Finding of No Significant Impact/Record of Decision and Final Environmental Assessment

UPS Flight Forward, Inc.
Drone Package Delivery Operations
Winston-Salem, NC

December 2022

United States Department of Transportation
Federal Aviation Administration

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Cover Image: UPS Flight Forward

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Finding of No Significant Impact/Record of Decision for Final Environmental Assessment for UPS Flight Forward, Inc. Drone Package Delivery Operations in Winston-Salem, North Carolina

Introduction

The Federal Aviation Administration (FAA) prepared the attached Environmental Assessment (EA) to analyze the potential environmental impacts that may result from FAA's approval of the Part 135 air carrier Operations Specifications (OpSpecs) amendments requested by UPS Flight Forward, Inc. (UPSFF) to expand drone package delivery operations in Winston-Salem, North Carolina (described in more detail in the Proposed Action section below). The requested approval would, among other things, add descriptive language to UPSFF's OpSpecs about the operating area boundaries. This approval would enable UPSFF to expand unmanned aircraft (UA)[1] commercial delivery operations in Winston-Salem (operating area boundary is depicted in Figure 1 of the EA). The approval of UPSFF's OpSpec amendments for this operating area is considered a major federal action subject to National Environmental Policy Act (NEPA) review requirements.

The FAA prepared the EA in accordance with the National Environmental Policy Act of 1969, as amended (42 United States Code [U.S.C.] § 4321 et seq.); Council on Environmental Quality's (CEQ) NEPA implementing regulations (40 Code of Federal Regulations [CFR] parts 1500 to 1508); and FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*.

After completing the EA and reviewing and analyzing available data and information on existing conditions and potential impacts, the FAA has determined that the proposed action will not significantly affect the quality of the human environment. Therefore, the preparation of an Environmental Impact Statement is not required, and the FAA is issuing this Finding of No Significant Impact (FONSI) and Record of Decision (ROD). The FAA has made this determination in accordance with applicable

[1] Drone and UA may be used interchangeably.

environmental laws and regulations. The EA is incorporated by reference into and supports this FONSI/ROD.

Purpose and Need

The FAA has multiple approvals associated with UPSFF's commercial delivery operations in Winston-Salem. However, the FAA amendment of UPSFF's OpSpecs to add the expanded area of operations (as depicted in Figure 1 of the EA) is the approval that will ultimately enable the expansion of UA commercial delivery operations in this area. UPSFF's request for OpSpec amendments requires FAA review and approval.[2] The FAA has a statutory obligation to review UPSFF's request to amend the OpSpecs and determine whether the issuance would affect safety in air transportation or air commerce, and whether the public interest requires the amendment. After making this determination, the FAA must take an action on the OpSpecs amendment.

The purpose of UPSFF's request is 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 area. UPSFF has determined that it needs to increase the number of Distribution Centers (DCs) it operates in Winston-Salem in order to safely expand its commercial package delivery operations in the area.

See Section 1.3 of the EA for further information.

Proposed Action

In order for UPSFF to be issued the amended OpSpecs under its Part 135 air carrier certificate, it must receive a number of approvals from the FAA, such as a waiver of 14 CFR § 91.113(b) to enable beyond visual line of sight (BVLOS) operations and a Certificate of Waiver or Authorization (COA). UPSFF has requested that the FAA amend the OpSpecs in its Part 135 air carrier certificate; this is the FAA approval that ultimately would enable the expanded commercial delivery operations in Winston-Salem. The proposed action is the FAA approval of an amendment to UPSFF's B050 OpSpec, *Authorized Areas of En Route Operations, Limitations, and Provisions*, specifically a reference section titled Limitations, Provisions, and Special Requirements. The approval would include a paragraph with descriptive language about the operating area boundaries (depicted in Figure 1 of the attached EA), including the

[2] UPSFF's Part 135 air carrier certificate was issued in September 2019.

specific location and operational profile proposed in UPSFF's request. The operating area is also the study area for the EA.

Under the scope of the proposed action (discussed in Section 2.1 of the attached EA), UPSFF will continue operations at existing DCs located at Meads Hall, Piedmont Plaza (Piedmont) and Miller Infusion Center/Miller Medical Plaza (Miller). UPSFF is seeking to expand the number of potential daily operations at these three locations and begin operations at three new DCs: Country Club Road (Country Club), Downtown Health Plaza (Downtown), and Shepherd Street (Shepherd). UPSFF projects operating a maximum of 14 flights per operating day between the Meads Hall DC and Piedmont DC; 14 flights per operating day between the Meads Hall DC and Miller DC; 28 flights per operating day between the Meads Hall DC and Downtown DC; 28 flights per operating day between the Meads Hall DC and Shepard DC; and 28 flights per operating day between the Meads Hall DC and Country Club DC. One delivery flight includes the outbound takeoff and inbound landing at the DC.

The operating area is approximately 40.4 square miles in Winston-Salem, NC. The proposed operations would occur during daylight hours Monday-Friday, with no flights on holidays. No nighttime operations are anticipated or requested under the proposed action.

The OpSpec amendment will restrict UPSFF to the operating area identified in Figure 1 of the EA. The FAA's analysis was completed for the known DC locations identified in Figure 1 of the EA.. Any future DC locations that are outside of the characteristics of these locations, such as locations that are not within parking lots or other developed properties, will require further FAA review. Additionally, 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. As its business grows, UPSFF could increase the projected number of delivery flights per day in the study area, but any substantial increase in the projected number of delivery flights per day would receive appropriate NEPA review by the FAA.

See Section 2.1 of the EA for further information.

Alternatives

Alternatives analyzed in detail in the EA include the proposed action and the no action alternative. Under the no action alternative, the FAA would not issue the approvals necessary, including the amendment to the OpSpecs, to enable UPSFF to expand UA commercial delivery operations in the

operating area. Under the no action alternative, UPSFF could continue to conduct package delivery operations in this operating area under their existing OpSpecs. This alternative does not support the stated purpose and need.

See Section 2.2 of the EA for further information.

Environmental Impacts

The potential environmental impacts from the proposed action and no action alternative were evaluated in the attached EA for each of the environmental impact categories identified in FAA Order 1050.1.F. In the attached EA, Section 3 describes the physical, natural, and human environment within the project study area, and identifies those environmental impact categories that are not analyzed in detail, explaining why the proposed action would have no potential effects on those environmental impact categories. Those categories are: Air Quality; Climate; Coastal Resources; Farmlands; Hazardous Materials, Solid Waste, and Pollution Prevention; Land Use; Natural Resources and Energy Supply; Socioeconomic Impacts and Children's Environmental Health and Safety Risks; Visual Effects (Light Emissions Only); and Water Resources (Wetlands, Floodplains, Groundwater, and Wild and Scenic Rivers).

Section 3 also provides detailed evaluations of the potential environmental consequences for each of the remaining environmental impact categories and documents the finding that no significant environmental impacts would result from the proposed action. A summary of the documented findings for each category, including requisite findings with respect to relevant special purpose laws, regulations, and executive orders, is presented below:

- **Biological Resources (including Fish, Wildlife, and Plants), EA Section 3.2.** 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. The Endangered Species Act (ESA) of 1973 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. Federal agencies are responsible for determining if an action "may affect" listed species or critical habitat, 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.

The Migratory Bird Treaty Act of 1918 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. The Bald and Golden Eagle Protection Act of 1940 prohibits anyone from "taking" a bald or golden eagle, including their parts, nests, or eggs, without a permit issued by the USFWS. The USFWS 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. The official species list also 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.

Additionally, the North Carolina Wildlife Resources Commission lists species of amphibians, birds, fish, mammals, reptiles, and mollusks as state-designated endangered, threatened, or species of special concern within the State of North Carolina.

The proposed action will not involve ground construction or habitat modification, as the landing and take off locations are in places that are already developed. The operations will be taking place within airspace, and typically well above the tree line and away from sensitive habitats. The average number of daily operations and altitude of the flights (approximately 250 feet above ground level) are not expected to affect wildlife in the area.

Bird species are expected to be most sensitive to disturbance from drones during the breeding season when they are selecting nest sites and protecting young in nests. The EA identifies several special status bird species that could breed in the study area, including the Bald Eagle (see the U.S. Fish and Wildlife Service Information for Planning and Consultation report, or IPaC report, and official species list in Appendix A of the EA). UPSFF has agreed to a monitoring plan for Bald Eagle nests that integrates multiple strategies and resources. If UPSFF identifies a Bald Eagle nest or is notified of the presence of a nest, UPSFF will establish an avoidance area such

that there is a 1,000 feet vertical and horizontal separation distance between a vehicle's flight path and the nest. This avoidance area will be maintained until the end of the breeding season or until a qualified biologist indicates the nest has been vacated.

The Red-headed Woodpecker is a BCC that may occur in the operating area. Red-headed Woodpecker nest locations should not be disturbed during the breeding period (May 10 to September 10)[3] 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 the breeding season or until a qualified biologist indicates the nest has been vacated.

There is no critical habitat within the operating area for any species identified in the official species list. There are no ESA-listed bird species identified in the operating area.

The federally threatened Northern Long-eared Bat (*Myotis septentrionalis*), as well as two state bat species of concern, the Eastern Big-eared Bat and Eastern Small-footed Bat, have the potential to occur within the operating area. While these bat species may occur within the operating area, they should not encounter the aircraft as UPSFF's proposed operations will be limited to daylight hours. Based on the operating times proposed by UPSFF, the FAA has made a finding of *no effect* for the Northern Long-eared Bat. Similarly, the FAA has determined that the proposed action will cause no significant impacts to state bat species of concern, the Eastern Big-eared Bat and Eastern Small-footed Bat, because USPFF's operations will be limited to daylight hours.

Additionally, the Monarch Butterfly (*Danaus plexippus*) is a candidate for federal listing and could occur in the operating area. 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.

The FAA has determined that the proposed action will cause no significant impacts to state-listed species. State protected bird species may display disturbance behaviors towards drones,

[3] See Official Species List in Appendix A of the EA.

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.

The proposed action will not involve ground construction or habitat modification and no impacts to fish, reptiles, or terrestrial mammal species are expected. The proposed action would not result in: extirpation of a species from the project area; adverse impacts to special status species or their habitats; substantial impacts to native species' habitats or their populations; or adverse impacts on any species' reproductive success rates, natural mortality rates, non-natural mortality, or ability to sustain the minimum population levels required. The FAA's analysis finds that the proposed action is not expected to cause any significant impacts to biological resources.

- **Department of Transportation (DOT) Act, Section 4(f) Resources, EA Section 3.3.** Section 4(f) of the DOT Act protects significant publicly owned parks, recreational areas, wildlife and waterfowl refuges, and public and private historic sites. Section 4(f) states that, subject to exceptions for de minimis impacts:[4] "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.

  The FAA identified many properties that could meet the definition of a Section 4(f) resource within the operating area. These include Salem Creek Trail, Bolton Park, Griffith Park, Miller Park, and Forest Park. There are several historic sites in the operating area as listed on the North Carolina State Historic Preservation Office (SHPO) website; however, these historic properties are generally considered for architectural purposes or historical events and will not typically be affected by UA operations. There are no wildlife refuges or wilderness areas in the operating area.

  There will be no physical use of Section 4(f) resources under the proposed action. The FAA has determined that infrequent UA overflights as described in the proposed action would not cause

[4] 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

substantial impairment to Section 4(f) resources, and therefore would not be considered a constructive use of any Section 4(f) resource. As described in the Section 3.5 of the EA and the Noise Analysis Report (Appendix C of the EA), noise and visual effects from UPSFF's occasional overflights are not expected to diminish the activities, features, or attributes of any resources in the study area. Therefore, there will be no significant impacts to Section 4(f) resources as a result of the proposed action.

- **Historical, Architectural, Archaeological, and Cultural Resources, EA Section 3.4.** 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. Compliance with Section 106 requires consultation with the State Historic Preservation Officer (SHPO) and applicable other parties, including Indian tribes. The FAA identified several historic sites in the operating area; however, these sites are considered for architectural or other purposes that will not typically be affected by UA operations.

  On April 26, 2022 the FAA consulted the SHPO and Catawba Indian Nation THPO for operations proposed within the entire APE as shown in Figure 1. On May 27, 2022, the NC SHPO responded with no objections to the proposed action and concurred with a finding of *no effect* to historic resources. There was no response from the Catawba Indian Nation THPO. The 2022 historic outreach letters can be found in Appendix B.

  Based on the nature of potential UA effects on historic properties, namely limited to non-physical, reversible impacts, as well as the limited number of daily flights, and the FAA's noise exposure analysis discussed in Section 3.5 and attached in Appendix C, there would be no effect on historic or cultural resources from this action. Therefore, the action will not have a significant impact to historic, architectural, archaeological, or cultural resources.

- **Noise and Noise-Compatible Land Use, EA Section 3.5 and Appendix C.** The FAA has issued requirements for assessing aircraft noise in FAA Order 1050.1F, Appendix B. The FAA's required noise metric for aviation noise analysis is the yearly Day-Night Average Sound Level (DNL) metric. A significant noise impact is defined in Order 1050.1F as an increase in noise of DNL 1.5 decibel (dB) or more at or above DNL 65 dB DNL noise exposure or a noise exposure at or above

the 65 dB level due to a DNL 1.5 dB or greater increase. The compatibility of existing and planned land uses with an aviation proposal is usually associated with noise impacts.
The proposed action is not anticipated to result in any significant changes in the overall noise environment within the affected area. There is no construction and therefore no construction noise that will result from the proposed action. There are no airstrips and small airports in the study area.

The maximum noise exposure levels within the study area will occur at the DC locations.

Piedmont and Miller DCs

At the Piedmont and Miller DC sites, noise levels at or above DNL 45 dB could extend up to 100 feet from the DC locations, with DNL levels at or above DNL 50 dB extending up to 50 feet, and DNL levels of DNL 55 dB or greater extending up to 20 feet from the DC location, respectively. At each of these sites the extents of noise levels at or above DNL 45 dB would remain entirely within the vicinity of the DC infrastructure on the DC property and are well below the threshold of DNL 65 dB for compatible land use.

Downtown DC

At the proposed Downtown DC site, noise levels at or above DNL 45 dB could extend up to 200 feet from the DC location, 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 60 dB or greater extending up to 20 feet from the DC location, respectively. At the proposed Downtown DC site, there is no residential land use within the extents of noise levels at or above DNL 45 dB and any residential locations in the vicinity are well below the threshold of DNL 65 dB for compatible land use.

