13.6	96	100
OH	Franklin County	Block Group 1, Census Tract 75.20, Franklin County, Ohio	1369	1092	79.8	488	36.1
OH	Franklin County	Block Group 1, Census Tract 75.33, Franklin County, Ohio	821	765	93.2	280	42.7
OH	Franklin County	Block Group 1, Census Tract 63.87, Franklin County, Ohio	2101	870	41.4	518	24.7
OH	Franklin County	Block Group 4, Census Tract 83.12, Franklin County, Ohio	1173	601	51.2	156	13.3
OH	Franklin County	Block Group 2, Census Tract 70.44, Franklin County, Ohio	2004	413	20.6	109	5.8
OH	Franklin County	Block Group 2, Census Tract 74.24, Franklin County, Ohio	1069	177	16.6	110	10.3
OH	Franklin County	Block Group 1, Census Tract 92.40, Franklin County, Ohio	719	138	19.2	27	3.8
OH	Franklin County	Block Group 2, Census Tract 74.25, Franklin County, Ohio	937	198	21.1	31	3.5
OH	Franklin County	Block Group 1, Census Tract 5, Franklin County, Ohio	1556	468	30.1	72	4.6
OH	Franklin County	Block Group 1, Census Tract 84, Franklin County, Ohio	1316	45	3.4	19	1.4
OH	Franklin County	Block Group 2, Census Tract 71.93, Franklin County, Ohio	1646	110	6.7	58	3.5
OH	Franklin County	Block Group 2, Census Tract 50.02, Franklin County, Ohio	1521	840	55.2	922	60.6
OH	Franklin County	Block Group 2, Census Tract 88.22, Franklin County, Ohio	1722	470	27.3	610	38
OH	Franklin County	Block Group 2, Census Tract 63.30, Franklin County, Ohio	792	68	8.6	0	0
OH	Franklin County	Block Group 2, Census Tract 64.30, Franklin County, Ohio	1365	340	24.9	7	0.5
OH	Franklin County	Block Group 4, Census Tract 93.25, Franklin County, Ohio	1555	1420	91.3	608	39.1
OH	Franklin County	Block Group 1, Census Tract 69.44, Franklin County, Ohio	1506	726	48.2	495	32.9
OH	Franklin County	Block Group 1, Census Tract 58.10, Franklin County, Ohio	755	65	8.6	41	5.4
OH	Franklin County	Block Group 5, Census Tract 77.21, Franklin County, Ohio	1975	1922	97.3	649	33.2
OH	Franklin County	Block Group 6, Census Tract 10, Franklin County, Ohio	1225	189	15.4	216	17.6
OH	Franklin County	Block Group 3, Census Tract 82.42, Franklin County, Ohio	1750	860	49.1	508	29

OH	Franklin County	Block Group 1, Census Tract 71.99, Franklin County, Ohio	2333	1327	56.9	59	2.5
OH	Franklin County	Block Group 1, Census Tract 68.10, Franklin County, Ohio	1259	68	5.4	40	3.2
OH	Franklin County	Block Group 1, Census Tract 48.10, Franklin County, Ohio	897	407	45.4	93	10.4
OH	Franklin County	Block Group 1, Census Tract 97.57, Franklin County, Ohio	791	95	12	250	31.6
OH	Franklin County	Block Group 2, Census Tract 93.84, Franklin County, Ohio	853	172	20.2	127	14.9
OH	Franklin County	Block Group 2, Census Tract 93.32, Franklin County, Ohio	434	434	100	31	7.1
OH	Franklin County	Block Group 1, Census Tract 93.22, Franklin County, Ohio	856	472	55.1	39	4.6
OH	Franklin County	Block Group 1, Census Tract 81.65, Franklin County, Ohio	1452	122	8.4	163	12.5
OH	Franklin County	Block Group 1, Census Tract 27.40, Franklin County, Ohio	1004	146	14.5	44	4.4
OH	Franklin County	Block Group 2, Census Tract 3.10, Franklin County, Ohio	1513	477	31.5	183	12.1
OH	Franklin County	Block Group 1, Census Tract 4.10, Franklin County, Ohio	1233	74	6	11	0.9
OH	Franklin County	Block Group 1, Census Tract 73.02, Franklin County, Ohio	1529	828	54.2	147	9.6
OH	Franklin County	Block Group 1, Census Tract 47, Franklin County, Ohio	557	355	63.7	227	40.8
OH	Franklin County	Block Group 4, Census Tract 93.23, Franklin County, Ohio	641	523	81.6	332	51.8
OH	Franklin County	Block Group 2, Census Tract 32, Franklin County, Ohio	1541	218	14.1	108	7.8
OH	Franklin County	Block Group 2, Census Tract 93.81, Franklin County, Ohio	1158	566	48.9	0	0
OH	Franklin County	Block Group 2, Census Tract 93.96, Franklin County, Ohio	2260	1989	88	122	5.4
OH	Franklin County	Block Group 4, Census Tract 77.10, Franklin County, Ohio	994	326	32.8	354	35.6
OH	Franklin County	Block Group 3, Census Tract 94.40, Franklin County, Ohio	1351	777	57.5	0	0
OH	Franklin County	Block Group 3, Census Tract 97.53, Franklin County, Ohio	2422	149	6.2	4	0.2
OH	Franklin County	Block Group 4, Census Tract 78.20, Franklin County, Ohio	847	611	72.1	576	68
OH	Franklin County	Block Group 2, Census Tract 102.03, Franklin County, Ohio	2372	1574	66.4	159	6.8
OH	Franklin County	Block Group 1, Census Tract 75.53, Franklin County, Ohio	729	613	84.1	178	24.4
OH	Franklin County	Block Group 2, Census Tract 89, Franklin County, Ohio	796	126	15.8	7	0.9
OH	Franklin County	Block Group 1, Census Tract 63.21, Franklin County, Ohio	585	90	15.4	0	0
OH	Franklin County	Block Group 1, Census Tract 2.20, Franklin County, Ohio	794	62	7.8	49	6.2
OH	Franklin County	Block Group 1, Census Tract 82.10, Franklin County, Ohio	1121	221	19.7	257	23.2
OH	Franklin County	Block Group 1, Census Tract 97.51, Franklin County, Ohio	2423	133	5.5	31	1.3
OH	Franklin County	Block Group 1, Census Tract 72.15, Franklin County, Ohio	1938	376	19.4	37	1.9
OH	Franklin County	Block Group 3, Census Tract 83.22, Franklin County, Ohio	1056	213	20.2	143	13.5
OH	Franklin County	Block Group 2, Census Tract 67.22, Franklin County, Ohio	960	102	10.6	74	7.7
OH	Franklin County	Block Group 2, Census Tract 17, Franklin County, Ohio	833	398	47.8	389	46.7
OH	Franklin County	Block Group 1, Census Tract 69.91, Franklin County, Ohio	1282	237	18.5	14	1.1
OH	Franklin County	Block Group 1, Census Tract 28, Franklin County, Ohio	697	694	99.6	437	62.7
OH	Franklin County	Block Group 4, Census Tract 63.96, Franklin County, Ohio	802	146	18.2	184	22.9
OH	Franklin County	Block Group 4, Census Tract 9.10, Franklin County, Ohio	661	569	86.1	121	18.3
OH	Franklin County	Block Group 1, Census Tract 81.69, Franklin County, Ohio	2426	725	29.9	358	14.9
OH	Franklin County	Block Group 3, Census Tract 63.84, Franklin County, Ohio	1417	419	29.6	50	3.5
OH	Franklin County	Block Group 2, Census Tract 62.39, Franklin County, Ohio	2965	2344	79.1	162	5.5
OH	Franklin County	Block Group 3, Census Tract 6, Franklin County, Ohio	945	133	14.1	187	19.8
OH	Franklin County	Block Group 5, Census Tract 45, Franklin County, Ohio	2508	376	15	613	24.7
OH	Franklin County	Block Group 3, Census Tract 93.12, Franklin County, Ohio	697	417	59.8	262	37.6
OH	Franklin County	Block Group 1, Census Tract 73.98, Franklin County, Ohio	3294	1858	56.4	162	4.9
OH	Franklin County	Block Group 3, Census Tract 63.23, Franklin County, Ohio	835	154	18.4	9	1.1
OH	Franklin County	Block Group 2, Census Tract 20, Franklin County, Ohio	827	3	0.4	5	0.6
OH	Franklin County	Block Group 4, Census Tract 49, Franklin County, Ohio	1422	536	37.7	592	41.6
OH	Franklin County	Block Group 1, Census Tract 93.36, Franklin County, Ohio	978	710	72.6	350	35.8
OH	Franklin County	Block Group 1, Census Tract 15, Franklin County, Ohio	895	832	93	258	28.8
OH	Franklin County	Block Group 2, Census Tract 50.01, Franklin County, Ohio	1116	365	32.7	308	33.3
OH	Franklin County	Block Group 3, Census Tract 56.20, Franklin County, Ohio	534	215	40.3	85	15.9
OH	Franklin County	Block Group 1, Census Tract 93.94, Franklin County, Ohio	1187	395	33.3	34	2.9
OH	Franklin County	Block Group 1, Census Tract 70.48, Franklin County, Ohio	2244	1162	51.8	196	8.7
OH	Franklin County	Block Group 4, Census Tract 93.72, Franklin County, Ohio	2053	1596	77.7	597	29.1
OH	Franklin County	Block Group 1, Census Tract 94.03, Franklin County, Ohio	1897	590	31.1	539	28.4
OH	Franklin County	Block Group 5, Census Tract 37, Franklin County, Ohio	463	244	52.7	172	37.1
OH	Franklin County	Block Group 2, Census Tract 83.50, Franklin County, Ohio	1737	1428	82.2	87	5
OH	Franklin County	Block Group 1, Census Tract 79.59, Franklin County, Ohio	1395	179	12.8	84	6
OH	Franklin County	Block Group 2, Census Tract 95.20, Franklin County, Ohio	1162	59	5.1	99	8.5
OH	Franklin County	Block Group 2, Census Tract 78.12, Franklin County, Ohio	793	122	15.4	113	16.5
OH	Franklin County	Block Group 2, Census Tract 52, Franklin County, Ohio	701	204	29.1	92	13.1
OH	Franklin County	Block Group 1, Census Tract 92.51, Franklin County, Ohio	993	809	81.5	97	9.8
OH	Franklin County	Block Group 1, Census Tract 93.40, Franklin County, Ohio	1656	950	57.4	406	24.5
OH	Franklin County	Block Group 4, Census Tract 55, Franklin County, Ohio	729	465	63.8	443	60.8
OH	Franklin County	Block Group 2, Census Tract 75.12, Franklin County, Ohio	1530	1475	96.4	139	9.1
OH	Franklin County	Block Group 4, Census Tract 70.44, Franklin County, Ohio	2494	1735	69.6	0	0
OH	Franklin County	Block Group 2, Census Tract 63.94, Franklin County, Ohio	1637	73	4.5	8	0.5
OH	Franklin County	Block Group 2, Census Tract 30, Franklin County, Ohio	121	81	66.9	112	92.6
OH	Franklin County	Block Group 3, Census Tract 62.37, Franklin County, Ohio	1729	870	50.3	46	2.7
OH	Franklin County	Block Group 2, Census Tract 71.14, Franklin County, Ohio	1204	355	29.5	0	0
OH	Franklin County	Block Group 4, Census Tract 7.10, Franklin County, Ohio	1179	617	52.3	151	12.8
OH	Franklin County	Block Group 1, Census Tract 81.71, Franklin County, Ohio	1824	928	50.9	542	29.7
OH	Franklin County	Block Group 1, Census Tract 91, Franklin County, Ohio	952	324	34	68	7.1
OH	Franklin County	Block Group 4, Census Tract 69.23, Franklin County, Ohio	1160	596	51.4	20	1.7
OH	Franklin County	Block Group 2, Census Tract 18.20, Franklin County, Ohio	899	163	18.1	138	15.4
OH	Franklin County	Block Group 2, Census Tract 97.11, Franklin County, Ohio	1066	28	2.6	202	22.9
OH	Franklin County	Block Group 2, Census Tract 79.55, Franklin County, Ohio	1705	327	19.2	111	6.8
OH	Franklin County	Block Group 3, Census Tract 74.92, Franklin County, Ohio	1136	150	13.2	87	7.8
OH	Franklin County	Block Group 2, Census Tract 79.66, Franklin County, Ohio	3702	1872	50.6	399	10.9
OH	Franklin County	Block Group 3, Census Tract 13.02, Franklin County, Ohio	838	191	22.8	481	61.7
OH	Franklin County	Block Group 3, Census Tract 106.02, Franklin County, Ohio	2015	738	36.6	0	0
OH	Franklin County	Block Group 4, Census Tract 69.33, Franklin County, Ohio	1273	1223	96.1	735	60.2
OH	Franklin County	Block Group 2, Census Tract 92.20, Franklin County, Ohio	1326	653	49.2	393	29.6
OH	Franklin County	Block Group 2, Census Tract 69.21, Franklin County, Ohio	666	98	14.7	143	21.7

OH	Franklin County	Block Group 2, Census Tract 4.10, Franklin County, Ohio	1145	137	12	84	7.4
OH	Franklin County	Block Group 2, Census Tract 19.01, Franklin County, Ohio	550	107	19.5	41	7.5
OH	Franklin County	Block Group 2, Census Tract 105.02, Franklin County, Ohio	1355	381	28.1	13	1
OH	Franklin County	Block Group 2, Census Tract 88.13, Franklin County, Ohio	1289	1056	81.9	322	25
OH	Franklin County	Block Group 2, Census Tract 83.11, Franklin County, Ohio	1570	209	13.3	124	7.9
OH	Franklin County	Block Group 2, Census Tract 71.98, Franklin County, Ohio	989	213	21.5	46	4.7
OH	Franklin County	Block Group 1, Census Tract 12, Franklin County, Ohio	744	298	40.1	378	50.8
OH	Franklin County	Block Group 4, Census Tract 70.20, Franklin County, Ohio	2064	102	4.9	215	10.7
OH	Franklin County	Block Group 3, Census Tract 70.44, Franklin County, Ohio	672	116	17.3	0	0
OH	Franklin County	Block Group 2, Census Tract 84, Franklin County, Ohio	1864	751	40.3	53	2.8
OH	Franklin County	Block Group 3, Census Tract 71.93, Franklin County, Ohio	732	42	5.7	0	0
OH	Franklin County	Block Group 5, Census Tract 71.15, Franklin County, Ohio	1536	1124	73.2	318	20.7
OH	Franklin County	Block Group 2, Census Tract 75.20, Franklin County, Ohio	485	430	88.7	134	27.6
OH	Franklin County	Block Group 2, Census Tract 63.87, Franklin County, Ohio	879	141	16	0	0
OH	Franklin County	Block Group 4, Census Tract 1.10, Franklin County, Ohio	768	29	3.8	0	0
OH	Franklin County	Block Group 3, Census Tract 50.02, Franklin County, Ohio	595	134	22.5	191	32.1
OH	Franklin County	Block Group 3, Census Tract 74.24, Franklin County, Ohio	1533	64	4.2	0	0
OH	Franklin County	Block Group 3, Census Tract 63.30, Franklin County, Ohio	735	40	5.4	0	0
OH	Franklin County	Block Group 3, Census Tract 81.20, Franklin County, Ohio	840	147	17.5	92	11
OH	Franklin County	Block Group 5, Census Tract 83.12, Franklin County, Ohio	869	229	26.4	349	40.2
OH	Franklin County	Block Group 3, Census Tract 78.11, Franklin County, Ohio	1232	112	9.1	55	4.5
OH	Franklin County	Block Group 2, Census Tract 75.34, Franklin County, Ohio	1773	1702	96	448	25.3
OH	Franklin County	Block Group 1, Census Tract 77.22, Franklin County, Ohio	899	601	66.9	33	3.7
OH	Franklin County	Block Group 1, Census Tract 79.64, Franklin County, Ohio	1925	99	5.1	10	0.5
OH	Franklin County	Block Group 1, Census Tract 11.10, Franklin County, Ohio	987	384	38.9	477	48.3
OH	Franklin County	Block Group 1, Census Tract 40.01, Franklin County, Ohio	1012	385	38	325	32.1
OH	Franklin County	Block Group 2, Census Tract 81.65, Franklin County, Ohio	493	57	11.6	16	3.2
OH	Franklin County	Block Group 1, Census Tract 94.20, Franklin County, Ohio	1156	306	26.5	276	23.9
OH	Franklin County	Block Group 2, Census Tract 69.44, Franklin County, Ohio	1479	460	31.1	9	0.6
OH	Franklin County	Block Group 2, Census Tract 66, Franklin County, Ohio	1590	45	2.8	42	2.6
OH	Franklin County	Block Group 2, Census Tract 93.22, Franklin County, Ohio	1824	1296	71.1	655	35.9
OH	Franklin County	Block Group 2, Census Tract 73.06, Franklin County, Ohio	2049	110	5.4	18	0.9
OH	Franklin County	Block Group 2, Census Tract 72.09, Franklin County, Ohio	2380	943	39.6	263	11.7
OH	Franklin County	Block Group 2, Census Tract 27.40, Franklin County, Ohio	918	219	23.9	28	3.1
OH	Franklin County	Block Group 2, Census Tract 58.10, Franklin County, Ohio	684	89	13	40	5.8
OH	Franklin County	Block Group 3, Census Tract 46.10, Franklin County, Ohio	1320	262	19.8	196	14.8
OH	Franklin County	Block Group 4, Census Tract 97.52, Franklin County, Ohio	2136	419	19.6	0	0
OH	Franklin County	Block Group 3, Census Tract 93.85, Franklin County, Ohio	1447	796	55	80	5.5
OH	Franklin County	Block Group 3, Census Tract 63.53, Franklin County, Ohio	881	518	58.8	263	29.9
OH	Franklin County	Block Group 1, Census Tract 93.25, Franklin County, Ohio	1465	1168	79.7	743	50.7
OH	Franklin County	Block Group 1, Census Tract 72.02, Franklin County, Ohio	723	270	37.3	16	2.3
OH	Franklin County	Block Group 1, Census Tract 3.20, Franklin County, Ohio	1211	330	27.3	40	3.4
OH	Franklin County	Block Group 2, Census Tract 82.30, Franklin County, Ohio	1502	1375	91.5	817	54.4
OH	Franklin County	Block Group 1, Census Tract 63.02, Franklin County, Ohio	2975	837	28.1	750	25.3
OH	Franklin County	Block Group 1, Census Tract 87.30, Franklin County, Ohio	1939	1443	74.4	784	47
OH	Franklin County	Block Group 2, Census Tract 97.54, Franklin County, Ohio	1794	35	2	0	0
OH	Franklin County	Block Group 3, Census Tract 26, Franklin County, Ohio	1887	1684	89.2	1407	74.6
OH	Franklin County	Block Group 2, Census Tract 47, Franklin County, Ohio	1788	1277	71.4	371	20.7
OH	Franklin County	Block Group 1, Census Tract 63.96, Franklin County, Ohio	2209	844	38.2	171	7.7
OH	Franklin County	Block Group 1, Census Tract 69.92, Franklin County, Ohio	711	231	32.5	91	12.8
OH	Franklin County	Block Group 1, Census Tract 10, Franklin County, Ohio	1192	189	15.9	717	60.2
OH	Franklin County	Block Group 3, Census Tract 72.13, Franklin County, Ohio	1615	359	22.2	99	6.1
OH	Franklin County	Block Group 3, Census Tract 67.21, Franklin County, Ohio	1162	78	6.7	0	0
OH	Franklin County	Block Group 1, Census Tract 16, Franklin County, Ohio	1286	640	49.8	293	22.8
OH	Franklin County	Block Group 1, Census Tract 90, Franklin County, Ohio	1241	107	8.6	32	2.6
OH	Franklin County	Block Group 4, Census Tract 63.21, Franklin County, Ohio	1055	219	20.8	7	0.7
OH	Franklin County	Block Group 4, Census Tract 2.20, Franklin County, Ohio	1482	160	10.8	9	0.6
OH	Franklin County	Block Group 2, Census Tract 62.40, Franklin County, Ohio	1911	339	17.7	0	0
OH	Franklin County	Block Group 3, Census Tract 63.72, Franklin County, Ohio	1459	648	44.4	70	5.1
OH	Franklin County	Block Group 1, Census Tract 7.10, Franklin County, Ohio	568	357	62.9	305	53.7
OH	Franklin County	Block Group 1, Census Tract 93.82, Franklin County, Ohio	1741	508	29.2	253	14.6
OH	Franklin County	Block Group 3, Census Tract 62.36, Franklin County, Ohio	2455	400	16.3	0	0
OH	Franklin County	Block Group 3, Census Tract 93.73, Franklin County, Ohio	920	744	80.9	8	0.9
OH	Franklin County	Block Group 1, Census Tract 93.34, Franklin County, Ohio	1187	1049	88.4	501	42.2
OH	Franklin County	Block Group 2, Census Tract 93.37, Franklin County, Ohio	1363	1304	95.7	343	25.2
OH	Franklin County	Block Group 2, Census Tract 43.02, Franklin County, Ohio	797	384	48.2	281	35.3
OH	Franklin County	Block Group 2, Census Tract 57, Franklin County, Ohio	1348	29	2.2	18	1.3
OH	Franklin County	Block Group 2, Census Tract 56.10, Franklin County, Ohio	990	630	63.6	263	27.3
OH	Franklin County	Block Group 4, Census Tract 74.92, Franklin County, Ohio	664	330	49.7	24	3.6
OH	Franklin County	Block Group 1, Census Tract 99, Franklin County, Ohio	1952	1434	73.5	525	26.9
OH	Franklin County	Block Group 1, Census Tract 22, Franklin County, Ohio	1464	450	30.7	359	24.5
OH	Franklin County	Block Group 1, Census Tract 49, Franklin County, Ohio	722	427	59.1	208	28.8
OH	Franklin County	Block Group 2, Census Tract 79.60, Franklin County, Ohio	652	107	16.4	0	0
OH	Franklin County	Block Group 3, Census Tract 94.95, Franklin County, Ohio	1566	431	27.5	354	22.6
OH	Franklin County	Block Group 4, Census Tract 5, Franklin County, Ohio	999	321	32.1	242	24.2
OH	Franklin County	Block Group 2, Census Tract 81.63, Franklin County, Ohio	2187	1077	49.2	512	23.9
OH	Franklin County	Block Group 3, Census Tract 102.01, Franklin County, Ohio	335	335	100	102	30.4
OH	Franklin County	Block Group 3, Census Tract 72.12, Franklin County, Ohio	1838	277	15.1	0	0
OH	Franklin County	Block Group 1, Census Tract 79.66, Franklin County, Ohio	1411	292	20.7	469	34.1
OH	Franklin County	Block Group 2, Census Tract 67.21, Franklin County, Ohio	1190	56	4.7	27	2.4
OH	Franklin County	Block Group 1, Census Tract 97.54, Franklin County, Ohio	590	112	19	0	0
OH	Franklin County	Block Group 1, Census Tract 72.09, Franklin County, Ohio	4916	1203	24.5	60	1.2
OH	Franklin County	Block Group 1, Census Tract 81.63, Franklin County, Ohio	1436	767	53.4	410	28.6
OH	Franklin County	Block Group 2, Census Tract 63.01, Franklin County, Ohio	1942	369	19	33	1.7
OH	Franklin County	Block Group 4, Census Tract 95.90, Franklin County, Ohio	1717	517	30.1	162	9.7
OH	Franklin County	Block Group 3, Census Tract 81.70, Franklin County, Ohio	1426	751	52.7	8	0.6
OH	Franklin County	Block Group 2, Census Tract 72.12, Franklin County, Ohio	2768	535	19.3	105	3.8