Shepherd DC

At the proposed Shepherd Street DC site, 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 60 dB or greater extending up to 20 feet from the DC location, respectively. The extents of noise levels at or above DNL 50 dB would remain entirely within the vicinity of the proposed Shepherd Street DC site infrastructure on the Shepherd Street property. The extents of noise levels at or above DNL

45 dB to DNL 50 dB could include surrounding residential properties, as shown in Figures 18 and 19, but is well below the threshold of DNL 65 dB for compatible land use.

Country Club DC

At the proposed Country Club DC site, 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 60 dB or greater extending up to 20 feet from the DC location, respectively. The extents of noise levels at or above DNL 60 dB would remain entirely within the vicinity of the proposed Country Club DC site infrastructure on the Country Club property. The extents of noise levels at or above DNL 45 dB to DNL 60 dB could include surrounding residential properties, but is below the threshold of DNL 65 dB for compatible land use.

Meads Hall DC

At the Meads Hall DC site, noise levels at or above DNL 45 dB could extend up to 600 feet from the DC location, with DNL levels at or above DNL 50 dB extending up to 200 feet, DNL levels of DNL 55 dB or greater extending up to 100 feet, and DNL levels of 60 dB or greater extending up to 50 feet, and DNL levels of 65 dB or greater extending up to 20 feet from the DC location, respectively. The extents of noise levels at or above DNL 55 dB would remain entirely within the vicinity of the Meads Hall DC infrastructure on the Meads Hall property. The extents of noise levels at or above between DNL 45 dB to DNL 55 dB could include surrounding residential properties, but is well below the threshold of DNL 65 dB for compatible land use.

For en route operations between each of the DC's, the estimated noise exposure for en route flight paths would not exceed DNL 45 dB at any location within the study area.

Based on FAA's noise analysis, the proposed action will not have a significant noise impact.

- **Environmental Justice, EA Section 3.6.** 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 addressing disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.

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 within Forsyth County, North Carolina. Based on census block data, obtained through the FAA's Aviation Environmental Design Tool (AEDT), the percentage of low-income individuals residing within the study area at the census block group level is approximately 21.97 percent as compared to 17.17 percent in the reference community. The FAA's AEDT analysis data is included in Appendix F of the EA.

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 Forsyth County, North Carolina. The percentage of minority persons residing within the study area at the census block group level, approximately 52.63 percent, is somewhat higher than that of the reference community, at approximately 44.66 percent. However, while there is a minority population in the study area, 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.

The proposed action will not result in adverse impacts in any environmental resource category. In particular, as noted in Section 3.5, *Noise and Noise-Compatible Land Use*, the UA's noise emissions could be perceptible in areas within the operating area, but will stay well below the level determined to constitute a significant impact. The FAA is not aware of impacts that would uniquely affect low-income or minority populations. For these reasons, the proposed action would not result in a disproportionately high or adverse effect on a low-income or a minority population, nor would the action result in a significant environmental justice impact.

- **Visual Effects (Visual Resources and Visual Character), EA Section 3.7.** 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. Impacts to visual resources are not expected to be significant. 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 such as Section 4(f) properties

where the visual setting is an important resource of the property. However, the short duration that each UA flight could be seen from any particular resource in the operating area combined with the low number of proposed flights per day minimizes any potential for significant impacts. Accordingly, any potential impacts of the proposed action on visual resources and visual character will not be significant.

- **Water Resources (Surface Waters), EA Section 3.8.** Surface water resources generally consist of oceans, wetlands, lakes, rivers, and streams. The Clean Water Act (CWA) established the National Pollutant Discharge Elimination System 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 CWA. Waters of the United States are defined by the CWA and are protected by various regulations and permitting programs administered by the Environmental Protection Agency and the U.S. Army Corps of Engineers.

  Approximately 0.16 square miles of surface waters occur within the operating area, or less than one percent of the area, based on the Environmental Justice Screening and Mapping Tool (EJSCREEN) report for this proposed action (Appendix E). Surface waters in the study area include Salem Creek, Burke Creek, Little Creek, Silas Creek, and South Fork Muddy Creek, in addition to wetlands that are also protected by the CWA. As there are no construction activities occurring under the proposed action that could impact surface waters, the proposed action would not be expected to result in impacts to surface water resources. Additionally, the UA is not expected to become lost in the event of a water landing as UPSFF is required to locate and secure any downed aircraft. For these reasons, the proposed action would not have the potential to exceed water quality standards established by federal, state, local, and tribal regulatory agencies; or contaminate public drinking water supply such that public health may be adversely affected.

The proposed action would not be anticipated to result in cumulative impacts to environmental resources within the operating area.

Finding

The FAA finding is based on a comparative examination of environmental impacts for each of the alternatives studied during the environmental review process. The EA discloses the potential environmental impacts for each of the alternatives and provides a full and fair discussion of those impacts. Based on FAA's review and analysis and consideration of comments, the agency has determined that there would be no significant impacts to the natural environment or surrounding population as a result of the proposed action.

The FAA believes the proposed action best fulfills the purpose and need identified in the EA. In contrast, the no action alternative fails to meet the purpose and need identified in the EA. An FAA decision to take the required actions and approvals is consistent with its statutory mission and policies supported by the findings and conclusions reflected in the environmental documentation and this FONSI.

After careful and thorough consideration of the facts contained herein and following consideration of the environmental impacts described, the undersigned finds that the proposed federal action is consistent with existing national environmental policies and objectives as set forth in section 101(a) of the National Environmental Policy Act of 1969 and other applicable environmental requirements and will not significantly affect the quality of the human environment or otherwise include any condition requiring consultation pursuant to Section 102(2)(C) of NEPA.

Decision and Order

The FAA recognizes its responsibilities under NEPA, CEQ regulations, and its own directives. Recognizing these responsibilities, I have carefully considered the FAA's goals and objectives in reviewing the environmental aspects of the proposed action to approve UPSFF's request to expand its UA commercial delivery operations in Winston-Salem. Based upon the above analysis, the FAA has determined that the proposed action meets the purpose and need.

The environmental review included the purpose and need to be served by the proposed action, alternatives to achieving them, the environmental impacts of these alternatives, and conditions to preserve and enhance the human environment. This decision is based on a comparative examination of the environmental impacts for each of these alternatives. The attached EA provides a fair and full discussion of the impacts of the proposed action. The NEPA process included appropriate consideration

for avoidance and minimization of impacts, as required by NEPA, the CEQ regulations, and other special purpose environmental laws, and appropriate FAA environmental orders and guidance.

The FAA has determined that environmental concerns presented by interested agencies and the general public have been addressed in the EA. The FAA believes that, with respect to the proposed action, the NEPA requirements have been met. FAA approval of this environmental review document indicates that applicable federal requirements for environmental review of the proposed action have been met.

After careful and thorough consideration of the facts contained herein, the undersigned finds that the proposed federal action is consistent with existing national environmental policies and objectives as set forth in Section 101 of NEPA and other applicable environmental requirements and will not significantly affect the quality of the human environment or otherwise include any condition requiring consultation pursuant to Section 102(2)(C) of NEPA.

Issued on: December 23, 2022

DAVID M MENZIMER

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Date: 2022.12.23 06:32:08 -08'00'

David Menzimer
Aviation Safety
Manager, General Aviation Operations Branch
General Aviation and Commercial Division
Office of Safety Standards, Flight Standards Service

Right of Appeal

This FONSI/ROD constitutes a final agency action and a final order taken pursuant to 49 U.S.C. §§ 40101 et seq., and constitutes a final order of the FAA Administrator which is subject to exclusive judicial review by the Courts of Appeals of the United States in accordance with the provisions of 49 U.S.C. § 46110. Any party having substantial interest in this order may apply for a review of the decision by filing a petition for review in the appropriate U.S. Court of Appeals no later than 60 days after the order is issued in accordance with the provisions of 49 U.S.C. § 46110.

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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 expand unmanned aircraft (UA) commercial package delivery operations within a 40.4 square mile operating area located in Winston-Salem, NC using the 29-pound Matternet M2 UA. UPSFF proposes to operate at a total of six Distribution Centers (DCs) including continuing operations at three existing DC locations at Meads Hall, Piedmont Plaza (Piedmont), and Miller Infusion Center/Miller Medical Plaza (Miller), and at three new DC locations at Country Club Road (Country Club), Downtown Health Plaza (Downtown), and Shepherd Street (Shepherd). Based on the scope of the proposed action, as discussed in Section 2.1., UPSFF seeks to modify existing operations by adding routes between Meads Hall and the three new DCs. UPSFF projects operating a maximum of 112 delivery operations per operating day throughout the area. UPSFF projects operating a maximum of 14 flights per operating day between the Meads Hall DC and Piedmont DC; 14 flights per operating day between the Meads Hall DC and Miller DC; 28 flights per operating day between the Meads Hall DC and Downtown DC; 28 flights per operating day between the Meads Hall DC and Shepard DC; and 28 flights per operating day between the Meads Hall DC and Country Club DC. An increase in the scope of operations will require additional regulatory approvals and environmental review. The proposed operations would occur during daylight hours Monday-Friday, with no flights on holidays. No nighttime operations are anticipated or requested under the proposed action. The approval of UPSFF's amended OpSpecs to include this expanded operating area in Winston-Salem 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 UA commercial delivery operations at six DCs within a 40.4 square mile airspace box located in Winston-Salem, NC, 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* and the FAA Order 1050.1F Desk Reference.

1.2 Background and Location

In 2012, Congress first charged the FAA with integrating unmanned aircraft systems (UAS) into the National Airspace System (NAS).[5] 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.

[5] 49 U.S.C. 44802; FAA Modernization and Reform Act of 2012, Pub. L. No. 112-95, Sec. 332. 126 Stat. 11, 73 (2012).

Over the past several years UPSFF has been working under various FAA programs, including the UAS Integration Pilot Program (IPP),[6] the Partnership for Safety Plan (PSP) Program,[7] and the BEYOND program,[8] 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 UA, through the use of current regulations and exemptions and waivers from some of these regulatory requirements.

UPSFF was one of the first to obtain an FAA Part 135 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 amended 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.

The location is shown in Figure 1 below, with the operating area outlined in red and the DCs identified using the green pins. The operating area should also be considered as the study area for the purposes of this EA. There are no airports in the operating area. There is one heliport in the operating area, and it is located at the same hospital campus as the Meads Hall and Miller DCs . The heliport is only used as needed to support medical emergencies.