OH	Franklin County	Block Group 2, Census Tract 63.23, Franklin County, Ohio	1368	280	20.5	22	1.6
OH	Franklin County	Block Group 2, Census Tract 81.64, Franklin County, Ohio	3173	1050	33.1	407	12.8
OH	Franklin County	Block Group 2, Census Tract 97.53, Franklin County, Ohio	1023	141	13.8	0	0
OH	Franklin County	Block Group 1, Census Tract 93.81, Franklin County, Ohio	979	413	42.2	302	30.8
OH	Franklin County	Block Group 2, Census Tract 77.21, Franklin County, Ohio	1016	772	76	618	60.8
OH	Franklin County	Block Group 2, Census Tract 73.03, Franklin County, Ohio	2673	1422	53.2	597	22.3
OH	Franklin County	Block Group 2, Census Tract 88.11, Franklin County, Ohio	958	26	2.7	226	23.8
OH	Franklin County	Block Group 2, Census Tract 80.01, Franklin County, Ohio	1419	123	8.7	62	4.4
OH	Franklin County	Block Group 2, Census Tract 62.41, Franklin County, Ohio	3758	2222	59.1	1231	32.8
OH	Franklin County	Block Group 5, Census Tract 71.93, Franklin County, Ohio	893	56	6.3	0	0
OH	Franklin County	Block Group 3, Census Tract 94.20, Franklin County, Ohio	800	198	24.8	101	12.6
OH	Franklin County	Block Group 1, Census Tract 101, Franklin County, Ohio	1298	872	67.2	85	6.5
OH	Franklin County	Block Group 2, Census Tract 73.97, Franklin County, Ohio	2563	1335	52.1	42	1.6
OH	Franklin County	Block Group 1, Census Tract 63.86, Franklin County, Ohio	1597	466	29.2	95	5.9
OH	Franklin County	Block Group 1, Census Tract 70.43, Franklin County, Ohio	2072	496	23.9	198	9.6
OH	Franklin County	Block Group 2, Census Tract 71.20, Franklin County, Ohio	1495	596	39.9	343	22.9
OH	Franklin County	Block Group 1, Census Tract 83.80, Franklin County, Ohio	1559	218	14	185	11.9
OH	Franklin County	Block Group 1, Census Tract 32, Franklin County, Ohio	1346	233	17.3	118	9.4
OH	Franklin County	Block Group 2, Census Tract 93.97, Franklin County, Ohio	1604	1377	85.8	572	39.4
OH	Franklin County	Block Group 1, Census Tract 81.72, Franklin County, Ohio	1951	153	7.8	415	21.3
OH	Franklin County	Block Group 3, Census Tract 79.57, Franklin County, Ohio	2122	335	15.8	60	2.8
OH	Franklin County	Block Group 2, Census Tract 74.94, Franklin County, Ohio	2027	615	30.3	67	3.3
OH	Franklin County	Block Group 4, Census Tract 69.21, Franklin County, Ohio	1066	321	30.1	53	5
OH	Franklin County	Block Group 1, Census Tract 102.02, Franklin County, Ohio	788	147	18.7	0	0
OH	Franklin County	Block Group 4, Census Tract 97.11, Franklin County, Ohio	1408	103	7.3	40	2.8
OH	Franklin County	Block Group 4, Census Tract 93.81, Franklin County, Ohio	1663	961	57.8	100	6
OH	Franklin County	Block Group 3, Census Tract 73.98, Franklin County, Ohio	2068	777	37.6	67	3.2
OH	Franklin County	Block Group 3, Census Tract 15, Franklin County, Ohio	570	478	83.9	196	34.4
OH	Franklin County	Block Group 2, Census Tract 72.13, Franklin County, Ohio	1127	286	25.4	7	0.6
OH	Franklin County	Block Group 2, Census Tract 94.95, Franklin County, Ohio	919	362	39.4	24	2.6
OH	Franklin County	Block Group 1, Census Tract 93.37, Franklin County, Ohio	1386	1133	81.7	451	32.5
OH	Franklin County	Block Group 2, Census Tract 63.95, Franklin County, Ohio	1153	366	31.7	25	2.2
OH	Franklin County	Block Group 3, Census Tract 69.91, Franklin County, Ohio	1667	80	4.8	74	4.4
OH	Franklin County	Block Group 3, Census Tract 97.54, Franklin County, Ohio	822	70	8.5	171	20.8
OH	Franklin County	Block Group 4, Census Tract 87.20, Franklin County, Ohio	730	514	70.4	140	19.2
OH	Franklin County	Block Group 2, Census Tract 69.50, Franklin County, Ohio	717	21	2.9	44	6.1
OH	Franklin County	Block Group 3, Census Tract 69.44, Franklin County, Ohio	757	176	23.2	206	27.2
OH	Franklin County	Block Group 1, Census Tract 82.41, Franklin County, Ohio	977	326	33.4	176	18
OH	Franklin County	Block Group 2, Census Tract 63.53, Franklin County, Ohio	1572	382	24.3	169	10.8
OH	Franklin County	Block Group 3, Census Tract 27.40, Franklin County, Ohio	750	385	51.3	150	20
OH	Franklin County	Block Group 2, Census Tract 72.15, Franklin County, Ohio	3675	1205	32.8	38	1
OH	Franklin County	Block Group 2, Census Tract 62.36, Franklin County, Ohio	2115	611	28.9	13	0.6
OH	Franklin County	Block Group 2, Census Tract 46.10, Franklin County, Ohio	399	73	18.3	100	25.1
OH	Franklin County	Block Group 1, Census Tract 66, Franklin County, Ohio	1283	38	3	22	1.7
OH	Franklin County	Block Group 1, Census Tract 75.34, Franklin County, Ohio	2412	1972	81.8	888	37.3
OH	Franklin County	Block Group 4, Census Tract 100, Franklin County, Ohio	1193	100	8.4	102	8.5
OH	Franklin County	Block Group 3, Census Tract 93.92, Franklin County, Ohio	2041	1117	54.7	438	21.5
OH	Franklin County	Block Group 2, Census Tract 102.01, Franklin County, Ohio	1133	790	69.7	0	0
OH	Franklin County	Block Group 2, Census Tract 78.11, Franklin County, Ohio	1320	361	27.3	365	27.8
OH	Franklin County	Block Group 4, Census Tract 94.95, Franklin County, Ohio	1068	593	55.5	214	20
OH	Franklin County	Block Group 4, Census Tract 71.93, Franklin County, Ohio	1836	114	6.2	26	1.4
OH	Franklin County	Block Group 3, Census Tract 97.57, Franklin County, Ohio	1292	41	3.2	69	5.3
OH	Franklin County	Block Group 4, Census Tract 71.14, Franklin County, Ohio	848	699	82.4	142	16.7
OH	Franklin County	Block Group 2, Census Tract 93.85, Franklin County, Ohio	792	319	40.3	49	6.6
OH	Franklin County	Block Group 2, Census Tract 81.20, Franklin County, Ohio	1552	649	41.8	157	10.2
OH	Franklin County	Block Group 1, Census Tract 69.21, Franklin County, Ohio	1110	666	60	180	16.2
OH	Franklin County	Block Group 3, Census Tract 69.33, Franklin County, Ohio	1773	1391	78.5	751	42.4
OH	Franklin County	Block Group 2, Census Tract 106.02, Franklin County, Ohio	2603	535	20.6	15	0.6
OH	Franklin County	Block Group 1, Census Tract 97.11, Franklin County, Ohio	1331	119	8.9	149	11.2
OH	Franklin County	Block Group 4, Census Tract 83.40, Franklin County, Ohio	1573	565	35.9	140	12.4
OH	Franklin County	Block Group 1, Census Tract 18.20, Franklin County, Ohio	711	210	29.5	60	8.5
OH	Franklin County	Block Group 1, Census Tract 83.50, Franklin County, Ohio	3422	1405	41.1	604	18.1
OH	Franklin County	Block Group 1, Census Tract 71.14, Franklin County, Ohio	1556	412	26.5	270	18.1
OH	Franklin County	Block Group 1, Census Tract 53, Franklin County, Ohio	1098	436	39.7	371	36.7
OH	Franklin County	Block Group 1, Census Tract 69.24, Franklin County, Ohio	2054	1295	63	106	5.2
OH	Franklin County	Block Group 1, Census Tract 79.55, Franklin County, Ohio	1298	153	11.8	0	0
OH	Franklin County	Block Group 3, Census Tract 75.12, Franklin County, Ohio	1385	1120	80.9	696	50.3
OH	Franklin County	Block Group 2, Census Tract 93.40, Franklin County, Ohio	1352	971	71.8	220	16.3
OH	Franklin County	Block Group 3, Census Tract 70.47, Franklin County, Ohio	1521	457	30	157	10.3
OH	Franklin County	Block Group 1, Census Tract 7.20, Franklin County, Ohio	930	884	95.1	457	49.1
OH	Franklin County	Block Group 3, Census Tract 93.72, Franklin County, Ohio	1132	771	68.1	77	6.8
OH	Franklin County	Block Group 1, Census Tract 74.26, Franklin County, Ohio	2151	205	9.5	171	7.9
OH	Franklin County	Block Group 4, Census Tract 69.45, Franklin County, Ohio	1281	1010	78.8	233	18.2
OH	Franklin County	Block Group 1, Census Tract 50.01, Franklin County, Ohio	800	142	17.8	346	43.2
OH	Franklin County	Block Group 2, Census Tract 79.61, Franklin County, Ohio	2280	408	17.9	35	1.5
OH	Franklin County	Block Group 3, Census Tract 20, Franklin County, Ohio	1594	465	29.2	292	18.4
OH	Franklin County	Block Group 2, Census Tract 25.10, Franklin County, Ohio	913	896	98.1	378	41.4
OH	Franklin County	Block Group 4, Census Tract 83.22, Franklin County, Ohio	934	294	31.5	280	30
OH	Franklin County	Block Group 1, Census Tract 43.01, Franklin County, Ohio	407	87	21.4	29	7.1
OH	Franklin County	Block Group 1, Census Tract 78.30, Franklin County, Ohio	1124	253	22.5	164	14.6
OH	Franklin County	Block Group 1, Census Tract 93.96, Franklin County, Ohio	1094	1018	93.1	116	10.6
OH	Franklin County	Block Group 2, Census Tract 82.10, Franklin County, Ohio	1247	652	52.3	280	22.5
OH	Franklin County	Block Group 2, Census Tract 74.92, Franklin County, Ohio	1266	354	28	14	1.1
OH	Franklin County	Block Group 1, Census Tract 102.04, Franklin County, Ohio	1115	702	63	176	15.8
OH	Franklin County	Block Group 2, Census Tract 69.45, Franklin County, Ohio	2297	1901	82.8	576	26.5
OH	Franklin County	Block Group 1, Census Tract 72.05, Franklin County, Ohio	2304	619	26.9	40	1.7
OH	Franklin County	Block Group 4, Census Tract 30, Franklin County, Ohio	1163	229	19.7	148	12.7
OH	Franklin County	Block Group 2, Census Tract 11.21, Franklin County, Ohio	3187	678	21.3	0	0
OH	Franklin County	Block Group 1, Census Tract 93.90, Franklin County, Ohio	2904	1642	56.5	35	1.2
OH	Franklin County	Block Group 6, Census Tract 47, Franklin County, Ohio	778	277	35.6	298	38.3

OH	Franklin County	Block Group 3, Census Tract 79.64, Franklin County, Ohio	2487	591	23.8	217	8.7
OH	Franklin County	Block Group 3, Census Tract 3.30, Franklin County, Ohio	1134	305	26.9	483	42.6
OH	Franklin County	Block Group 1, Census Tract 71.98, Franklin County, Ohio	1948	588	30.2	46	2.4
OH	Franklin County	Block Group 2, Census Tract 75.50, Franklin County, Ohio	1523	785	51.5	229	23
OH	Franklin County	Block Group 3, Census Tract 70.10, Franklin County, Ohio	3084	392	12.7	235	14.8
OH	Franklin County	Block Group 2, Census Tract 80.02, Franklin County, Ohio	1260	33	2.6	0	0
OH	Franklin County	Block Group 3, Census Tract 12, Franklin County, Ohio	1183	238	20.1	857	77.6
OH	Franklin County	Block Group 1, Census Tract 97.56, Franklin County, Ohio	2364	355	15	121	5.1
OH	Franklin County	Block Group 1, Census Tract 61, Franklin County, Ohio	1059	539	50.9	540	51
OH	Franklin County	Block Group 4, Census Tract 63.97, Franklin County, Ohio	2257	453	20.1	0	0
OH	Franklin County	Block Group 3, Census Tract 73.01, Franklin County, Ohio	1285	318	24.7	100	7.8
OH	Franklin County	Block Group 2, Census Tract 82.42, Franklin County, Ohio	1519	83	5.5	15	1
OH	Franklin County	Block Group 2, Census Tract 63.52, Franklin County, Ohio	956	341	35.7	188	19.7
OH	Franklin County	Block Group 2, Census Tract 25.20, Franklin County, Ohio	1228	927	75.5	337	27.4
OH	Franklin County	Block Group 1, Census Tract 93.32, Franklin County, Ohio	1266	1121	88.5	494	39
OH	Franklin County	Block Group 2, Census Tract 68.22, Franklin County, Ohio	1053	71	6.7	15	1.4
OH	Franklin County	Block Group 3, Census Tract 63.86, Franklin County, Ohio	921	384	41.7	0	0
OH	Franklin County	Block Group 1, Census Tract 75.32, Franklin County, Ohio	2991	2708	90.5	876	29.3
OH	Franklin County	Block Group 1, Census Tract 71.93, Franklin County, Ohio	885	53	6	305	34.5
OH	Franklin County	Block Group 1, Census Tract 64.30, Franklin County, Ohio	774	85	11	21	2.7
OH	Franklin County	Block Group 1, Census Tract 78.12, Franklin County, Ohio	1100	545	49.5	607	56.9
OH	Franklin County	Block Group 3, Census Tract 94.98, Franklin County, Ohio	1896	1079	56.9	47	2.5
OH	Franklin County	Block Group 1, Census Tract 88.22, Franklin County, Ohio	2745	1189	43.3	559	20.5
OH	Franklin County	Block Group 1, Census Tract 13.01, Franklin County, Ohio	1711	279	16.3	682	39.9
OH	Franklin County	Block Group 4, Census Tract 4.20, Franklin County, Ohio	636	64	10.1	39	6.1
OH	Franklin County	Block Group 4, Census Tract 92.30, Franklin County, Ohio	789	403	51.1	194	25.2
OH	Franklin County	Block Group 1, Census Tract 74.25, Franklin County, Ohio	783	26	3.3	6	0.8
OH	Franklin County	Block Group 1, Census Tract 74.24, Franklin County, Ohio	771	386	50.1	262	34
OH	Franklin County	Block Group 1, Census Tract 106.01, Franklin County, Ohio	2379	524	22	166	7
OH	Franklin County	Block Group 3, Census Tract 81.10, Franklin County, Ohio	528	65	12.3	47	9.1
OH	Franklin County	Block Group 2, Census Tract 1.10, Franklin County, Ohio	1066	72	6.8	142	13.3
OH	Franklin County	Block Group 3, Census Tract 95.90, Franklin County, Ohio	1621	25	1.5	219	13.5
OH	Franklin County	Block Group 1, Census Tract 62.37, Franklin County, Ohio	930	123	13.2	6	0.7
OH	Franklin County	Block Group 2, Census Tract 63.91, Franklin County, Ohio	2101	254	12.1	47	2.2
OH	Franklin County	Block Group 2, Census Tract 65, Franklin County, Ohio	838	36	4.3	11	1.3
OH	Franklin County	Block Group 2, Census Tract 77.30, Franklin County, Ohio	1470	658	44.8	335	22.8
OH	Franklin County	Block Group 1, Census Tract 94.05, Franklin County, Ohio	1972	160	8.1	30	1.5
OH	Franklin County	Block Group 1, Census Tract 59, Franklin County, Ohio	629	462	73.4	287	45.6
OH	Franklin County	Block Group 5, Census Tract 63.87, Franklin County, Ohio	293	33	11.3	0	0
OH	Franklin County	Block Group 1, Census Tract 73.05, Franklin County, Ohio	3070	188	6.1	0	0
OH	Franklin County	Block Group 3, Census Tract 93.91, Franklin County, Ohio	1053	738	70.1	391	37.1
OH	Franklin County	Block Group 1, Census Tract 98.02, Franklin County, Ohio	2379	0	0	197	8.3
OH	Franklin County	Block Group 1, Census Tract 83.12, Franklin County, Ohio	737	379	51.4	510	69.2
OH	Franklin County	Block Group 2, Census Tract 79.56, Franklin County, Ohio	3206	508	15.8	557	17.4
OH	Franklin County	Block Group 1, Census Tract 63.40, Franklin County, Ohio	1975	511	25.9	27	1.4
OH	Franklin County	Block Group 1, Census Tract 109, Franklin County, Ohio	1206	310	25.7	0	0
OH	Franklin County	Block Group 3, Census Tract 93.23, Franklin County, Ohio	1449	1419	97.9	408	28.2
OH	Franklin County	Block Group 1, Census Tract 7.30, Franklin County, Ohio	1040	1029	98.9	744	71.6
OH	Franklin County	Block Group 2, Census Tract 79.22, Franklin County, Ohio	2071	254	12.3	22	1.1
OH	Franklin County	Block Group 1, Census Tract 63.10, Franklin County, Ohio	957	133	13.9	0	0
OH	Franklin County	Block Group 4, Census Tract 93.61, Franklin County, Ohio	1890	943	49.9	71	3.8
OH	Franklin County	Block Group 3, Census Tract 71.12, Franklin County, Ohio	2039	1515	74.3	192	9.4
OH	Franklin County	Block Group 1, Census Tract 71.01, Franklin County, Ohio	1181	359	30.4	0	0
OH	Franklin County	Block Group 1, Census Tract 83.82, Franklin County, Ohio	1337	79	5.9	27	2
OH	Franklin County	Block Group 1, Census Tract 83.40, Franklin County, Ohio	1109	40	3.6	520	46.9
OH	Franklin County	Block Group 1, Census Tract 83.60, Franklin County, Ohio	2873	678	23.6	171	6.1
OH	Franklin County	Block Group 1, Census Tract 105.02, Franklin County, Ohio	2039	540	26.5	0	0
OH	Franklin County	Block Group 3, Census Tract 54.20, Franklin County, Ohio	656	587	89.5	270	41.2
OH	Franklin County	Block Group 1, Census Tract 104.01, Franklin County, Ohio	2308	1239	53.7	80	3.5
OH	Franklin County	Block Group 2, Census Tract 74.27, Franklin County, Ohio	3411	1099	32.2	100	2.9
OH	Franklin County	Block Group 3, Census Tract 28, Franklin County, Ohio	791	599	75.7	334	42.2
OH	Franklin County	Block Group 2, Census Tract 93.73, Franklin County, Ohio	1440	521	36.2	2	0.1
OH	Franklin County	Block Group 1, Census Tract 93.95, Franklin County, Ohio	1643	482	29.3	16	1
OH	Franklin County	Block Group 1, Census Tract 71.15, Franklin County, Ohio	891	364	40.9	0	0
OH	Franklin County	Block Group 1, Census Tract 70.47, Franklin County, Ohio	1750	676	38.6	12	0.7
OH	Franklin County	Block Group 3, Census Tract 37, Franklin County, Ohio	593	261	44	151	25.5
OH	Franklin County	Block Group 3, Census Tract 81.69, Franklin County, Ohio	848	95	11.2	15	1.8
OH	Franklin County	Block Group 1, Census Tract 72.11, Franklin County, Ohio	1826	665	36.4	18	1
OH	Franklin County	Block Group 3, Census Tract 8.20, Franklin County, Ohio	1153	238	20.6	34	2.9
OH	Franklin County	Block Group 1, Census Tract 63.93, Franklin County, Ohio	2906	729	25.1	77	2.7
OH	Franklin County	Block Group 5, Census Tract 78.12, Franklin County, Ohio	1393	498	35.8	375	28.9
OH	Franklin County	Block Group 3, Census Tract 69.32, Franklin County, Ohio	1356	1022	75.4	139	10.3
OH	Franklin County	Block Group 1, Census Tract 92.50, Franklin County, Ohio	932	302	32.4	474	50.9
OH	Franklin County	Block Group 2, Census Tract 88.25, Franklin County, Ohio	1610	94	5.8	111	6.9
OH	Franklin County	Block Group 1, Census Tract 2.10, Franklin County, Ohio	954	54	5.7	18	1.9
OH	Franklin County	Block Group 1, Census Tract 27.70, Franklin County, Ohio	541	333	61.6	112	20.7
OH	Franklin County	Block Group 1, Census Tract 94.97, Franklin County, Ohio	1735	147	8.5	151	8.7
OH	Franklin County	Block Group 3, Census Tract 79.60, Franklin County, Ohio	900	76	8.4	0	0
OH	Franklin County	Block Group 1, Census Tract 45, Franklin County, Ohio	980	128	13.1	424	43.3
OH	Franklin County	Block Group 3, Census Tract 85, Franklin County, Ohio	875	9	1	34	3.9
OH	Franklin County	Block Group 1, Census Tract 81.67, Franklin County, Ohio	2141	483	22.6	179	8.4
OH	Franklin County	Block Group 2, Census Tract 93.82, Franklin County, Ohio	1164	36	3.1	61	5.2
OH	Franklin County	Block Group 3, Census Tract 48.20, Franklin County, Ohio	1657	494	29.8	465	28.4
OH	Franklin County	Block Group 1, Census Tract 83.22, Franklin County, Ohio	764	445	58.2	270	35.6
OH	Franklin County	Block Group 1, Census Tract 93.21, Franklin County, Ohio	948	554	58.4	159	16.8
OH	Franklin County	Block Group 2, Census Tract 93.11, Franklin County, Ohio	1281	560	43.7	56	4.4
OH	Franklin County	Block Group 1, Census Tract 56.10, Franklin County, Ohio	775	499	64.4	282	36.4
OH	Franklin County	Block Group 1, Census Tract 100, Franklin County, Ohio	1754	75	4.3	184	10.7
OH	Franklin County	Block Group 4, Census Tract 93.32, Franklin County, Ohio	1079	388	36	59	5.5
OH	Franklin County	Block Group 3, Census Tract 2.20, Franklin County, Ohio	1012	52	5.1	13	1.3