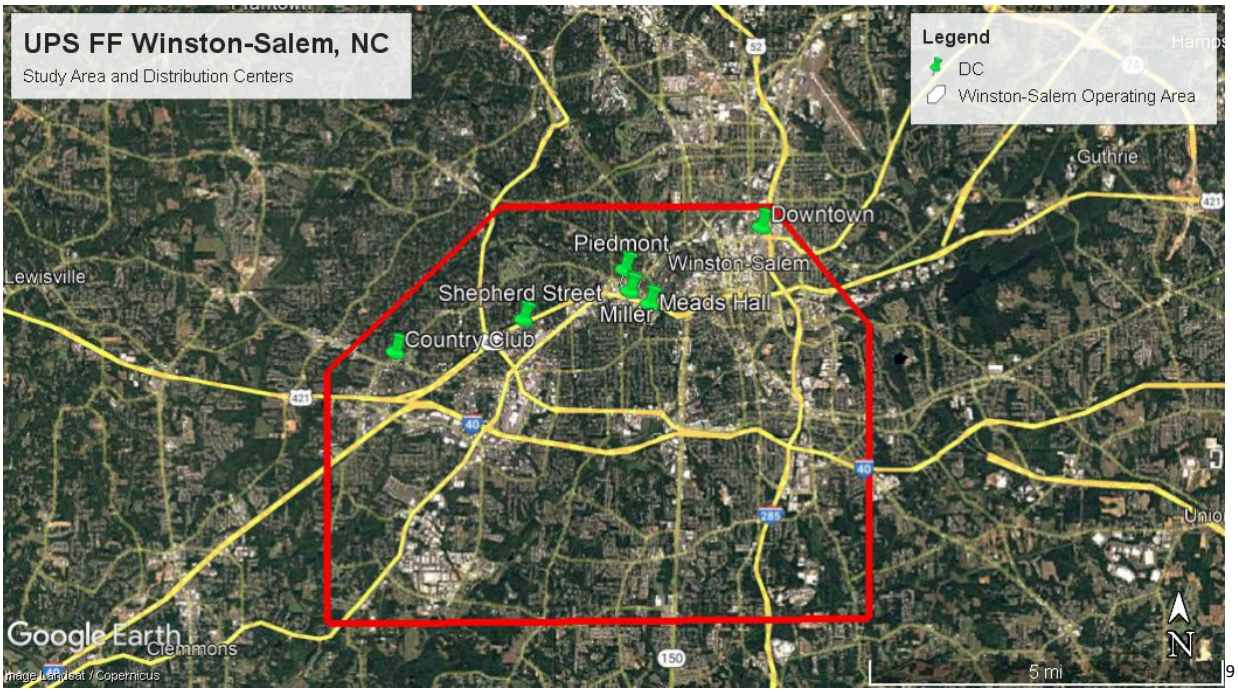


Figure 1 *Study Area in Winston-Salem, North Carolina*

[6] 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/

[7] https://www.faa.gov/uas/programs_partnerships/psp/

[8] https://www.faa.gov/uas/programs_partnerships/beyond/

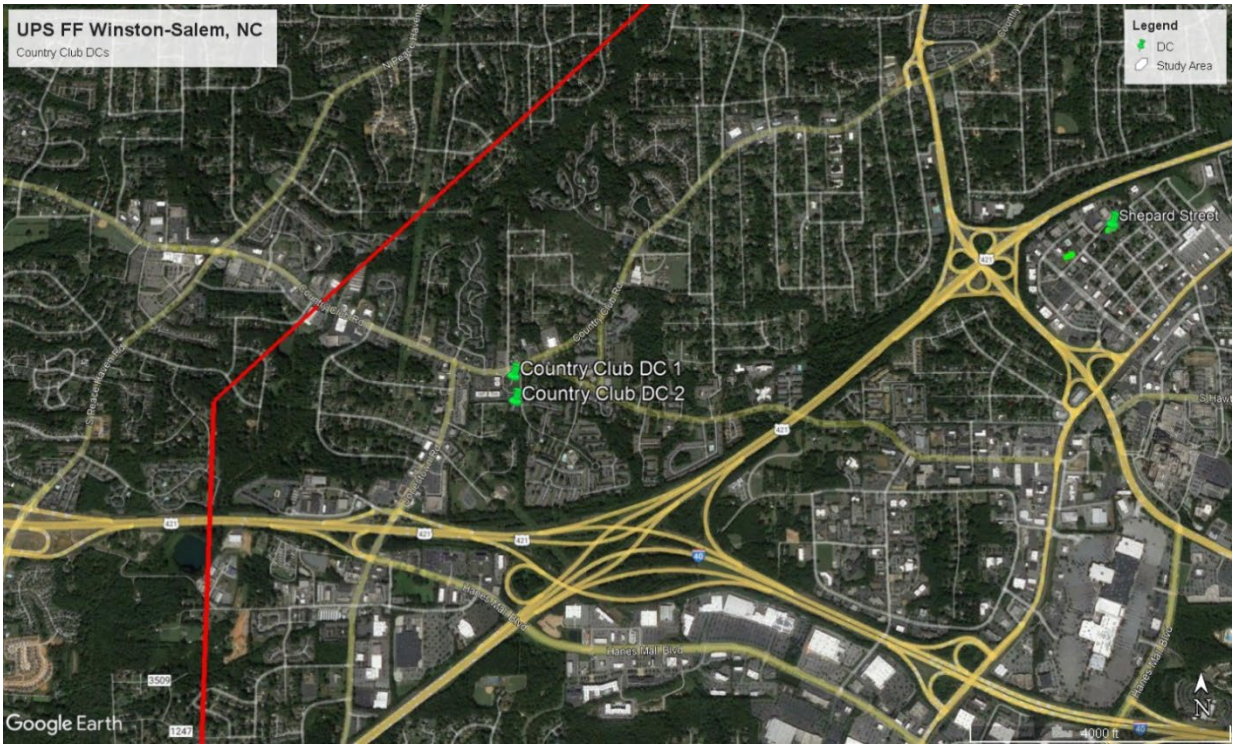
[9] Image: Google Earth, as modified by the FAA

UPSFF proposes to conduct deliveries of healthcare and other consumer products to multiple DCs within the Winston-Salem operating area.[10] As part of issuance of the previous COA and OpSpecs for UPSFF at this location, the FAA conducted NEPA reviews for limited UAS delivery operations at Meads Hall, Piedmont, and Miller DCs.[11] No significant environmental impacts were identified in the reviews, and the FAA determined that an Environmental Impact Statement was not required.

1.2.1 Distribution Centers (DCs)

Country Club DC

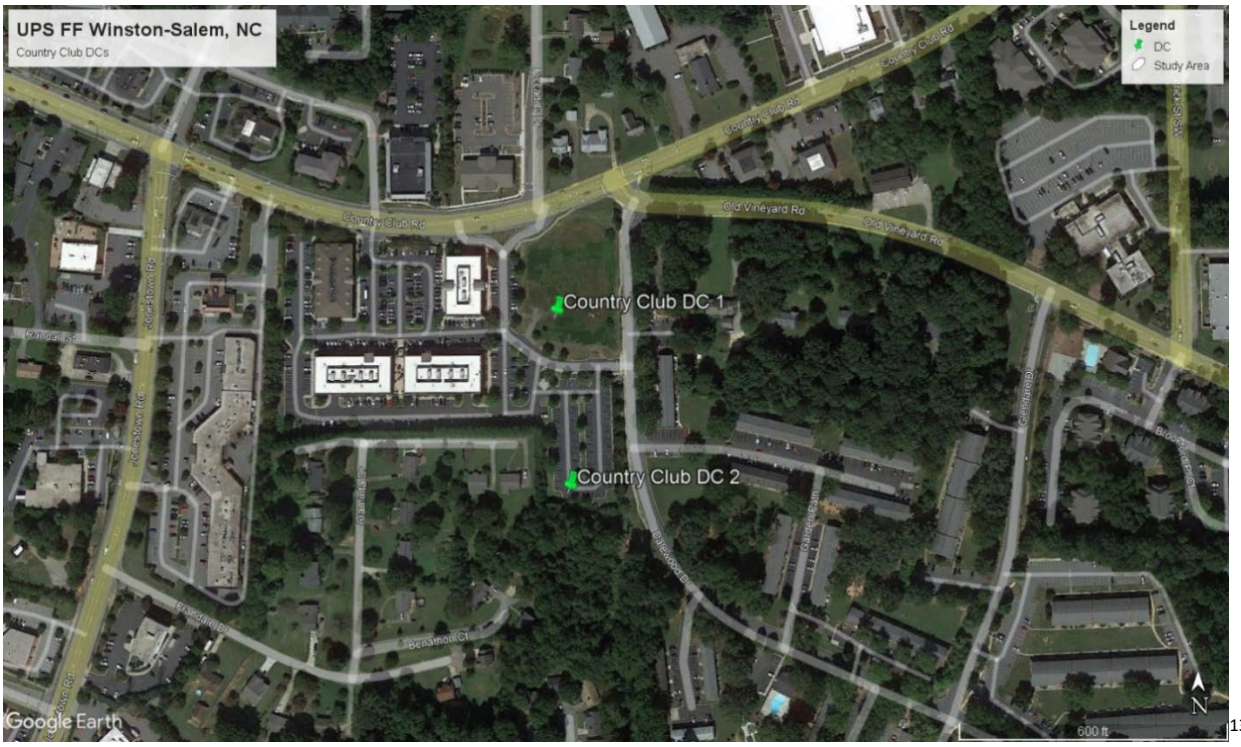
UPSFF has proposed two possible locations for the Country Club DC as shown in Figures 2 and 3. Only one of the proposed locations will be used once UPSFF makes a selection. The proposed locations are in close proximity to each other and are located on the property of the Wake Forest Baptist Health University Internal Medicine building located at 4614 Country Club Rd, Winston-Salem, NC 27104. The property and the surrounding area to the north and south is zoned for commercial use where restaurants and other businesses are located. The areas just east and south of the DC are residential neighborhoods. The closest intersection is Dalewood Dr. and Old Vineyard Rd.



12

Figure 2 *View of the Two Potential Country Club DC Locations, and the Shepard Street Location*

[10] Each delivery site is pre-approved by UPSFF to ensure that the area is capable of receiving deliveries.
[11] See UPSFF Winston-Salem FONSI/ROD and Final EA from December 2021: https://www.faa.gov/uas/advanced_operations/nepa_and_drones
[12] Image: Google Earth, as modified by the FAA



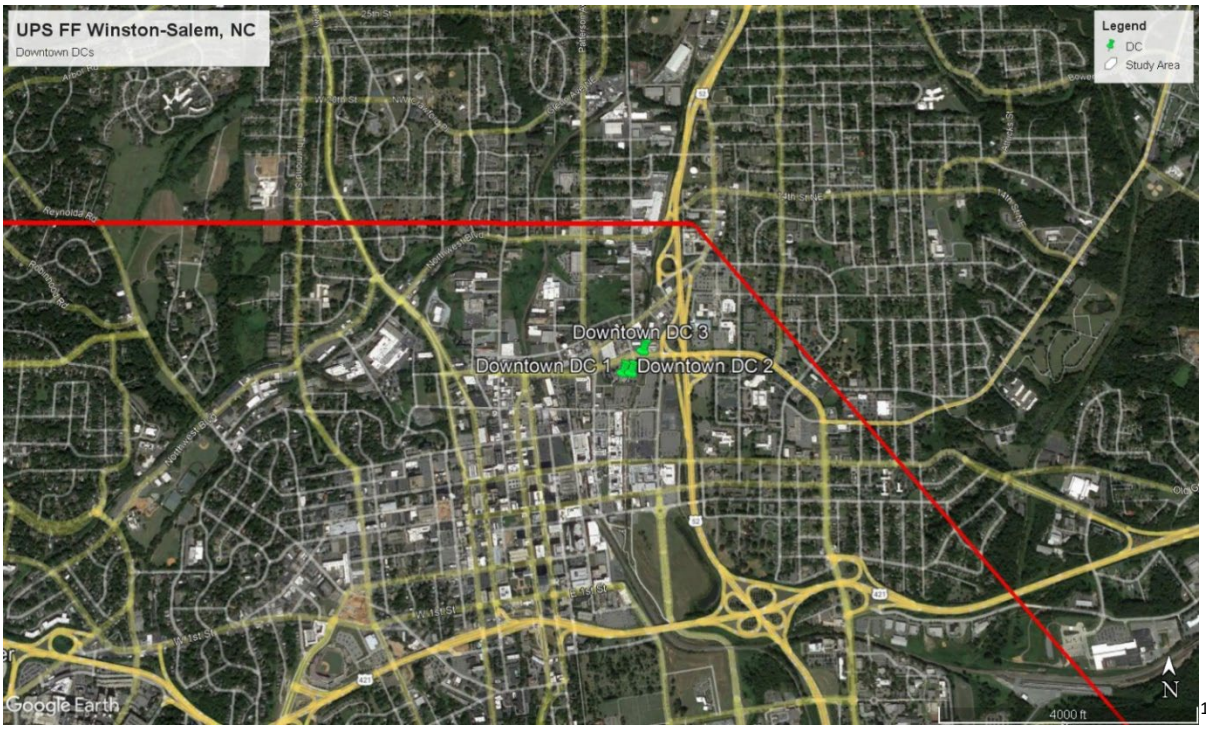
[13]

Figure 3 *Closer View of Two Potential Country Club DC Locations*

Downtown Health Plaza DC

UPSFF has proposed three possible locations for the Downtown DC as shown in Figures 4 and 5. Only one of the proposed locations will be used once UPSFF makes a selection. The proposed locations are in close proximity to each other and are located on the property of the Downtown Health Plaza building at 1200 N. Martin Luther King Jr. Dr., Winston-Salem, NC 27101. The property is zoned for industrial use. The areas to the north and west of the DC are commercial districts where restaurants and other businesses are located. Immediately to the east is the North Research Parkway and the John Gold Memorial Expressway. Across the expressway are businesses and government buildings. There are residential neighborhoods to the southeast and Carter High School across the highway to the northeast.

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



[14]

Figure 4 *View of Three Potential Downtown Distribution Centers and Surrounding Area*

[15]

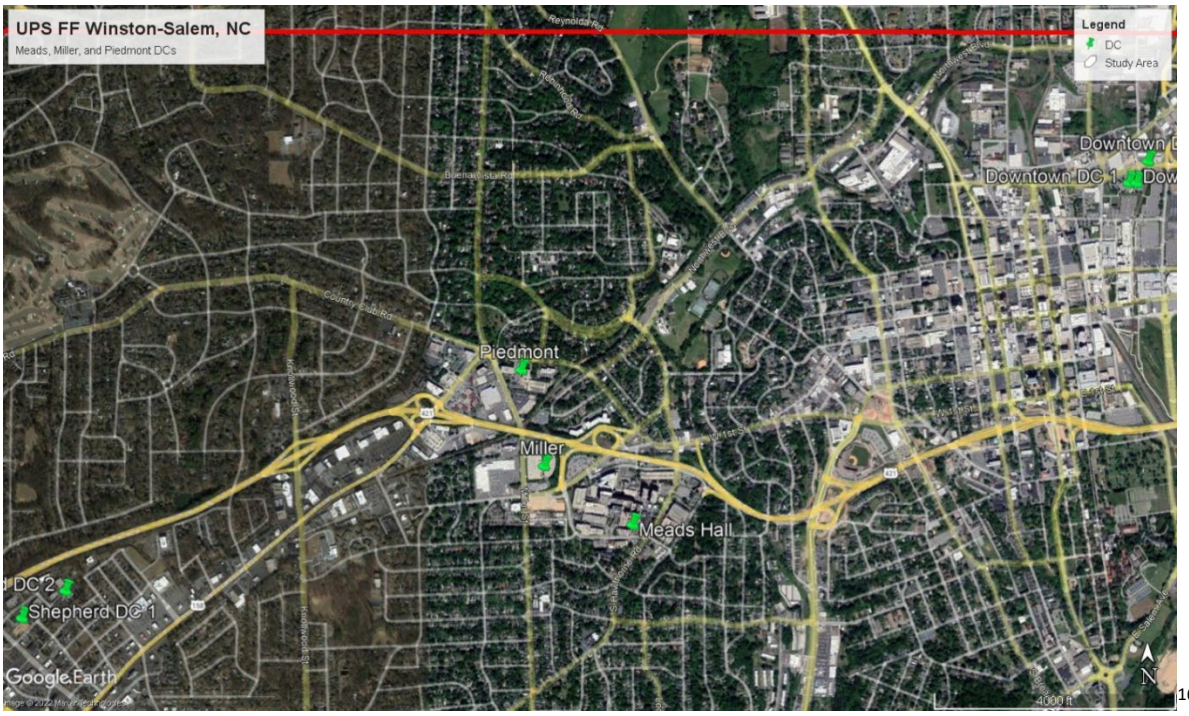
Figure 5 *Closer View of Three Potential Downtown Distribution Center Locations*

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

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

Meads Hall DC

The Meads Hall DC is located across the street from the MRI Center at 2008 Queen St, Winston-Salem, NC 27103. The property is zoned for institutional and mixed uses. The area is surrounded by residential neighborhoods except a commercial district to the northwest where the Miller Center and other businesses are located. The closest intersection is Queen St. and South Hawthorne Rd. The DC is approximately a quarter mile from U.S. 421/Salem Parkway. See Figures 6 and 7. Note: the red line in the top of Figure 6 is the north side of the operating area boundary.



[16]

Figure 6 *View of Piedmont, Miller and Meads Hall DCs and Surrounding Area*

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

[17]

Figure 7 *Closer View of Meads Hall Distribution Center*

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

Miller DC

The Miller DC is located at 131 Miller Street, Winston-Salem, NC 27103. The property is zoned for commercial use. The areas surrounding the DC are primarily commercial districts where restaurants and other businesses are located with residential neighborhoods across U.S. 421/Salem Parkway to the northeast. The closest intersection is Miller Street and U.S. 421/Salem Parkway. See Figures 6 and 8.