OH	Franklin County	Block Group 3, Census Tract 63.21, Franklin County, Ohio	1194	135	11.3	36	3
OH	Franklin County	Block Group 4, Census Tract 89, Franklin County, Ohio	2398	882	36.8	584	47.4
OH	Franklin County	Block Group 1, Census Tract 43.02, Franklin County, Ohio	368	61	16.6	135	36.7
OH	Franklin County	Block Group 2, Census Tract 10, Franklin County, Ohio	964	243	25.2	434	45
OH	Franklin County	Block Group 1, Census Tract 87.20, Franklin County, Ohio	818	736	90	174	21.3
OH	Franklin County	Block Group 2, Census Tract 16, Franklin County, Ohio	932	546	58.6	515	55.3
OH	Franklin County	Block Group 4, Census Tract 67.21, Franklin County, Ohio	795	31	3.9	0	0
OH	Franklin County	Block Group 4, Census Tract 72.13, Franklin County, Ohio	2539	843	33.2	11	0.4
OH	Franklin County	Block Group 1, Census Tract 23, Franklin County, Ohio	520	449	86.3	29	5.6
OH	Franklin County	Block Group 2, Census Tract 69.31, Franklin County, Ohio	2346	1730	73.7	675	33.6
OH	Franklin County	Block Group 1, Census Tract 75.52, Franklin County, Ohio	2105	2088	99.2	1326	63
OH	Franklin County	Block Group 1, Census Tract 62.40, Franklin County, Ohio	1994	327	16.4	366	18.4
OH	Franklin County	Block Group 4, Census Tract 70.48, Franklin County, Ohio	1574	485	30.8	135	8.6
OH	Franklin County	Block Group 2, Census Tract 63.93, Franklin County, Ohio	2011	667	33.2	8	0.4
OH	Franklin County	Block Group 1, Census Tract 9.10, Franklin County, Ohio	718	604	84.1	315	43.9
OH	Franklin County	Block Group 3, Census Tract 64.10, Franklin County, Ohio	965	83	8.6	47	4.9
OH	Franklin County	Block Group 1, Census Tract 29, Franklin County, Ohio	1410	1301	92.3	699	49.6
OH	Franklin County	Block Group 2, Census Tract 72.11, Franklin County, Ohio	2570	274	10.7	22	0.9
OH	Franklin County	Block Group 4, Census Tract 69.32, Franklin County, Ohio	1172	623	53.2	385	32.8
OH	Franklin County	Block Group 3, Census Tract 83.21, Franklin County, Ohio	1014	568	56	169	16.7
OH	Franklin County	Block Group 2, Census Tract 102.02, Franklin County, Ohio	2421	2111	87.2	109	4.5
OH	Franklin County	Block Group 1, Census Tract 69.23, Franklin County, Ohio	1097	597	54.4	42	3.9
OH	Franklin County	Block Group 3, Census Tract 19.02, Franklin County, Ohio	740	127	17.2	69	9.3
OH	Franklin County	Block Group 1, Census Tract 51, Franklin County, Ohio	1204	1002	83.2	820	73.5
OH	Franklin County	Block Group 1, Census Tract 97.12, Franklin County, Ohio	500	0	0	73	14.6
OH	Franklin County	Block Group 1, Census Tract 81.70, Franklin County, Ohio	1008	160	15.9	39	3.9
OH	Franklin County	Block Group 1, Census Tract 79.58, Franklin County, Ohio	1280	178	13.9	0	0
OH	Franklin County	Block Group 2, Census Tract 71.15, Franklin County, Ohio	1631	1308	80.2	1071	65.7
OH	Franklin County	Block Group 1, Census Tract 78.20, Franklin County, Ohio	461	348	75.5	308	66.8
OH	Franklin County	Block Group 2, Census Tract 93.95, Franklin County, Ohio	1020	453	44.4	0	0
OH	Franklin County	Block Group 2, Census Tract 37, Franklin County, Ohio	520	326	62.7	54	10.4
OH	Franklin County	Block Group 1, Census Tract 94.01, Franklin County, Ohio	1893	1221	64.5	0	0
OH	Franklin County	Block Group 2, Census Tract 83.60, Franklin County, Ohio	2490	556	22.3	121	4.9
OH	Franklin County	Block Group 2, Census Tract 93.50, Franklin County, Ohio	909	629	69.2	241	26.5
OH	Franklin County	Block Group 2, Census Tract 83.81, Franklin County, Ohio	2373	154	6.5	560	23.6
OH	Franklin County	Block Group 3, Census Tract 74.27, Franklin County, Ohio	1461	226	15.5	113	7.7
OH	Franklin County	Block Group 1, Census Tract 75.11, Franklin County, Ohio	855	802	93.8	145	17
OH	Franklin County	Block Group 3, Census Tract 102.04, Franklin County, Ohio	2758	2207	80	70	3.1
OH	Franklin County	Block Group 3, Census Tract 53, Franklin County, Ohio	1065	741	69.6	446	41.9
OH	Franklin County	Block Group 4, Census Tract 91, Franklin County, Ohio	1002	163	16.3	0	0
OH	Franklin County	Block Group 1, Census Tract 69.31, Franklin County, Ohio	716	609	85.1	145	20.3
OH	Franklin County	Block Group 3, Census Tract 96, Franklin County, Ohio	1046	126	12	196	18.7
OH	Franklin County	Block Group 1, Census Tract 79.22, Franklin County, Ohio	1801	112	6.2	0	0
OH	Franklin County	Block Group 2, Census Tract 81.72, Franklin County, Ohio	3033	813	26.8	262	8.6
OH	Franklin County	Block Group 3, Census Tract 7.20, Franklin County, Ohio	895	428	47.8	437	49
OH	Franklin County	Block Group 2, Census Tract 70.43, Franklin County, Ohio	3743	1683	45	808	21.6
OH	Franklin County	Block Group 1, Census Tract 36, Franklin County, Ohio	787	476	60.5	115	14.6
OH	Franklin County	Block Group 2, Census Tract 83.80, Franklin County, Ohio	2452	941	38.4	45	5.1
OH	Franklin County	Block Group 2, Census Tract 109, Franklin County, Ohio	2143	656	30.6	36	1.7
OH	Franklin County	Block Group 1, Census Tract 27.30, Franklin County, Ohio	1109	979	88.3	253	23
OH	Franklin County	Block Group 2, Census Tract 83.12, Franklin County, Ohio	1142	1041	91.2	765	67
OH	Franklin County	Block Group 1, Census Tract 79.57, Franklin County, Ohio	2176	48	2.2	23	1.1
OH	Franklin County	Block Group 2, Census Tract 73.05, Franklin County, Ohio	695	237	34.1	151	22
OH	Franklin County	Block Group 3, Census Tract 92.30, Franklin County, Ohio	807	209	25.9	252	31.2
OH	Franklin County	Block Group 6, Census Tract 63.30, Franklin County, Ohio	1080	110	10.2	0	0
OH	Franklin County	Block Group 4, Census Tract 81.10, Franklin County, Ohio	847	293	34.6	126	14.9
OH	Franklin County	Block Group 2, Census Tract 106.01, Franklin County, Ohio	890	76	8.5	8	0.9
OH	Franklin County	Block Group 1, Census Tract 1.10, Franklin County, Ohio	968	117	12.1	96	9.9
OH	Franklin County	Block Group 3, Census Tract 65, Franklin County, Ohio	1119	0	0	0	0
OH	Franklin County	Block Group 4, Census Tract 57, Franklin County, Ohio	621	175	28.2	47	7.6
OH	Franklin County	Block Group 2, Census Tract 94.04, Franklin County, Ohio	842	126	15	93	11
OH	Franklin County	Block Group 1, Census Tract 8.20, Franklin County, Ohio	935	716	76.6	441	47.2
OH	Franklin County	Block Group 2, Census Tract 13.01, Franklin County, Ohio	1415	203	14.3	1240	88.8
OH	Franklin County	Block Group 2, Census Tract 93.91, Franklin County, Ohio	2097	969	46.2	17	0.8
OH	Franklin County	Block Group 3, Census Tract 88.21, Franklin County, Ohio	800	33	4.1	419	52.4
OH	Franklin County	Block Group 2, Census Tract 98.02, Franklin County, Ohio	1416	0	0	119	8.4
OH	Franklin County	Block Group 3, Census Tract 81.32, Franklin County, Ohio	1556	186	12	45	2.9
OH	Franklin County	Block Group 1, Census Tract 69.10, Franklin County, Ohio	845	66	7.8	29	3.4
OH	Franklin County	Block Group 3, Census Tract 71.20, Franklin County, Ohio	1626	280	17.2	11	0.7
OH	Franklin County	Block Group 1, Census Tract 69.33, Franklin County, Ohio	2804	2390	85.2	707	25.4
OH	Franklin County	Block Group 2, Census Tract 63.86, Franklin County, Ohio	1907	794	41.6	129	6.8
OH	Franklin County	Block Group 1, Census Tract 70.20, Franklin County, Ohio	1721	357	20.7	0	0
OH	Franklin County	Block Group 1, Census Tract 63.98, Franklin County, Ohio	2330	444	19.1	43	1.9
OH	Franklin County	Block Group 2, Census Tract 93.83, Franklin County, Ohio	1861	1114	59.9	195	12
OH	Franklin County	Block Group 2, Census Tract 85, Franklin County, Ohio	1815	256	14.1	265	14.6
OH	Franklin County	Block Group 2, Census Tract 61, Franklin County, Ohio	1229	282	22.9	474	41.9
OH	Franklin County	Block Group 2, Census Tract 97.51, Franklin County, Ohio	1710	295	17.3	10	0.6
OH	Franklin County	Block Group 3, Census Tract 25.20, Franklin County, Ohio	1190	647	54.4	98	8.9
OH	Franklin County	Block Group 2, Census Tract 27.50, Franklin County, Ohio	1176	793	67.4	457	39
OH	Franklin County	Block Group 4, Census Tract 12, Franklin County, Ohio	1163	164	14.1	708	77.6
OH	Franklin County	Block Group 2, Census Tract 97.55, Franklin County, Ohio	2833	742	26.2	32	1.1
OH	Franklin County	Block Group 3, Census Tract 73.94, Franklin County, Ohio	1278	272	21.3	10	0.8
OH	Franklin County	Block Group 2, Census Tract 93.21, Franklin County, Ohio	571	386	67.6	156	27.3
OH	Franklin County	Block Group 4, Census Tract 94.20, Franklin County, Ohio	979	609	62.2	172	17.6
OH	Franklin County	Block Group 3, Census Tract 69.43, Franklin County, Ohio	953	332	34.8	212	22.2
OH	Franklin County	Block Group 1, Census Tract 80.02, Franklin County, Ohio	1972	24	1.2	49	2.5
OH	Franklin County	Block Group 1, Census Tract 77.10, Franklin County, Ohio	1175	947	80.6	424	36.1
OH	Franklin County	Block Group 3, Census Tract 77.21, Franklin County, Ohio	1638	1491	91	763	46.6
OH	Franklin County	Block Group 4, Census Tract 10, Franklin County, Ohio	569	116	20.4	414	72.8
OH	Franklin County	Block Group 1, Census Tract 79.65, Franklin County, Ohio	1830	546	29.8	251	13.7

OH	Franklin County	Block Group 2, Census Tract 22, Franklin County, Ohio	1788	628	35.1	236	13.2
OH	Franklin County	Block Group 3, Census Tract 62.41, Franklin County, Ohio	1971	287	14.6	78	4
OH	Franklin County	Block Group 1, Census Tract 88.12, Franklin County, Ohio	1764	1237	70.1	285	16.2
OH	Franklin County	Block Group 2, Census Tract 87.20, Franklin County, Ohio	783	442	56.4	222	28.4
OH	Franklin County	Block Group 4, Census Tract 63.72, Franklin County, Ohio	1883	443	23.5	211	11.2
OH	Franklin County	Block Group 2, Census Tract 46.20, Franklin County, Ohio	1432	711	49.7	688	48
OH	Franklin County	Block Group 5, Census Tract 47, Franklin County, Ohio	1168	438	37.5	544	47.9
OH	Franklin County	Block Group 2, Census Tract 72.05, Franklin County, Ohio	1749	319	18.2	36	2.1
OH	Franklin County	Block Group 2, Census Tract 93.23, Franklin County, Ohio	1107	977	88.3	357	32.2
OH	Franklin County	Block Group 2, Census Tract 3.30, Franklin County, Ohio	1048	458	43.7	545	52
OH	Franklin County	Block Group 1, Census Tract 69.45, Franklin County, Ohio	2323	2057	88.5	844	36.3
OH	Franklin County	Block Group 2, Census Tract 67.10, Franklin County, Ohio	1285	17	1.3	25	1.9
OH	Franklin County	Block Group 3, Census Tract 63.52, Franklin County, Ohio	1451	599	41.3	320	22.1
OH	Franklin County	Block Group 2, Census Tract 93.90, Franklin County, Ohio	2200	909	41.3	85	3.9
OH	Franklin County	Block Group 1, Census Tract 81.68, Franklin County, Ohio	1436	246	17.1	319	22.2
OH	Franklin County	Block Group 2, Census Tract 71.13, Franklin County, Ohio	1873	813	43.4	111	5.9
OH	Franklin County	Block Group 3, Census Tract 45, Franklin County, Ohio	943	516	54.7	602	63.8
OH	Franklin County	Block Group 1, Census Tract 79.61, Franklin County, Ohio	2272	29	1.3	24	1.1
OH	Franklin County	Block Group 1, Census Tract 27.80, Franklin County, Ohio	1125	418	37.2	19	1.7
OH	Franklin County	Block Group 1, Census Tract 69.50, Franklin County, Ohio	1842	90	4.9	9	0.5
OH	Franklin County	Block Group 1, Census Tract 62.41, Franklin County, Ohio	2301	128	5.6	0	0
OH	Franklin County	Block Group 1, Census Tract 63.84, Franklin County, Ohio	492	177	36	12	2.4
OH	Franklin County	Block Group 4, Census Tract 69.31, Franklin County, Ohio	851	565	66.4	41	4.8
OH	Franklin County	Block Group 1, Census Tract 25.10, Franklin County, Ohio	724	599	82.7	71	9.8
OH	Franklin County	Block Group 2, Census Tract 7.10, Franklin County, Ohio	922	542	58.8	221	24
OH	Franklin County	Block Group 2, Census Tract 69.92, Franklin County, Ohio	2408	2182	90.6	929	38.6
OH	Franklin County	Block Group 2, Census Tract 63.96, Franklin County, Ohio	1073	385	35.9	138	14.1
OH	Franklin County	Block Group 1, Census Tract 94.40, Franklin County, Ohio	1623	226	13.9	78	4.8
OH	Franklin County	Block Group 5, Census Tract 85, Franklin County, Ohio	802	74	9.2	32	4
OH	Franklin County	Block Group 3, Census Tract 43.02, Franklin County, Ohio	1086	797	73.4	994	91.5
OH	Franklin County	Block Group 4, Census Tract 93.73, Franklin County, Ohio	771	413	53.6	61	7.9
OH	Franklin County	Block Group 4, Census Tract 88.25, Franklin County, Ohio	1514	508	33.6	265	17.5
OH	Franklin County	Block Group 3, Census Tract 2.10, Franklin County, Ohio	438	27	6.2	31	7.1
OH	Franklin County	Block Group 1, Census Tract 63.23, Franklin County, Ohio	1293	187	14.5	70	5.4
OH	Franklin County	Block Group 3, Census Tract 92.50, Franklin County, Ohio	641	410	64	84	13.2
OH	Franklin County	Block Group 2, Census Tract 93.34, Franklin County, Ohio	844	797	94.4	131	15.5
OH	Franklin County	Block Group 3, Census Tract 100, Franklin County, Ohio	1588	495	31.2	143	9
OH	Franklin County	Block Group 1, Census Tract 6, Franklin County, Ohio	516	180	34.9	5	1
OH	Franklin County	Block Group 1, Census Tract 56.20, Franklin County, Ohio	583	294	50.4	142	24.4
OH	Franklin County	Block Group 2, Census Tract 63.98, Franklin County, Ohio	1152	252	21.9	59	5.1
OH	Franklin County	Block Group 1, Census Tract 93.12, Franklin County, Ohio	1177	816	69.3	156	13.3
OH	Franklin County	Block Group 2, Census Tract 9.10, Franklin County, Ohio	1457	1022	70.1	508	34.9
OH	Franklin County	Block Group 2, Census Tract 49, Franklin County, Ohio	332	107	32.2	39	11.7
OH	Franklin County	Block Group 2, Census Tract 81.70, Franklin County, Ohio	2299	399	17.4	325	14.1
OH	Franklin County	Block Group 1, Census Tract 72.12, Franklin County, Ohio	470	140	29.8	45	9.6
OH	Franklin County	Block Group 3, Census Tract 71.15, Franklin County, Ohio	1369	599	43.8	380	27.8
OH	Franklin County	Block Group 2, Census Tract 79.31, Franklin County, Ohio	2594	239	9.2	187	7.2
OH	Franklin County	Block Group 2, Census Tract 69.23, Franklin County, Ohio	923	559	60.6	128	13.9
OH	Franklin County	Block Group 4, Census Tract 19.02, Franklin County, Ohio	610	13	2.1	33	5.4
OH	Franklin County	Block Group 2, Census Tract 29, Franklin County, Ohio	1612	1547	96	1021	63.3
OH	Franklin County	Block Group 2, Census Tract 79.58, Franklin County, Ohio	1393	14	1	37	2.7
OH	Franklin County	Block Group 2, Census Tract 55, Franklin County, Ohio	519	478	92.1	197	38
OH	Franklin County	Block Group 3, Census Tract 93.37, Franklin County, Ohio	658	519	78.9	48	7.3
OH	Franklin County	Block Group 2, Census Tract 75.11, Franklin County, Ohio	901	821	91.1	304	33.7
OH	Franklin County	Block Group 3, Census Tract 74.25, Franklin County, Ohio	883	208	23.6	90	10.2
OH	Franklin County	Block Group 3, Census Tract 102.02, Franklin County, Ohio	1775	802	45.2	0	0
OH	Franklin County	Block Group 2, Census Tract 51, Franklin County, Ohio	1159	400	34.5	524	47.4
OH	Franklin County	Block Group 2, Census Tract 97.12, Franklin County, Ohio	523	0	0	121	23.1
OH	Franklin County	Block Group 1, Census Tract 71.02, Franklin County, Ohio	1638	32	2	30	1.8
OH	Franklin County	Block Group 2, Census Tract 78.20, Franklin County, Ohio	1756	1206	68.7	530	30.2
OH	Franklin County	Block Group 3, Census Tract 93.95, Franklin County, Ohio	1645	550	33.4	82	5
OH	Franklin County	Block Group 2, Census Tract 93.72, Franklin County, Ohio	536	311	58	47	8.8
OH	Franklin County	Block Group 2, Census Tract 90, Franklin County, Ohio	1697	285	16.8	34	2
OH	Franklin County	Block Group 5, Census Tract 91, Franklin County, Ohio	1005	63	6.3	0	0
OH	Franklin County	Block Group 3, Census Tract 63.10, Franklin County, Ohio	983	136	13.8	18	1.8
OH	Franklin County	Block Group 2, Census Tract 94.01, Franklin County, Ohio	1135	172	15.2	205	18.1
OH	Franklin County	Block Group 3, Census Tract 7.30, Franklin County, Ohio	873	593	67.9	397	45.5
OH	Franklin County	Block Group 1, Census Tract 74.92, Franklin County, Ohio	2623	630	24	0	0
OH	Franklin County	Block Group 2, Census Tract 79.41, Franklin County, Ohio	1978	367	18.6	45	2.3
OH	Franklin County	Block Group 2, Census Tract 104.02, Franklin County, Ohio	2235	659	29.5	106	4.9
OH	Franklin County	Block Group 3, Census Tract 63.93, Franklin County, Ohio	783	173	22.1	14	1.8
OH	Franklin County	Block Group 5, Census Tract 18.10, Franklin County, Ohio	1318	606	46	382	45
OH	Franklin County	Block Group 3, Census Tract 83.40, Franklin County, Ohio	852	283	33.2	469	65.6
OH	Franklin County	Block Group 4, Census Tract 96, Franklin County, Ohio	1372	0	0	163	11.9
OH	Franklin County	Block Group 5, Census Tract 94.20, Franklin County, Ohio	937	417	44.5	139	14.8
OH	Franklin County	Block Group 2, Census Tract 71.03, Franklin County, Ohio	1943	549	28.3	426	21.9
OH	Franklin County	Block Group 1, Census Tract 78.11, Franklin County, Ohio	599	7	1.2	36	6
OH	Franklin County	Block Group 1, Census Tract 11.22, Franklin County, Ohio	1193	420	35.2	376	33.3
OH	Franklin County	Block Group 1, Census Tract 70.44, Franklin County, Ohio	1139	340	29.9	114	10
OH	Franklin County	Block Group 2, Census Tract 69.10, Franklin County, Ohio	881	71	8.1	56	6.4
OH	Franklin County	Block Group 3, Census Tract 18.20, Franklin County, Ohio	770	165	21.4	83	10.8
OH	Franklin County	Block Group 2, Census Tract 36, Franklin County, Ohio	1097	644	58.7	286	26.1
OH	Franklin County	Block Group 1, Census Tract 81.20, Franklin County, Ohio	1592	841	52.8	307	19.3
OH	Franklin County	Block Group 3, Census Tract 83.80, Franklin County, Ohio	2037	364	17.9	239	11.7
OH	Franklin County	Block Group 1, Census Tract 96, Franklin County, Ohio	1180	969	82.1	499	42.3
OH	Franklin County	Block Group 1, Census Tract 106.02, Franklin County, Ohio	1754	342	19.5	72	4.4
OH	Franklin County	Block Group 2, Census Tract 27.30, Franklin County, Ohio	1179	912	77.4	478	40.5
OH	Franklin County	Block Group 2, Census Tract 79.57, Franklin County, Ohio	1212	28	2.3	148	12.9
OH	Franklin County	Block Group 1, Census Tract 63.51, Franklin County, Ohio	2134	599	28.1	293	13.7
OH	Franklin County	Block Group 3, Census Tract 73.05, Franklin County, Ohio	1262	511	40.5	97	7.7