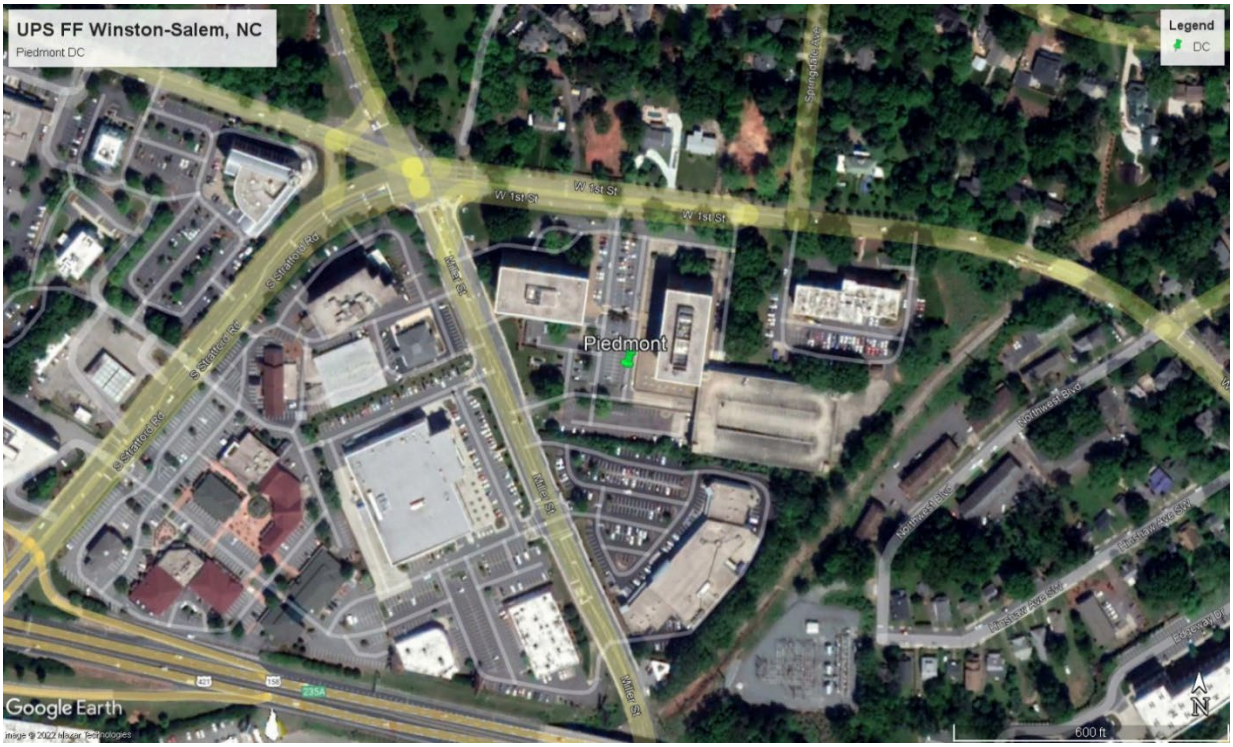
[18]

Figure 8 *Closer View of Miller Distribution Center*

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

Piedmont DC

The Piedmont DC is located at 1920 W 1st Street, Winston-Salem, NC 27104. The property and immediate areas to the southwest are zoned for commercial use where resturants and other businesses are located. The areas just north and east of the DC are residental neighborhoods with U.S. 421/Salem Parkway approximately 0.15 miles to the south. The closest intersection is West 1st Street and Miller Street. See Figures 6 and 9.



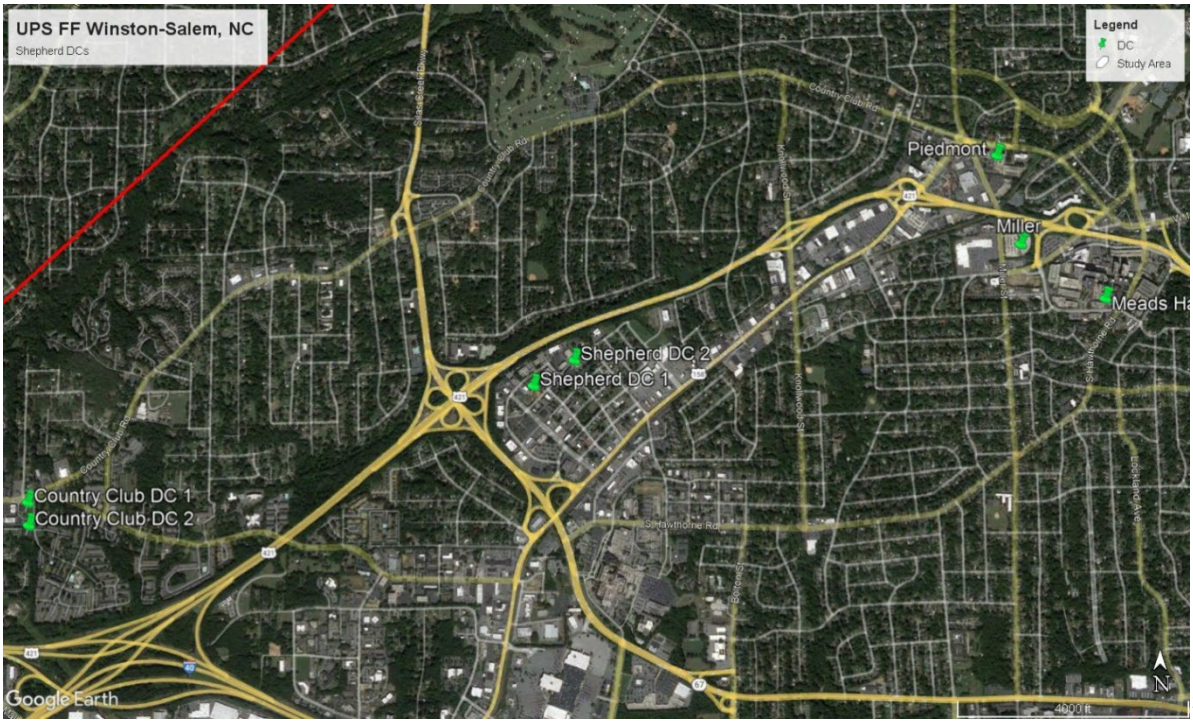
19

Figure 9 *Closer View of Piedmont Distribution Center*

Shepherd Street DC

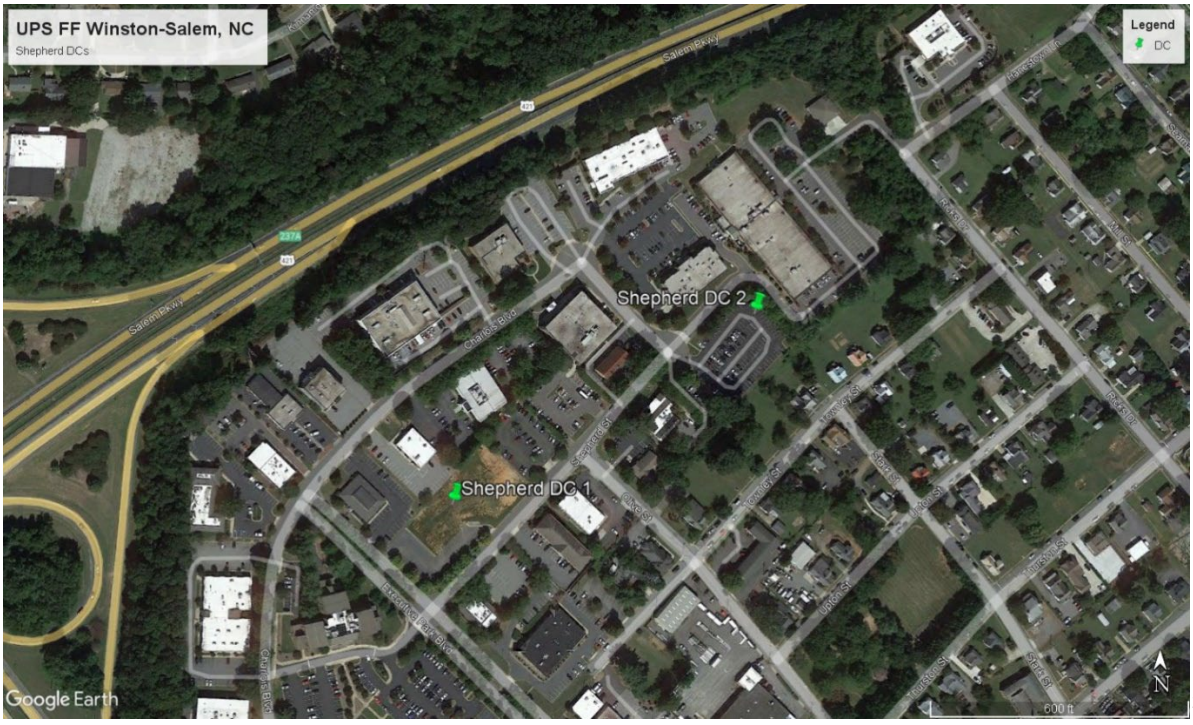
UPSFF has proposed two possible locations for the Shepherd DC as shown in Figures 10 and 11. Only one of the proposed locations will be used once UPSFF makes a selection. The proposed locations are in close proximity to each other and are located near the intersection of Shepherd St. and Olive St. The property is zoned for commercial use where various businesses are located. U.S. 421/Salem Parkway approximately is approximately 650 feet to the north and NC Highway 67 is approximately 0.20 miles to the west. Across both parkways to the north and west and areas immediately to the east are residential neighborhoods, with more businesses located to the south. Note: the red line in the upper left corner of Figure 10 is the northwest side of the operating area boundary.

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



[20]

Figure 10 *View of Two Potential Shepherd Distribution Center Locations and Surrounding Area*



[21]

Figure 11 *Closer View of Two Potential Shepherd DC Locations*

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

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 Winston-Salem; however, the FAA issuance of the amended OpSpecs is the approval that will ultimately enable UA BVLOS commercial delivery operations in this area. UPSFF's request for amended OpSpecs to add a new area of operations requires FAA review and approval.

The FAA has a statutory obligation to review UPSFF's request to amend the OpSpecs and determine whether the amendment would affect safety in air transportation or air commerce and 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. §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 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 expand UA commercial delivery service in the Winston-Salem area, which, in its business judgment, UPSFF has determined is an appropriate market for expanded operations. UPSFF's requested OpSpec amendments are needed so that UPSFF can continue and expand limited UA commercial delivery operations in the area. The approval will offer UPSFF an opportunity to continue to assess the viability of the UA commercial delivery option 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 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 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 Winston-Salem, NC.

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 location; 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 seeks to modify existing operations by expanding routes to three new DC locations at Country Club, Shepherd, and Downtown. Based on the scope of the proposed modification, UPSFF projects operating a maximum of 14 delivery flights per operating day between the Meads Hall DC and Piedmont DC; 14 delivery flights per operating day between the Meads Hall DC and Miller DC; 28 delivery flights per operating day between the Meads Hall DC and Downtown DC; 28 delivery flights per operating day between the Meads Hall DC and Shepherd DC; and 28 delivery flights per operating day between the Meads Hall DC and Country Club DC. These projected daily operating numbers are shown in Table 2-1 below. In total, UPSFF projects operating an approximate maximum of 112 delivery operations per day in the Winston-Salem operating area, which is an increase over the number of projected daily deliveries in the 2021 EA noted earlier. Additional regulatory approvals and environmental review would be needed to increase the number of flights per day. The operations would occur during daylight hours up to five 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 between DC Locations

DC Location	Average Daily Number of Operations Between DCs	DC Location
Meads Hall	14	Piedmont
Meads Hall	14	Miller
Meads Hall	28	Downtown
Meads Hall	28	Shepherd
Meads Hall	28	Country Club

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 aircraft 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 feet 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 for final delivery.

2.2 No Action Alternative

The alternative to the proposed action is the no action alternative, in which the FAA would not issue the approvals necessary, including the amendment to the OpSpecs, to enable UPSFF to expand UA commercial package delivery operations in the operating area. Under the no action alternative, UPSFF could continue to conduct package delivery operations in this operating area under existing OpSpecs. This alternative does not support the stated purpose and need. However, it was retained as required by the Council on Environmental Quality (CEQ) regulations (40 CFR 1502.14(c)).

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 Figure 1 in this report. 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 emissions that could result in air quality impacts or climate impacts. Electricity consumed for battery charging will 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 not directly affect any shorelines, change the use of shoreline zones, or be inconsistent with any National Oceanic and Atmospheric Administration (NOAA)-approved state Coastal Zone Management Plan (CZMP) since there are no coastal zones or shorelines in the area of operations.

- **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 impacts in relation to hazardous materials, pollution prevention, and solid waste is not anticipated. Additionally, each UA is made from recoverable materials and will be properly managed at the end of its operating life in accordance with 14 CFR Part 43. There were no Environmental Protection Agency (EPA) Superfund sites identified within the study 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. UPSFF's aircraft will be battery-powered and will not consume fuel resources.

- **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. Additionally, 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 nearest proximity of a school to a DC in the study area is at the Meads Hall DC, where the Brunson Elementary School is approximately 0.45 miles (2,391 feet) from the DC. This distance is outside of the 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 study area.

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.[22]

3.2.2 Affected Environment

This section describes the existing biological environment of the operating area. The operating area is in the Southern Outer Piedmont ecoregion of North Carolina, characterized by relatively low, gentle hills, with a mix of forest and cleared land.[23]

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

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 official species list. The study area covered the entire operating area, outlined in red in Figure 1 of this EA. The official species list is included as Appendix A.

Based on the official species list, there are no ESA-listed bird species in the study area. The Northern Long-eared Bat (*Myotis septentrionalis*), a threatened bat species, is identified in the official species list as having the potential to occur in the operating area. 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 North Carolina Wildlife Resources Commission (the Commission) lists 248 species of amphibians, birds, fish, mammals, reptiles, and mollusks as endangered, threatened, or of special concern within the State of North Carolina.[24] The majority of these species do not occur in the operating area because it is located outside their range and/or suitable habitat is not present in the operating area. Of the 248 species listed by the Commission, the FAA identified 17 species as having the potential to occur within the operating area for at least part of the year. These species are identified in Table 3-1 below.