OH	Franklin County	Block Group 3, Census Tract 63.95, Franklin County, Ohio	735	38	5.2	127	17.3
OH	Franklin County	Block Group 1, Census Tract 13.02, Franklin County, Ohio	840	157	18.7	369	74.8
OH	Franklin County	Block Group 3, Census Tract 64.30, Franklin County, Ohio	1053	23	2.2	0	0
OH	Franklin County	Block Group 2, Census Tract 75.33, Franklin County, Ohio	1291	979	75.8	278	22.5
OH	Franklin County	Block Group 2, Census Tract 8.20, Franklin County, Ohio	1103	645	58.5	295	26.7
OH	Franklin County	Block Group 2, Census Tract 92.40, Franklin County, Ohio	1486	528	35.5	259	17.4
OH	Franklin County	Block Group 3, Census Tract 83.12, Franklin County, Ohio	635	46	7.2	32	5
OH	Franklin County	Block Group 3, Census Tract 109, Franklin County, Ohio	1917	1102	57.5	205	10.7
OH	Franklin County	Block Group 2, Census Tract 69.33, Franklin County, Ohio	870	747	85.9	169	19.4
OH	Franklin County	Block Group 2, Census Tract 5, Franklin County, Ohio	1286	105	8.2	354	27.5
OH	Franklin County	Block Group 2, Census Tract 93.92, Franklin County, Ohio	936	615	65.7	21	2.2
OH	Franklin County	Block Group 1, Census Tract 102.01, Franklin County, Ohio	1130	0	0	0	0
OH	Franklin County	Block Group 1, Census Tract 88.25, Franklin County, Ohio	1440	336	23.3	107	7.4
OH	Franklin County	Block Group 1, Census Tract 14, Franklin County, Ohio	892	773	86.7	391	43.8
OH	Franklin County	Block Group 3, Census Tract 97.51, Franklin County, Ohio	2061	155	7.5	19	0.9
OH	Franklin County	Block Group 2, Census Tract 70.20, Franklin County, Ohio	2006	62	3.1	205	10.2
OH	Franklin County	Block Group 2, Census Tract 68.10, Franklin County, Ohio	1128	35	3.1	32	2.8
OH	Franklin County	Block Group 4, Census Tract 81.32, Franklin County, Ohio	1741	1014	58.2	351	20.2
OH	Franklin County	Block Group 3, Census Tract 93.32, Franklin County, Ohio	831	818	98.4	73	9.2
OH	Franklin County	Block Group 4, Census Tract 69.43, Franklin County, Ohio	1487	995	66.9	53	3.6
OH	Franklin County	Block Group 4, Census Tract 82.42, Franklin County, Ohio	1009	364	36.1	135	13.4
OH	Franklin County	Block Group 1, Census Tract 62.36, Franklin County, Ohio	1475	180	12.2	9	0.6
OH	Franklin County	Block Group 2, Census Tract 79.62, Franklin County, Ohio	1318	156	11.8	35	2.7
OH	Franklin County	Block Group 3, Census Tract 93.21, Franklin County, Ohio	1582	1244	78.6	775	49
OH	Franklin County	Block Group 2, Census Tract 48.10, Franklin County, Ohio	533	96	18	101	18.9
OH	Franklin County	Block Group 2, Census Tract 97.57, Franklin County, Ohio	2535	172	6.8	30	1.2
OH	Franklin County	Block Group 1, Census Tract 93.85, Franklin County, Ohio	1069	146	13.7	72	6.7
OH	Franklin County	Block Group 1, Census Tract 94.10, Franklin County, Ohio	1595	1001	62.8	15	0.9
OH	Franklin County	Block Group 1, Census Tract 67.21, Franklin County, Ohio	869	76	8.7	0	0
OH	Franklin County	Block Group 2, Census Tract 88.12, Franklin County, Ohio	1252	987	78.8	58	4.6
OH	Franklin County	Block Group 3, Census Tract 87.20, Franklin County, Ohio	1173	881	75.1	210	17.9
OH	Franklin County	Block Group 4, Census Tract 65, Franklin County, Ohio	798	13	1.6	0	0
OH	Franklin County	Block Group 3, Census Tract 46.20, Franklin County, Ohio	745	196	26.3	146	19.6
OH	Franklin County	Block Group 3, Census Tract 72.05, Franklin County, Ohio	1666	647	38.8	46	2.8
OH	Franklin County	Block Group 2, Census Tract 77.10, Franklin County, Ohio	1632	927	56.8	632	38.7
OH	Franklin County	Block Group 2, Census Tract 71.99, Franklin County, Ohio	2429	865	35.6	265	11
OH	Franklin County	Block Group 1, Census Tract 3.10, Franklin County, Ohio	1643	722	43.9	456	27.8
OH	Franklin County	Block Group 1, Census Tract 63.01, Franklin County, Ohio	942	267	28.3	339	36
OH	Franklin County	Block Group 1, Census Tract 26, Franklin County, Ohio	959	446	46.5	200	21.3
OH	Franklin County	Block Group 1, Census Tract 63.53, Franklin County, Ohio	2036	579	28.4	38	1.9
OH	Franklin County	Block Group 2, Census Tract 73.02, Franklin County, Ohio	3157	1090	34.5	39	1.2
OH	Franklin County	Block Group 3, Census Tract 59, Franklin County, Ohio	1517	1093	72.1	460	30.3
OH	Franklin County	Block Group 2, Census Tract 79.65, Franklin County, Ohio	1709	397	23.2	217	12.7
OH	Franklin County	Block Group 3, Census Tract 87.10, Franklin County, Ohio	1333	1061	79.6	441	33.1
OH	Franklin County	Block Group 1, Census Tract 94.95, Franklin County, Ohio	1307	204	15.6	0	0
OH	Franklin County	Block Group 4, Census Tract 97.53, Franklin County, Ohio	1308	70	5.4	31	2.4
OH	Franklin County	Block Group 3, Census Tract 43.01, Franklin County, Ohio	1988	237	11.9	202	10.2
OH	Franklin County	Block Group 2, Census Tract 83.30, Franklin County, Ohio	586	27	4.6	82	14
OH	Franklin County	Block Group 3, Census Tract 62.39, Franklin County, Ohio	1788	1129	63.1	407	22.8
OH	Franklin County	Block Group 1, Census Tract 63.72, Franklin County, Ohio	2127	1011	47.5	754	35.4
OH	Franklin County	Block Group 4, Census Tract 6, Franklin County, Ohio	562	142	25.3	95	16.9
OH	Franklin County	Block Group 2, Census Tract 63.21, Franklin County, Ohio	1382	82	5.9	22	1.6
OH	Franklin County	Block Group 3, Census Tract 89, Franklin County, Ohio	878	76	8.7	0	0
OH	Franklin County	Block Group 2, Census Tract 2.20, Franklin County, Ohio	725	110	15.2	0	0
OH	Franklin County	Block Group 1, Census Tract 72.13, Franklin County, Ohio	724	224	30.9	39	5.5
OH	Franklin County	Block Group 3, Census Tract 81.66, Franklin County, Ohio	1059	50	4.7	0	0
OH	Franklin County	Block Group 2, Census Tract 81.69, Franklin County, Ohio	892	67	7.5	416	48.6
OH	Franklin County	Block Group 2, Census Tract 15, Franklin County, Ohio	657	648	98.6	333	50.7
OH	Franklin County	Block Group 1, Census Tract 42, Franklin County, Ohio	434	180	41.5	216	49.8
OH	Franklin County	Block Group 1, Census Tract 46.10, Franklin County, Ohio	1134	146	12.9	72	6.3
OH	Franklin County	Block Group 2, Census Tract 69.91, Franklin County, Ohio	1409	26	1.8	0	0
OH	Franklin County	Block Group 2, Census Tract 92.52, Franklin County, Ohio	1165	773	66.4	99	8.5
OH	Franklin County	Block Group 4, Census Tract 93.12, Franklin County, Ohio	770	770	100	163	21.2
OH	Franklin County	Block Group 1, Census Tract 9.20, Franklin County, Ohio	564	523	92.7	97	17.2
OH	Franklin County	Block Group 5, Census Tract 49, Franklin County, Ohio	727	239	32.9	80	11
OH	Franklin County	Block Group 2, Census Tract 48.20, Franklin County, Ohio	272	110	40.4	69	25.4
OH	Franklin County	Block Group 4, Census Tract 63.84, Franklin County, Ohio	2543	525	20.6	0	0
OH	Franklin County	Block Group 2, Census Tract 93.36, Franklin County, Ohio	1211	611	50.5	80	6.6
OH	Franklin County	Block Group 4, Census Tract 56.20, Franklin County, Ohio	485	110	22.7	184	37.9
OH	Franklin County	Block Group 3, Census Tract 93.81, Franklin County, Ohio	2439	1132	46.4	93	3.8
OH	Franklin County	Block Group 3, Census Tract 27.60, Franklin County, Ohio	1585	1043	65.8	421	26.6
OH	Franklin County	Block Group 1, Census Tract 63.30, Franklin County, Ohio	517	0	0	0	0
OH	Franklin County	Block Group 2, Census Tract 73.98, Franklin County, Ohio	2362	1476	62.5	0	0
OH	Franklin County	Block Group 3, Census Tract 78.12, Franklin County, Ohio	1017	101	9.9	35	3.4
OH	Franklin County	Block Group 1, Census Tract 50.02, Franklin County, Ohio	774	329	42.5	508	70
OH	Franklin County	Block Group 4, Census Tract 102.01, Franklin County, Ohio	1414	1118	79.1	70	5
OH	Franklin County	Block Group 3, Census Tract 83.50, Franklin County, Ohio	2354	1181	50.2	356	15.2
OH	Franklin County	Block Group 2, Census Tract 18.10, Franklin County, Ohio	736	191	26	568	77.2
OH	Franklin County	Block Group 3, Census Tract 97.11, Franklin County, Ohio	803	280	34.9	72	9
OH	Franklin County	Block Group 4, Census Tract 75.53, Franklin County, Ohio	1133	931	82.2	41	3.6
OH	Franklin County	Block Group 2, Census Tract 105.01, Franklin County, Ohio	2930	1573	53.7	194	6.6
OH	Franklin County	Block Group 5, Census Tract 55, Franklin County, Ohio	1108	836	75.5	382	34.5
OH	Franklin County	Block Group 2, Census Tract 69.32, Franklin County, Ohio	801	371	46.3	349	43.6
OH	Franklin County	Block Group 1, Census Tract 74.27, Franklin County, Ohio	1294	161	12.4	176	13.6
OH	Franklin County	Block Group 2, Census Tract 93.94, Franklin County, Ohio	853	474	55.6	26	3
OH	Franklin County	Block Group 1, Census Tract 93.73, Franklin County, Ohio	3364	2985	88.7	399	11.9
OH	Franklin County	Block Group 2, Census Tract 28, Franklin County, Ohio	674	240	35.6	25	3.7
OH	Franklin County	Block Group 2, Census Tract 81.10, Franklin County, Ohio	627	159	25.4	34	5.4
OH	Franklin County	Block Group 2, Census Tract 95.90, Franklin County, Ohio	1177	55	4.7	188	16
OH	Franklin County	Block Group 2, Census Tract 81.71, Franklin County, Ohio	1372	185	13.5	271	19.8

OH	Franklin County	Block Group 3, Census Tract 71.14, Franklin County, Ohio	1414	618	43.7	340	24
OH	Franklin County	Block Group 2, Census Tract 71.12, Franklin County, Ohio	1846	769	41.7	100	5.8
OH	Franklin County	Block Group 2, Census Tract 63.92, Franklin County, Ohio	2334	168	7.2	51	2.2
OH	Franklin County	Block Group 1, Census Tract 63.95, Franklin County, Ohio	2036	570	28	270	13.3
OH	Franklin County	Block Group 1, Census Tract 74.94, Franklin County, Ohio	2338	910	38.9	330	14.1
OH	Franklin County	Block Group 2, Census Tract 54.20, Franklin County, Ohio	879	786	89.4	299	34
OH	Franklin County	Block Group 1, Census Tract 79.56, Franklin County, Ohio	1422	107	7.5	112	7.9
OH	Franklin County	Block Group 3, Census Tract 93.61, Franklin County, Ohio	1379	709	51.4	77	5.6
OH	Franklin County	Block Group 1, Census Tract 93.97, Franklin County, Ohio	1484	668	45	133	9
OH	Franklin County	Block Group 2, Census Tract 91, Franklin County, Ohio	1184	87	7.3	0	0
OH	Franklin County	Block Group 1, Census Tract 62.39, Franklin County, Ohio	1759	651	37	45	2.6
OH	Franklin County	Block Group 3, Census Tract 30, Franklin County, Ohio	1027	331	32.2	287	47.2
OH	Franklin County	Block Group 2, Census Tract 93.86, Franklin County, Ohio	1423	1061	74.6	300	21.1
OH	Franklin County	Block Group 1, Census Tract 65, Franklin County, Ohio	847	45	5.3	57	6.7
OH	Franklin County	Block Group 1, Census Tract 80.01, Franklin County, Ohio	842	19	2.3	16	1.9
OH	Franklin County	Block Group 2, Census Tract 98.01, Franklin County, Ohio	1778	5	0.3	431	24.2
OH	Franklin County	Block Group 3, Census Tract 73.03, Franklin County, Ohio	1373	124	9	0	0
OH	Franklin County	Block Group 3, Census Tract 19.01, Franklin County, Ohio	897	191	21.3	177	19.7
OH	Franklin County	Block Group 3, Census Tract 106.01, Franklin County, Ohio	2647	727	27.5	116	4.4
OH	Franklin County	Block Group 1, Census Tract 69.43, Franklin County, Ohio	1253	695	55.5	384	30.6
OH	Franklin County	Block Group 3, Census Tract 4.20, Franklin County, Ohio	672	13	1.9	28	4.2
OH	Franklin County	Block Group 3, Census Tract 83.11, Franklin County, Ohio	987	465	47.1	146	14.8
OH	Franklin County	Block Group 1, Census Tract 63.91, Franklin County, Ohio	2397	93	3.9	7	0.3
OH	Franklin County	Block Group 3, Census Tract 83.60, Franklin County, Ohio	1458	350	24	138	12.1
OH	Franklin County	Block Group 3, Census Tract 69.21, Franklin County, Ohio	959	744	77.6	498	51.9
OH	Franklin County	Block Group 2, Census Tract 8.10, Franklin County, Ohio	1083	365	33.7	450	41.6
OH	Franklin County	Block Group 1, Census Tract 19.02, Franklin County, Ohio	1010	131	13	44	4.4
OH	Franklin County	Block Group 3, Census Tract 72.09, Franklin County, Ohio	1904	547	28.7	122	6.4
OH	Franklin County	Block Group 2, Census Tract 94.98, Franklin County, Ohio	1498	1063	71	295	19.7
OH	Franklin County	Block Group 1, Census Tract 71.20, Franklin County, Ohio	1497	177	11.8	8	0.6
OH	Franklin County	Block Group 1, Census Tract 77.30, Franklin County, Ohio	1515	581	38.3	56	3.7
OH	Franklin County	Block Group 4, Census Tract 78.11, Franklin County, Ohio	1066	250	23.5	497	46.6
OH	Franklin County	Block Group 2, Census Tract 12, Franklin County, Ohio	728	212	29.1	262	46
OH	Franklin County	Block Group 4, Census Tract 50.02, Franklin County, Ohio	910	447	49.1	443	48.7
OH	Franklin County	Block Group 3, Census Tract 63.97, Franklin County, Ohio	1135	284	25	189	16.7
OH	Franklin County	Block Group 2, Census Tract 93.93, Franklin County, Ohio	1130	998	88.3	339	30
OH	Franklin County	Block Group 6, Census Tract 74.24, Franklin County, Ohio	894	272	30.4	68	8.4
OH	Franklin County	Block Group 1, Census Tract 83.21, Franklin County, Ohio	1230	427	34.7	363	29.5
OH	Franklin County	Block Group 5, Census Tract 69.32, Franklin County, Ohio	1458	1192	81.8	239	16.4
OH	Franklin County	Block Group 1, Census Tract 70.41, Franklin County, Ohio	2448	665	27.2	108	5.6
OH	Franklin County	Block Group 2, Census Tract 75.31, Franklin County, Ohio	1689	1579	93.5	547	32.4
OH	Franklin County	Block Group 1, Census Tract 68.22, Franklin County, Ohio	892	214	24	56	6.3
OH	Franklin County	Block Group 3, Census Tract 1.20, Franklin County, Ohio	744	50	6.7	15	2
OH	Franklin County	Block Group 1, Census Tract 81.32, Franklin County, Ohio	1721	831	48.3	262	15.2
OH	Franklin County	Block Group 2, Census Tract 94.20, Franklin County, Ohio	2051	1003	48.9	790	39.7
OH	Franklin County	Block Group 1, Census Tract 88.11, Franklin County, Ohio	799	410	51.3	200	26.3
OH	Franklin County	Block Group 3, Census Tract 66, Franklin County, Ohio	1037	57	5.5	16	1.6
OH	Franklin County	Block Group 4, Census Tract 46.10, Franklin County, Ohio	890	145	16.3	73	8.2
OH	Franklin County	Block Group 1, Census Tract 73.97, Franklin County, Ohio	853	125	14.7	0	0
OH	Franklin County	Block Group 2, Census Tract 73.01, Franklin County, Ohio	3198	1774	55.5	214	6.7
OH	Franklin County	Block Group 2, Census Tract 79.64, Franklin County, Ohio	1727	213	12.3	50	2.9
OH	Franklin County	Block Group 1, Census Tract 93.26, Franklin County, Ohio	2221	2004	90.2	659	29.7
OH	Franklin County	Block Group 1, Census Tract 103, Franklin County, Ohio	2327	656	28.2	460	19.9
OH	Franklin County	Block Group 1, Census Tract 25.20, Franklin County, Ohio	601	595	99	414	68.9
OH	Franklin County	Block Group 2, Census Tract 70.10, Franklin County, Ohio	900	556	61.8	158	17.6
OH	Franklin County	Block Group 6, Census Tract 71.93, Franklin County, Ohio	1038	9	0.9	0	0
OH	Franklin County	Block Group 1, Census Tract 73.94, Franklin County, Ohio	708	69	9.7	0	0
OH	Franklin County	Block Group 1, Census Tract 81.64, Franklin County, Ohio	1648	783	47.5	302	18.3
OH	Franklin County	Block Group 1, Census Tract 75.50, Franklin County, Ohio	1430	1319	92.2	134	9.4
OH	Franklin County	Block Group 1, Census Tract 97.53, Franklin County, Ohio	744	3	0.4	0	0
OH	Franklin County	Block Group 1, Census Tract 11.21, Franklin County, Ohio	5204	1158	22.3	0	0
OH	Franklin County	Block Group 2, Census Tract 40.02, Franklin County, Ohio	1135	250	22	94	8.3
OH	Franklin County	Block Group 3, Census Tract 93.22, Franklin County, Ohio	930	769	82.7	62	6.7
OH	Franklin County	Block Group 3, Census Tract 60, Franklin County, Ohio	739	284	38.4	211	29.5
OH	Franklin County	Block Group 2, Census Tract 58.20, Franklin County, Ohio	1397	164	11.7	144	10.4
OH	Franklin County	Block Group 1, Census Tract 27.10, Franklin County, Ohio	1798	1554	86.4	390	22.4
OH	Franklin County	Block Group 1, Census Tract 107, Franklin County, Ohio	1302	315	24.2	80	6.1
OH	Franklin County	Block Group 1, Census Tract 63.52, Franklin County, Ohio	810	430	53.1	125	15.4
OH	Franklin County	Block Group 1, Census Tract 82.42, Franklin County, Ohio	1471	593	40.3	231	15.7
OH	Franklin County	Block Group 2, Census Tract 72.02, Franklin County, Ohio	3018	1940	64.3	322	10.8
OH	Franklin County	Block Group 1, Census Tract 77.21, Franklin County, Ohio	694	421	60.7	3	0.4
OH	Franklin County	Block Group 2, Census Tract 3.20, Franklin County, Ohio	1768	574	32.5	412	23.3

Appendix G

Acronyms and Abbreviations

Appendix G: Acronyms and Abbreviations

ACS - American Community Survey

AEDT - Aviation Environmental Design Tool

AGL - Above Ground Level

APE - Area of Potential Effects

BCC - Birds of Conservation Concern

BVLOS - Beyond Visual Line of Sight

CEQ - Council on Environmental Quality

CFR - Code of Federal Regulations

COA - Certificate of Waiver or Authorization

CZMP - Coastal Zone Management Plan

dB - Decibel

DC - Distribution Center

DNL - Day-Night Average Sound Level

DOT - Department of Transportation

EA - Environmental Assessment

EJSCREEN - Environmental Justice Screening and Mapping Tool

EO - Executive Order

EPA - Environmental Protection Agency

ESA - Endangered Species Act

FAA - Federal Aviation Administration

FEMA - Federal Emergency Management Agency

FHWA - Federal Highway Administration

IPaC - Information for Planning and Consultation

IPP - UAS Integration Pilot Program

NAS - National Airspace System

NEPA - National Environmental Policy Act

NHPA - National Historic Preservation Act

NMFS - National Marine Fisheries Service

NOAA - National Oceanic and Atmospheric Administration

NPDES - National Pollutant Discharge Elimination System

NRHP - National Register of Historic Places

NRI - Nationwide Rivers Inventory

NTSB - National Transportation Safety Board

ODNR - The Ohio Department of Natural Resources

OpSpecs - Operations Specifications

PSP - Partnership for Safety Program

RPIC - Remote Pilot in Command

SHPO - State Historic Preservation Office(r)

THPO - Tribal Historic Preservation Office(r)

U.S.C - United States Code

UA - Unmanned Aircraft

UAS - Unmanned Aircraft Systems

UPSFF - UPS Flight Forward, Inc.

USFWS - United States Fish and Wildlife Service

WSRS - National Wild and Scenic Rivers System