Table 3-1 North Carolina State Species of Concern

Status	Species Name
State Endangered (Birds)	American Peregrine Falcon (*Falco peregrinus anatum*)

[22] 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.
[23] North Carolina Wildlife Resources Commission. 2015 Wildlife Action Plan. Available: https://www.ncwildlife.org/plan#6718619-2015-document-downloads. Accessed: December 13, 2021.
[24] North Carolina Wildlife Resources Commission. Protected Wildlife Species of North Carolina. Available: https://www.ncwildlife.org/Portals/0/Conserving/documents/Protected-Wildlife-Species-of-NC.pdf. Accessed: January 3, 2022.

	Common Tern (*Sterna hirundo*)
State Threatened (Birds)	Bald Eagle (*Haliaeetus leucocephalus*)
	Caspian Tern (*Hydroprogne caspia*)
	Northern Saw-whet Owl (*Aegolius acadicus*)
State Special Concern (Birds)	Brown Creeper (*Certhia americana nigrescens*)
	Cerulean Warbler (*Setophaga cerulea*)
	Golden-winged Warbler (*Vermivora chrysoptera*)
	Least Bittern (*Ixobrychus exilis*)
	Little Blue Heron (*Egretta caerulea*)
	Loggerhead Shrike (*Lanius ludovicianus*)
	Red Crossbill (*Loxia curvirostra*)
	Snowy Egret (*Egretta thula*)
	Vesper Sparrow (*Pooecetes gramineus*)
State Species of Concern (Mammals)	Eastern Big-eared Bat (*Corynorhinus rafinesquii macrotis*)
	Eastern Small-footed Bat (*Myotis leibii leibii)*
	Pungo White-footed Mouse (*Peromyscus leucopus easti*)

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.[25]

The official species list 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 does nest in forested areas near creeks in the area, and, as stated in the National Bald Eagle Management Guidelines,[26] 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. Other BCC species may be nesting within the operating area at certain times of the year, including the Cerulean Warbler (*Dendroica cerulea*), Eastern Whip-poor-will (*Antrostomus vociferus*), Prothonotary Warbler (*Protonotaria citrea*), Rusty Blackbird (*Euphagus carolinus*), and Wood Thrush (*Hylocichla mustelina*),

[25] 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.
[26] 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.

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.

3.2.3 Environmental Consequences

There will be no ground construction or habitat modification associated with the proposed action. The DCs are in already developed locations. 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 cruising altitude 250 feet AGL and follow a preplanned route to its delivery site. The pre-planned route is optimized to avoid properties where large numbers of people may congregate outdoors, including schools, and recreation areas. The aircraft will stay at its cruising altitude of approximately 250 feet 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 for approximately 22 seconds. After landing the package is retrieved for final delivery.

Special Status Species

The federally threatened Northern Long-eared Bat, as well as two state bat species of concern, the Eastern Big-eared Bat and Eastern Small-footed Bat, have the potential to occur within the operating area. While these bat species may occur within the operating area, they should not encounter the aircraft as UPSFF's proposed operations will be limited to daytime hours. Based on the operating times proposed by UPSFF, the FAA has made a finding of *no effect* for Northern Long-eared Bats under the Endangered Species Act. Similarly, the FAA hasdetermined that the proposed action will cause no significant impacts to state bat species of concern.

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.

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.

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, usually five to nine feet in diameter, with a vertical depth up to eight feet, and UPSFF should be able to visually identify any nests that may be present in the area.[27] 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

[27] USFWS Midwest Region: Identification of Large Nests. Available: https://www.fws.gov/midwest/eagle/Nhistory/nest_id.html. Accessed: December 13, 2021

(September 1 through July 31 in North Carolina) or a qualified biologist indicates the nest has been vacated.[28]

Red-headed Woodpecker nest locations should not be disturbed during the breeding period (May 10 to September 10)[29] 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 the breeding season or until a qualified biologist indicates the nest has been vacated. Online resources such as iNaturalist may also be used to identify Red-headed Woodpecker nests that may be active in the operating area. 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 private historic sites. Section 4(f) states that, subject to exceptions for de minimis impacts:[30] "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

[28] Step 6 – Eagle Protection. Raleigh Ecological Services Field Office. Available: https://www.fws.gov/raleigh/PR_16.html. Accessed: January 4, 2022.
[29] See Official Species List in Appendix A of this EA.
[30] 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

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.[31]

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 many properties that could meet the definition of a Section 4(f) resource within the operating area, including public parks, historic sites, and recreation areas. Section 4(f) resources in the operating area include Salem Creek Trail, Bolton Park, Griffith Park, Miller Park and Forest Park. There are no wilderness areas or wildlife refuges in the operating area.

There are several historic sites within the operating area as listed on the North Carolina State Historic Preservation Office (SHPO) website; however, most of these are considered for architectural or other purposes that will not typically be affected by UA operations.[32] Also, as discussed in Section 3.4, Historical, Architectural, Archaeological, and Cultural Resources, the FAA has previously consulted with the North Carolina SHPO for UPSFF route approvals to determine whether historic and traditional cultural properties would be affected by the proposed action, and support the FAA's determination that the proposed UA operations will not cause adverse effects to historic properties. On April 26, 2022, the FAA informed the North Carolina SHPO of the agency's determination that the proposed action has no potential to cause effects to historic properties within the operating area boundary, and the SHPO concurred that there will be no effects in their response letter dated May 27, 2022.

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

[31] 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

[32] Available: https://nc.maps.arcgis.com/apps/webappviewer/index.html?id=79ea671ebdcc45639f0860257d5f5ed7. Accessed: May 16, 2022.

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 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 between DC locations. 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. 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 when 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 Figure 1 in this EA. The FAA identified several historic sites that were listed on the North Carolina SHPO website.[33] However, these sites are considered for architectural or other purposes that will not typically be affected by UA operations.

[33] North Carolina State Historic Preservation Office GIS Web Service. Available: https://nc.maps.arcgis.com/apps/webappviewer/index.html?id=79ea671ebdcc45639f0860257d5f5ed7. Accessed: May 16, 2022.

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 limited number of daily flights that UPSFF is proposing – initially 112 delivery operations per day within an approximately 40.4 square mile area – means that any historic or cultural resources would be subject to only a small number of overflights per day, if any.

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. 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 this undertaking will have no potential to cause effects to historic properties, in accorance with 36 CFR § 800.3(a)(1).

Prior to UPSFF's route approvals in 2021, the FAA conducted historic and cultural outreach in accordance with 36 CFR § 800.4(a)(1). Additionally, in June of 2020 the FAA consulted with the SHPO and the Catawba Indian Nation THPO for operations along two routes between Meads Hall and Miller DCs, and between Miller and Piedmont DCs. On July 29th, 2020 the FAA received a response from the SHPO agreeing with FAA's no potential to effect determination. The FAA again sent consultation letters to the SHPO and THPO in September of 2020 and in December of 2021 for continuation of operations on a longer term basis. The FAA again received a response from the SHPO agreeing with FAA's determination on January 20, 2022. The FAA did not receive any responses or objections from the Catawba Indian Nation THPO. The FAA's tribal and historic outreach letters for the 2021 UPSFF Winston-Salem EA can be found in the appendix to that Final EA, which is posted on the FAA's website.[34]

On April 26, 2022 the FAA conducted outreach with the SHPO and THPO for operations proposed within the APE as shown in Figure 1. On May 27, 2022, the NC SHPO responded with no objections to the proposed action and concurred with a finding of no effect to historic resources. The 2022 historic outreach letters can be found in Appendix B.

Based on consultation with the THPO and SHPO, 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, and religious structures and sites, and parks, recreational areas, areas with wilderness characteristics, wildlife refuges, and cultural and historical sites."

[34] Available: https://www.faa.gov/uas/advanced_operations/nepa_and_drones. Accessed: December 17, 2021

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 Day-Night Average Sound Level (DNL) metric. The DNL metric is a single value representing the logarithmically average 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 40.4 square miles, and the estimated population within the area is roughly 90,170. The population density is approximately 2,298 persons per square mile.[35] There are no airports in the operating area. There is one heliport in the operating area, and it is located at the same hospital campus as the Meads Hall and Miller DCs. The heliport is located outside of the DNL 45 dB noise contour at both of these DCs and only used to support medical emergencies as needed.

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 defined in Sections 1 and 2, the noise analysis methodology detailed in Appendix C was then used to the estimate DNL levels for the proposed UPSFF Winston-Salem operations. Noise levels were calculated for each flight phase and are presented in the following two sub-sections:

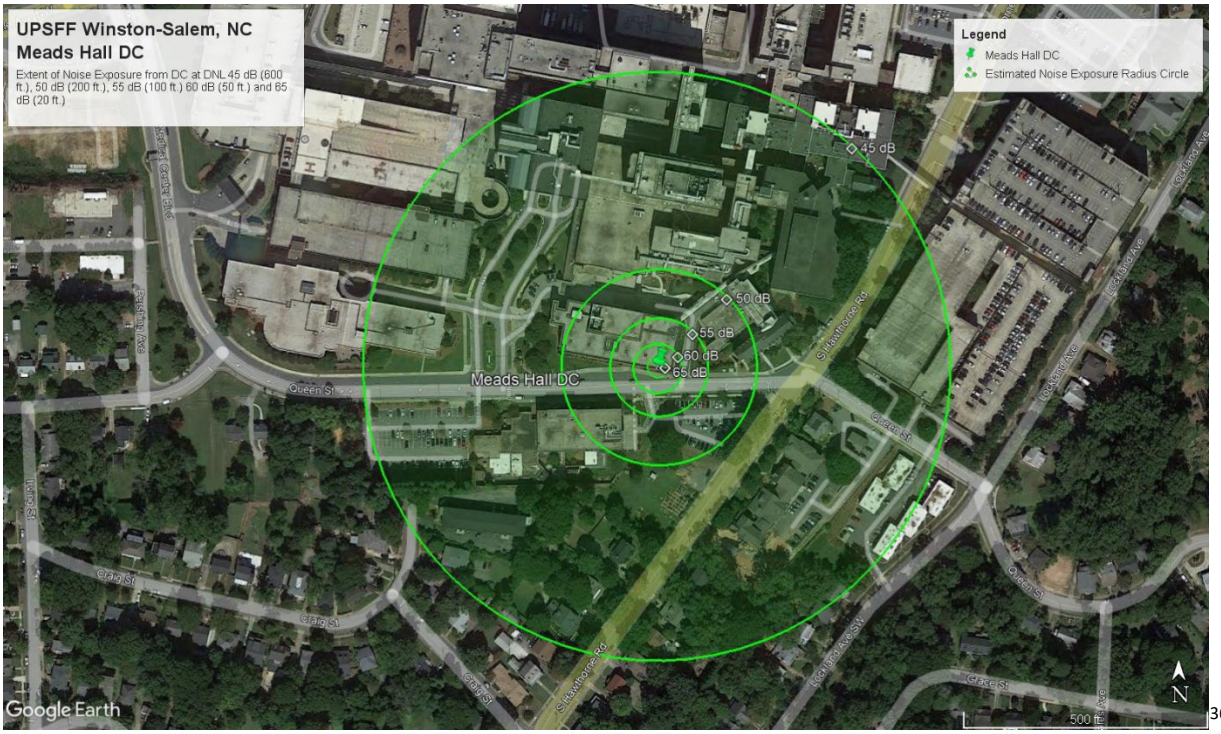
- Noise Exposure for Operations at the Landing Pad
- Noise Exposure under En route Paths

Noise Exposure for DC Operations

Based on the anticipated average daily maximum number of deliveries provided by UPSFF, the extent of DNL 45 dB associated with operations is shown in Figures 12 through 21. These regions were determined based on a review of the layout of takeoff and landing site plans including an analysis of

[35] Environmental Protection Agency's (EPA) Environmental Justice Screening Tool (EJSCREEN). Available: https://www.epa.gov/ejscreen. Accessed: May 162022

UPSFF's typical operation profile and using the noise level information presented in referencing Table 4 of Appendix C.



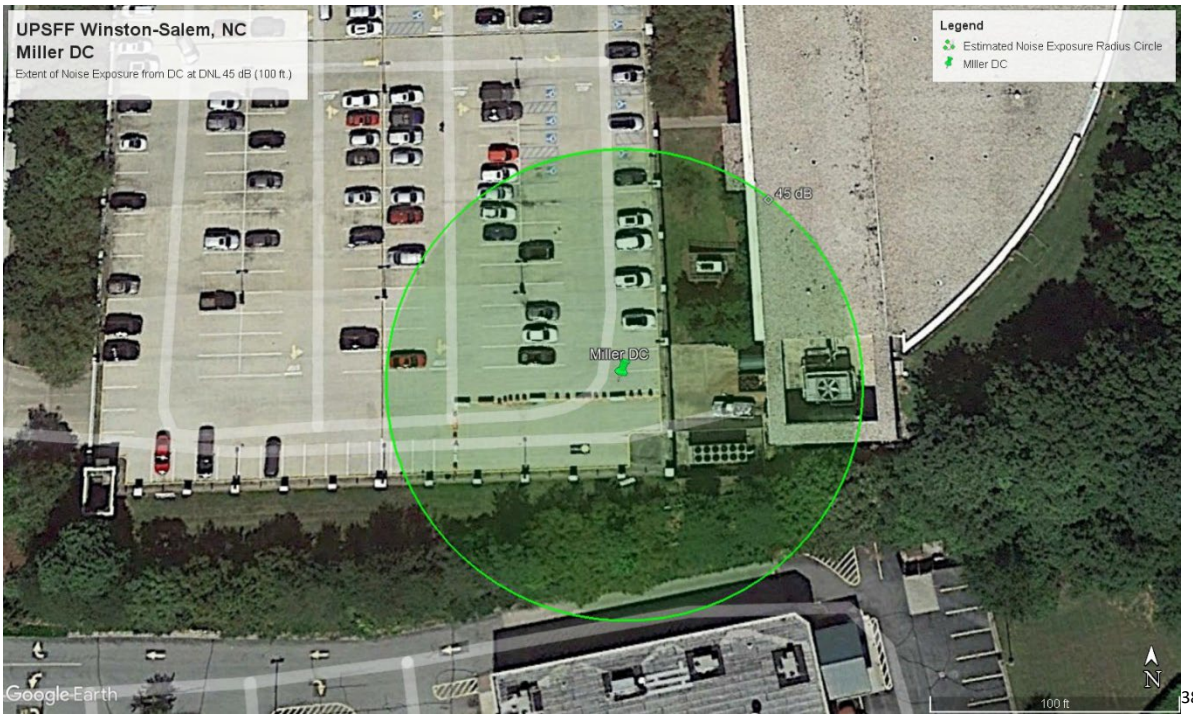
[36]

Figure 12 *DNL 45 dB or Greater Noise Exposure at Meads Hall DC*

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

[37]

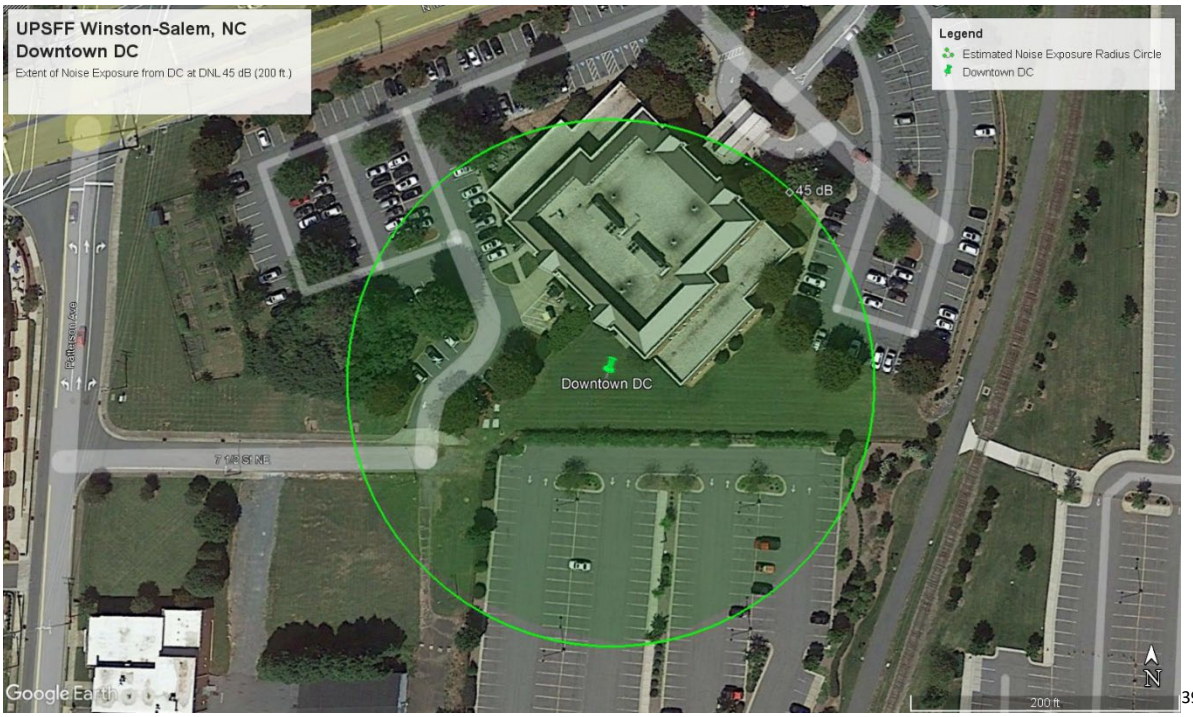
Figure 13 *DNL 45 dB or Greater Noise Exposure at Piedmont DC*



[38]

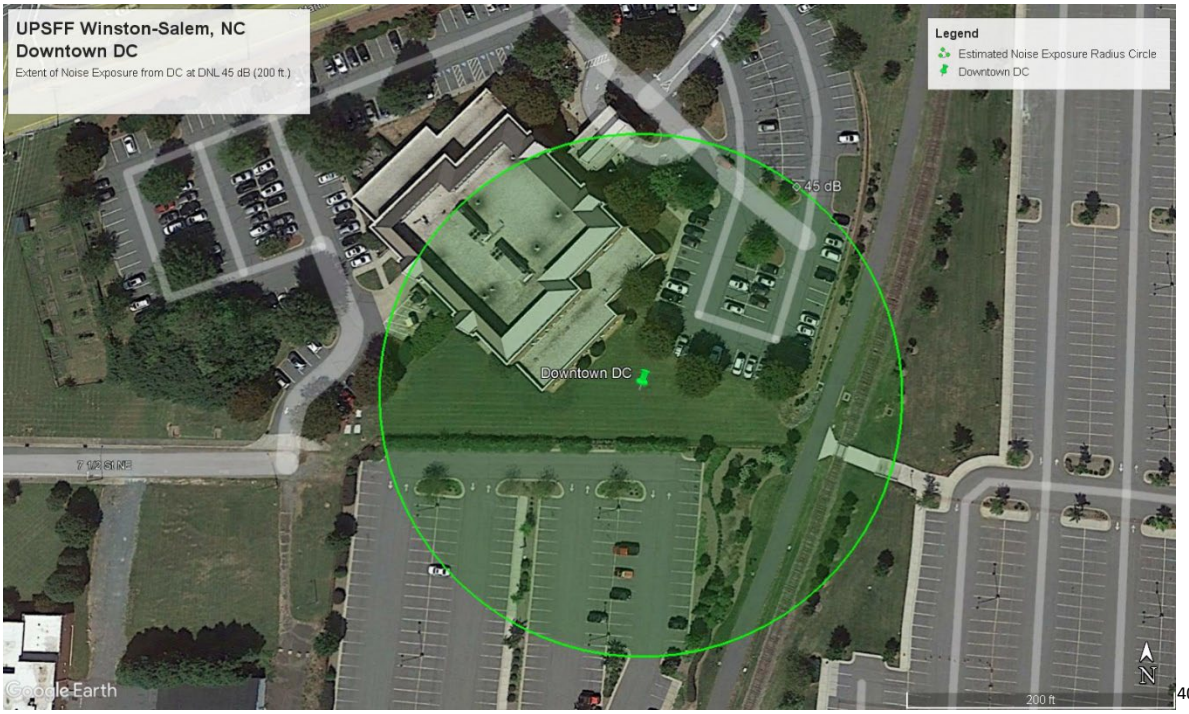
Figure 14 *DNL 45 dB or Greater Noise Exposure at Miller DC*

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



[39]

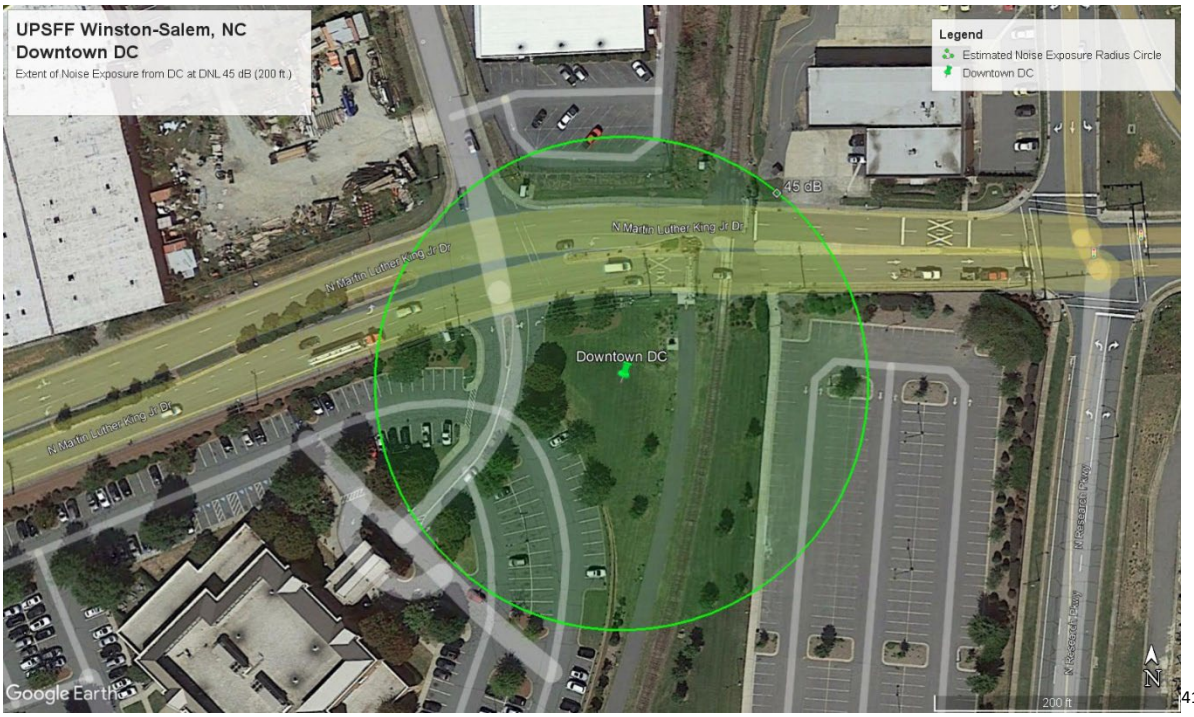
Figure 15 *DNL 45 dB or Greater Noise Exposure at Downtown DC Potential Location 1*



[40]

Figure 16 *DNL 45 dB or Greater Noise Exposure at Downtown DC Potential Location 2*

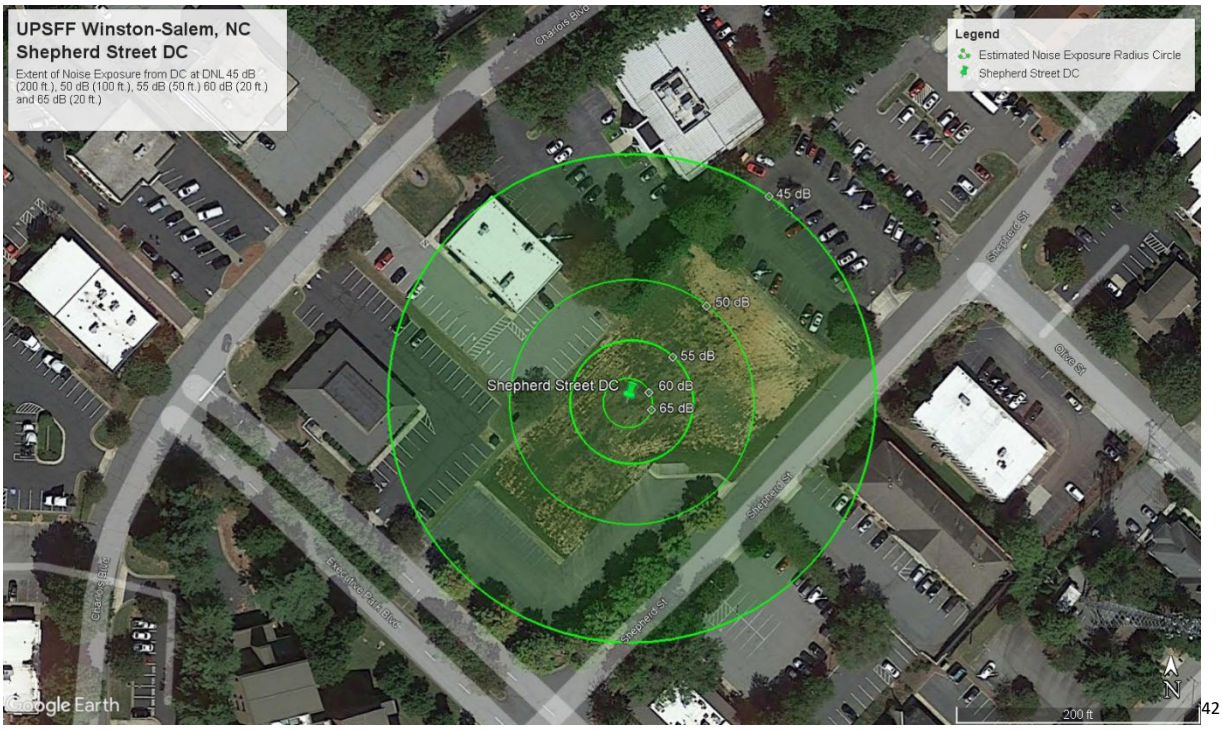
[39] Image: Google Earth, as modified by the FAA
[40] Image: Google Earth, as modified by the FAA



[41]

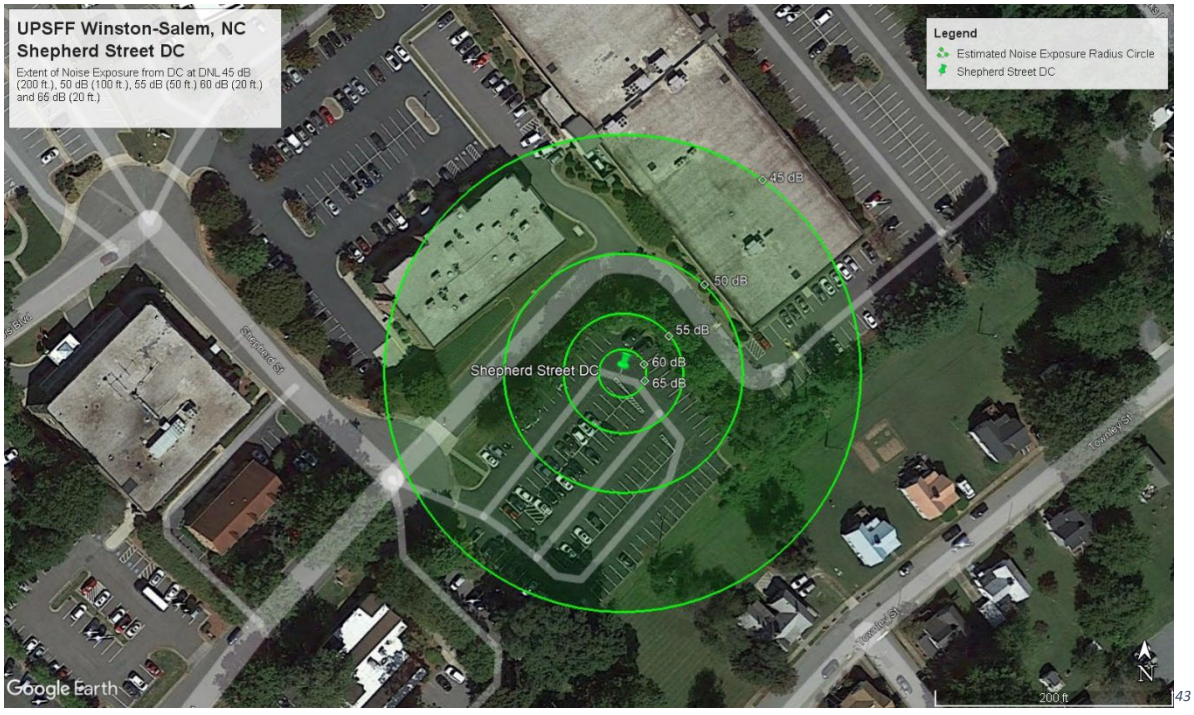
Figure 17 *DNL 45 dB or Greater Noise Exposure at Downtown DC Potential Location 3*

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



[42]

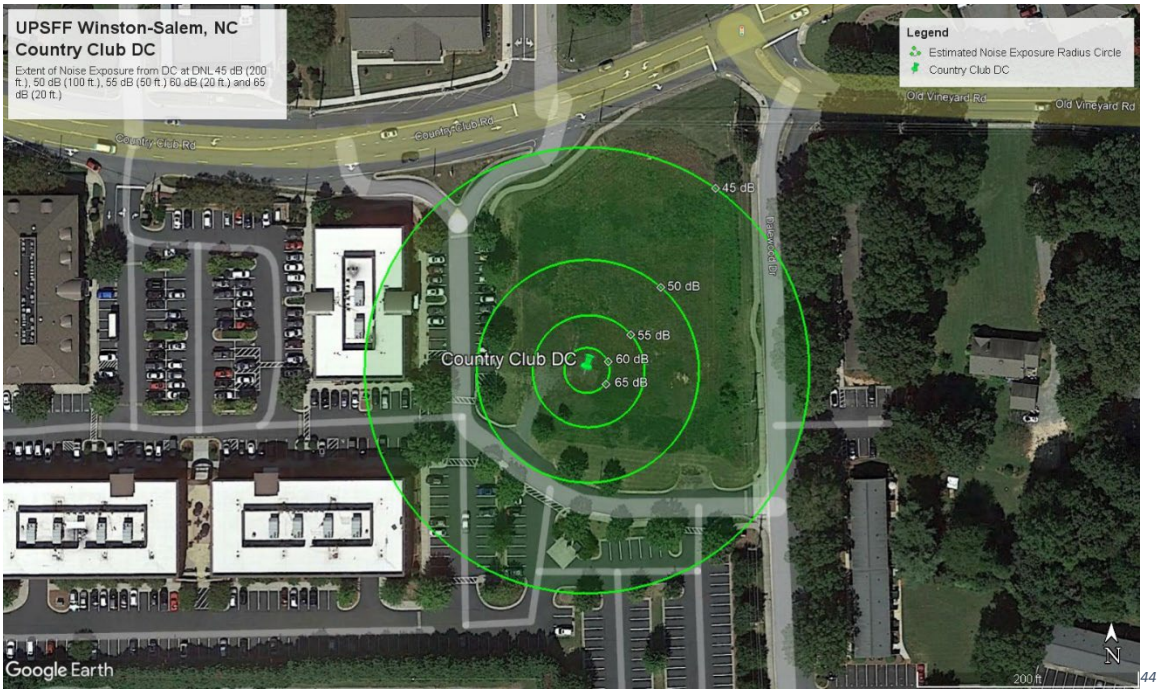
Figure 18 *DNL 45 dB or Greater Noise Exposure at Shepherd DC Potential Location 1*



[43]

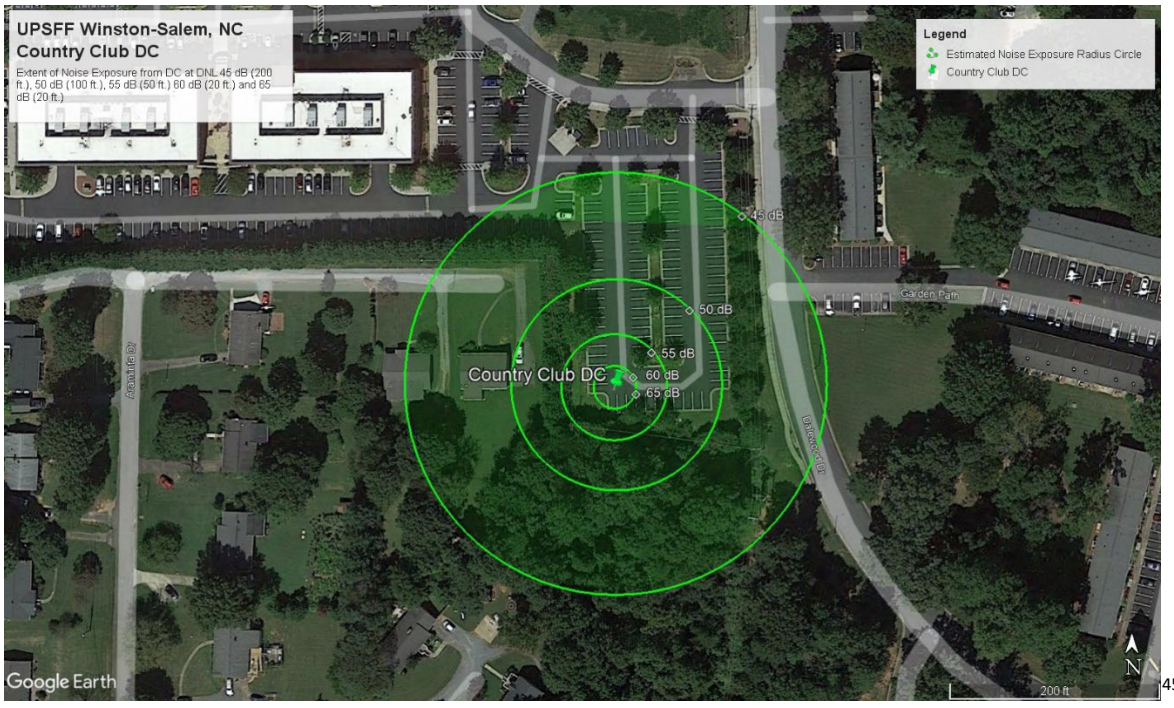
Figure 19 *DNL 45 dB or Greater Noise Exposure at Shepherd DC Potential Location 2*

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



[44]

Figure 20 *DNL 45 dB or Greater Noise Exposure at Country Club DC Potential Location 1*



[45]

Figure 21 *DNL 45 dB or Greater Noise Exposure at Country Club DC Potential Location 2*

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

[45]

Noise Exposure for En route Operations

Based on the information provided by UPSFF, it is anticipated that the UA will cruise at an altitude of 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 study area.

Total Noise Exposure Results

The maximum noise exposure levels within the study area will occur at the DC sites.

Piedmont and Miller DCs

At the Piedmont and Miller DCs, noise levels at or above DNL 45 dB could extend up to 100 feet from the DC locations, with DNL levels at or above DNL 50 dB extending up to 50 feet, and DNL levels of DNL 55 dB or greater extending up to 20 feet from the DC location, respectively. At each of these sites the extents of noise levels at or above DNL 45 dB would remain entirely within the vicinity of the DC infrastructure on the DC property and are well below the threshold of DNL 65 dB for compatible land use.

Downtown DC

At the proposed Downtown DC sites, noise levels at or above DNL 45 dB could extend up to 200 feet from the DC, 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 60 dB or greater extending up to 20 feet from the DC location, respectively. At each of the proposed Downtown DC sites, there is no residential land use within the extents of noise levels at or above DNL 45 dB.

Shepherd DC

At the proposed Shepherd DC sites, noise levels at or above DNL 45 dB could extend up to 200 feet from the DC, 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 60 dB or greater extending up to 20 feet from the DC, respectively. The extent of noise levels at or above DNL 50 dB would remain entirely within the vicinity of the proposed Shepherd Street DC infrastructure. The extent of noise levels at or above DNL 45 dB to DNL 50 dB could include surrounding residential properties, as shown in Figures 18 and 19, but is well below the threshold of DNL 65 dB for compatible land use.

Country Club DC

At the proposed Country Club DC sites, noise levels at or above DNL 45 dB could extend up to 200 feet from the DC, 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 60 dB or greater extending up to 20 feet from the DC, respectively. The extent of noise levels at or above DNL 60 dB would remain entirely within the vicinity of the proposed Country Club DC infrastructure. The extent of noise levels at or above DNL 45 dB to DNL 60 dB could include surrounding residential properties, but is below the threshold of DNL 65 dB for compatible land use.

Meads Hall DC

At the Meads Hall DC, noise levels at or above DNL 45 dB could extend up to 600 feet from the DC location, with DNL levels at or above DNL 50 dB extending up to 200 feet, DNL levels of DNL 55 dB or greater extending up to 100 feet, and DNL levels of 60 dB or greater extending up to 50 feet, and DNL

levels of 65 dB or greater extending up to 20 feet from the DC, respectively. The extent of noise levels at or above DNL 55 dB would remain entirely within the vicinity of the Meads Hall DC infrastructure. The extent of noise levels between DNL 45 dB to DNL 55 dB could include surrounding residential properties, but is well below the threshold of DNL 65 dB for compatible land use.

For en route operations between each of the DCs, the estimated noise exposure for en route flight paths would not exceed DNL 45 dB at any location within the study area.

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 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 Depart 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 includes 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.

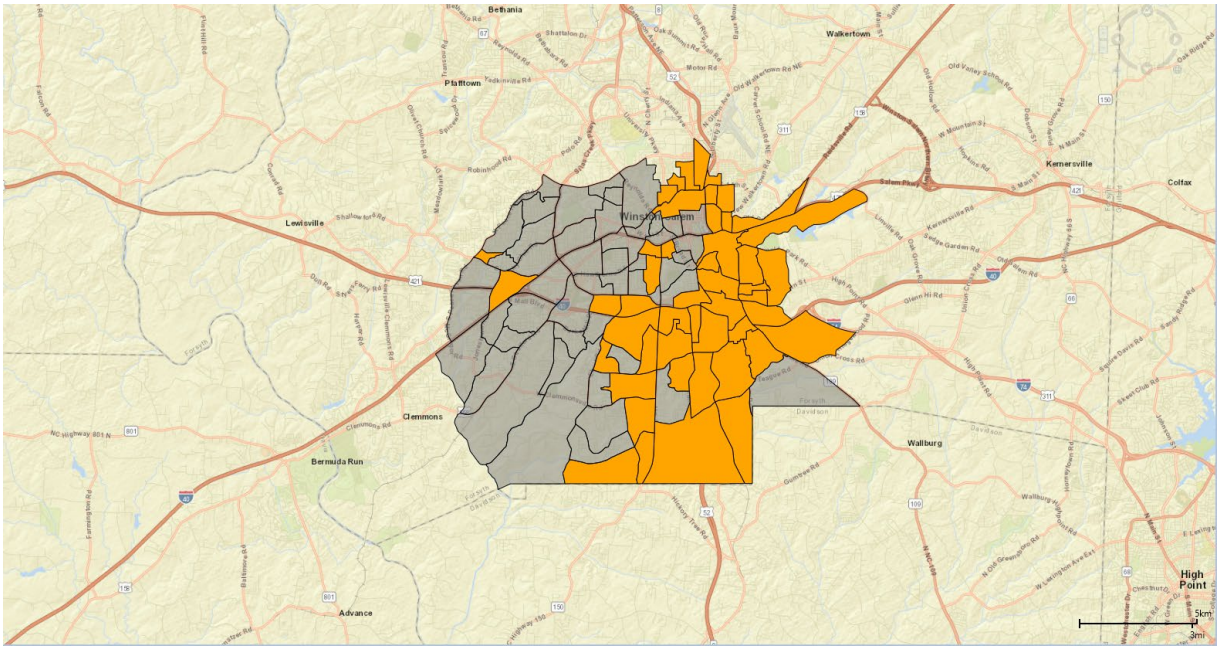
3.6.2 Affected Environment

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 5, there are 48 census block groups out of 96 that have minority populations at or above 50 percent. The percentage of minority individuals residing within the study area at the census block level is approximately 52.63 percent.



[46]

Figure 22 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 in Forsyth County. Because the study area is within part of Forsyth County, the FAA determined that it 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 52.63 percent, is somewhat higher than that of the reference community, which is approximately 44.66 percent. However, while there is a minority population in the study area, the FAA determined that the percentage of minority persons residing within study area was not meaningfully greater than the percentage of minorities 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 in Forsyth County.

[46] Image: AEDT, as modified by the FAA

Because the study area is within part of Forsyth County, the FAA determined that it 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 21.97 percent as compared to 17.17 percent in the reference community. The FAA's AEDT analysis data is included in Appendix F.

3.6.3 Environmental Consequences

The proposed action would not result in adverse 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 operating area, but will stay well below the level determined to constitute a significant impact. While there are both minority and low-income populations in the study area, UPSFF operations could potentially occur 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 minority or low-income populations would be disparately impacted by the proposed action. The FAA is also not aware of impacts that would uniquely affect these populations. Since the proposed action would not result in effects that would be predominately or uniquely born by an environmental justice population, the FAA determined that 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 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 public parks, historic properties, and recreation areas that could be valued for aesthetic attributes within the study area. However, UPSFF's proposal is to avoid overflights of these "no fly" areas during the scope of the proposed action. The DCs are on private property and in already 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 such as Section 4(f) properties 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 0.16 square miles of surface waters occur within the operating area, or approximately less than one percent of the area, based on the Environmental Justice Screening and Mapping Tool (EJSCREEN) report for this proposed action (Appendix D). Surface waters in the study area include Salem Creek, Burke Creek, Little Creek, Silas Creek, and South Fork Muddy Creek, 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, 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 within 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. This includes compliance with requirements to notify the FAA and/or National Transportation Safety Board (NTSB) in accordance with regulatory requirements in the event of an aircraft accident. 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 Part 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 Matternet 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 with other actions. CEQ regulations define cumulative impact as "an impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions." The regulations also state that cumulative impacts can result from individually minor, but collectively significant actions that take place over a period of time.

Because these are among 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 environmental review, 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 Subject Matter Expert, Biological Resources, and Document Review
Sean Doyle, FAA Office of National Engagement and Regional Administration	16	Noise Analysis 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	11	Noise Analysis and Document Review
Contractor Contributors		
Jodi Jones, FAA Aviation Safety, Primcorp, LLC	13	NEPA Subject Matter Expert, Research, and Document Review
Brad Thompson, FAA Aviation Safety, Science Applications International Corporation (SAIC)	8	NEPA Subject Matter Expert, Research, and Document Review

5.0 LIST of AGENCIES CONSULTED

State Agencies

North Carolina Department of Natural and Cultural Resources

Tribes

Catawba Indian Nation

Appendix A

Official Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Asheville Ecological Services Field Office
160 Zillicoa Street
Asheville, NC 28801-1082
Phone: (828) 258-3939 Fax: (828) 258-5330
http://www.fws.gov/nc-es/es/countyfr.html

In Reply Refer To:
Project Code: 2022-0042212
Project Name: Winston-Salem Area 2

May 12, 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 designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The enclosed 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.*).

Please note that new species information can change your official species list. 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. The Service recommends you visit the ECOS-IPaC website at regular intervals during project planning and implementation to ensure your species list is accurate or obtain an updated species 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 (BA) or biological evaluation (BE) should be completed for your project. A BA is required for major construction activities (or other undertakings having similar physical impacts) considered to be 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)) (NEPA). For projects other than major construction activities, the Service suggests that a BE be prepared to determine effects of the action and whether those effects may affect listed species and/or designated critical habitat. E?ects of the action are all consequences to listed species or

critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it is reasonably certain to occur and would not occur “but for” the proposed action.. Recommended contents of a BA/BE are described at 50 CFR 402.12. More information and resources about project review and preparing a BA/BE can be found at the following web link: https://www.fws.gov/office/asheville-ecological-services/asheville-field-office-online-review-process-overview.

If a Federal agency determines 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. The Service is not required to concur with "no effect" determinations from Federal action agencies. If consultation is required, the Service recommends that candidate species, proposed species, proposed critical habitat, and at-risk species be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or licensed applicants, can be found in the "Endangered Species Consultation Handbook" at the following web link: https://www.fws.gov/media/endangered-species-consultation-handbook.

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Act, 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 Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). More information about MBTA and BGEPA can be found at the following web link: https://www.fws.gov/program/migratory-birds.

We appreciate your consideration of Federally listed species. The Service encourages Federal agencies to include conservation of threatened and endangered species in their project planning to further the purposes of the Act. Please contact our staff at 828-258-3939, if you have any questions. In any future correspondence concerning this project, please reference the Consultation Code which can be found in the header of this letter.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds
- Wetlands

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".

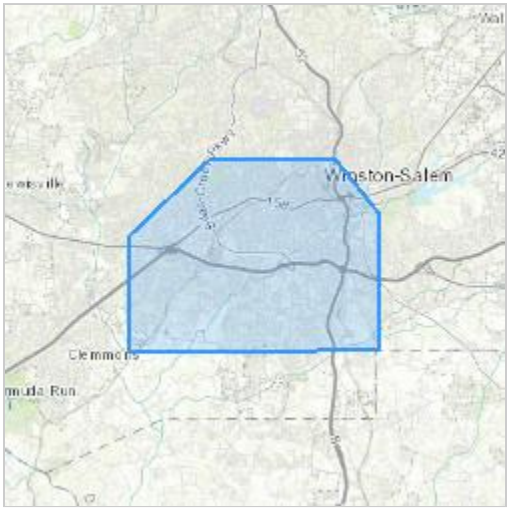
This species list is provided by:

Asheville Ecological Services Field Office
160 Zillicoa Street
Asheville, NC 28801-1082
(828) 258-3939

Project Summary

Project Code: 2022-0042212
Event Code: None
Project Name: Winston-Salem Area 2
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/@36.05279885,-80.2796123208465,14z



Counties: Forsyth County, North Carolina

Endangered Species Act Species

There is a total of 4 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.

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
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Reptiles

NAME	STATUS
Bog Turtle *Glyptemys muhlenbergii* Population: U.S.A. (GA, NC, SC, TN, VA) No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6962	Similarity of Appearance (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

Flowering Plants

NAME	STATUS
Schweinitz's Sunflower *Helianthus schweinitzii*	Endangered

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/3849

Critical habitats

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

USFWS National Wildlife Refuge Lands And Fish Hatcheries

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 OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

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.

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1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

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
Bald Eagle *Haliaeetus leucocephalus* 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	Breeds Sep 1 to Jul 31
Black-billed Cuckoo *Coccyzus erythropthalmus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9399	Breeds May 15 to Oct 10

NAME	BREEDING SEASON
Cerulean Warbler *Dendroica cerulea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/2974	Breeds Apr 28 to Jul 20
Eastern Whip-poor-will *Antrostomus vociferus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Aug 20
Kentucky Warbler *Oporornis formosus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 20
Prairie Warbler *Dendroica discolor* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Prothonotary Warbler *Protonotaria citrea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 1 to Jul 31
Red-headed Woodpecker *Melanerpes erythrocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Rusty Blackbird *Euphagus carolinus* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere
Wood Thrush *Hylocichla mustelina* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

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:

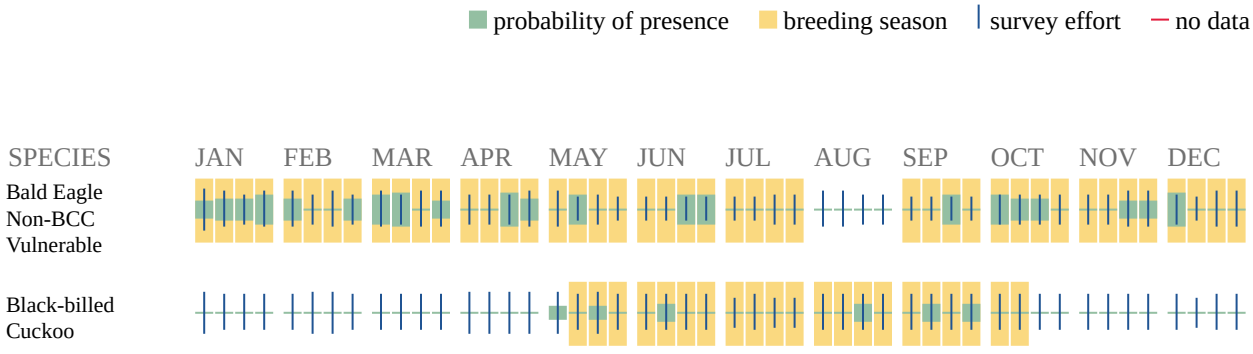
1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability 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.

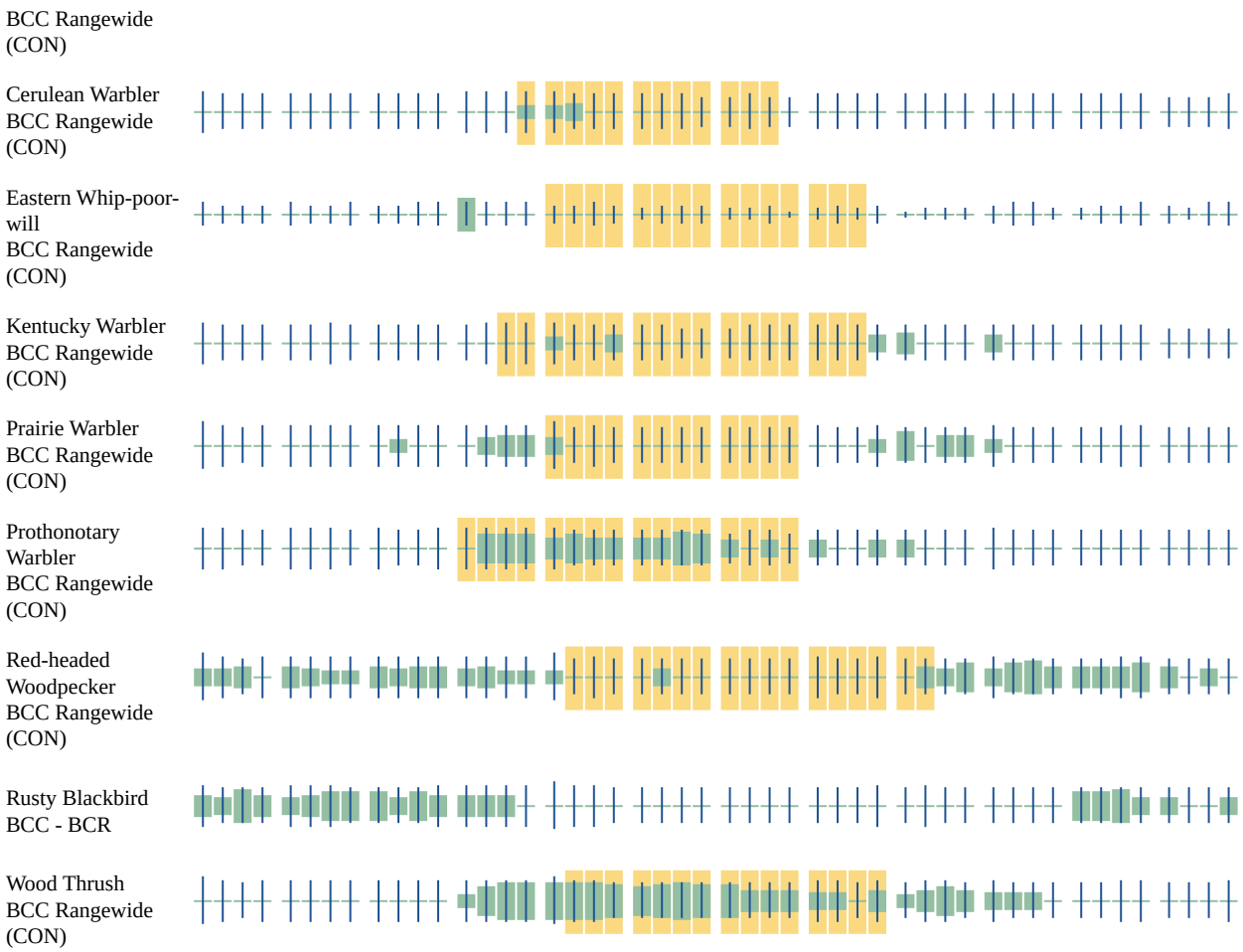
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

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.

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.





Additional information can be found using the following links:

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

Migratory Birds FAQ

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.

Wetlands

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.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

WETLAND INFORMATION WAS NOT AVAILABLE WHEN THIS SPECIES LIST WAS GENERATED. PLEASE VISIT HTTPS://WWW.FWS.GOV/WETLANDS/DATA/MAPPER.HTML OR CONTACT THE FIELD OFFICE FOR FURTHER INFORMATION.

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

Appendix B

Tribal and Historic Outreach Letters

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

Aviation Safety

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

Ms. Renee Gledhill-Early
State Historic Preservation Office
4617 Mail Service Center
Raleigh, NC 27699-4617

Via electronic submission to environmental.review@ncdcr.gov

Dear Ms. Gledhill-Early:

In June and September 2020, the Federal Aviation Administration (FAA) contacted the North Carolina State Historic Preservation Office regarding FAA's approval of waivers and operating exemptions and authorities that would permit UPS Flight Forward (UPS FF) to operate Unmanned Aircraft Systems (UAS) commonly called drones to provide delivery service, in the short term and then the long term, to its healthcare customer at the Wake Forest Baptist Health (WFBH) Medical Center in Winston-Salem, North Carolina. In June, we informed you that the FAA had determined that the initial short term action appeared to support a determination of no potential to effect, but we initiated consultation in part to get better understanding of the potential effects of UAS operations on historic properties. Your office's July 29, 2020 (ER 20-1508) response agreed with FAA's determination. In September 2020 and again in December of 2021, FAA sent consultation letters for a continuation of the operations on a long-term basis. Your office's January 20, 2022 (ER 20-1508) response again agreed with the FAA's determination.

We have again been asked to approve exemptions and authorities for UPS FF to modify its existing WFBH Medical Center UAS routes to become a large operating area. The UAS operation will operate in and around Winston-Salem, NC in Forsyth County as depicted on the enclosed graphic. The operator would conduct an estimated maximum of 100 flights in the operating area daily, M-F (except holidays) at a planned operating altitude of 300 feet above ground level (AGL). All flights would be during daylight hours. The dimension of the UAS area defines the Area of Potential Effect (APE). According to the National Park Service online database of the National Register of Historic Places and the NC Historic Preservation Office's HPOWEB 2.0 Web Mapping Application, there are numerous registered historical places within the proposed APE.

Based on a review of the route modifications as well as our increasing knowledge with respect to the level of environmental impacts from drone operations, FAA has determined that this new approval has no potential to effect historic properties. FAA expects that drone

operations will continue to grow and that we all will continue to learn more about this emerging technology. FAA would be amenable to trying to answer any questions you may have generally on this new technology. 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 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 Menzimer

Digitally signed by David Menzimer
Date: 2022.04.26 08:25:48 -07'00'

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

Enclosure

North Carolina Department of Natural and Cultural Resources

State Historic Preservation Office

Ramona M. Bartos, Administrator

Governor Roy Cooper
Secretary D. Reid Wilson

Office of Archives and History
Deputy Secretary, Darin J. Waters, Ph.D.

May 27, 2022

Mike Millard 9-AWA-AVS-AFS-ENVIRONMENTAL@faa.gov
FAA, AFS-800
800 Independence Avenue, Southwest
Washington, D.C. 20591

Re: Two unmanned drone routes, Wake Forest Baptist Health Main Campus to Medical Plaza Miller & Wake Forest Baptist Health Main Campus to Piedmont Plaza, Winston-Salem, Forsyth County, ER 20-1508

Dear Mr. Millard:

Thank you for your April 26, 2022, concerning the above-referenced federal action and the request to expand the service. We understand that the FAA has determined that this new approval has no potential to effect historic properties and again concur with your finding of no effect on historic properties. We do, however, look forward to learning more about the experiences of other locales that are subject to similar operations, when that information is available.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, contact Renee Gledhill-Earley, environmental review coordinator, at 919-814-6579 or environmental.review@ncdcr.gov. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

for Ramona Bartos, Deputy
State Historic Preservation Officer

cc: Michelle McCullough, HPC michellem@cityofws.org

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

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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.

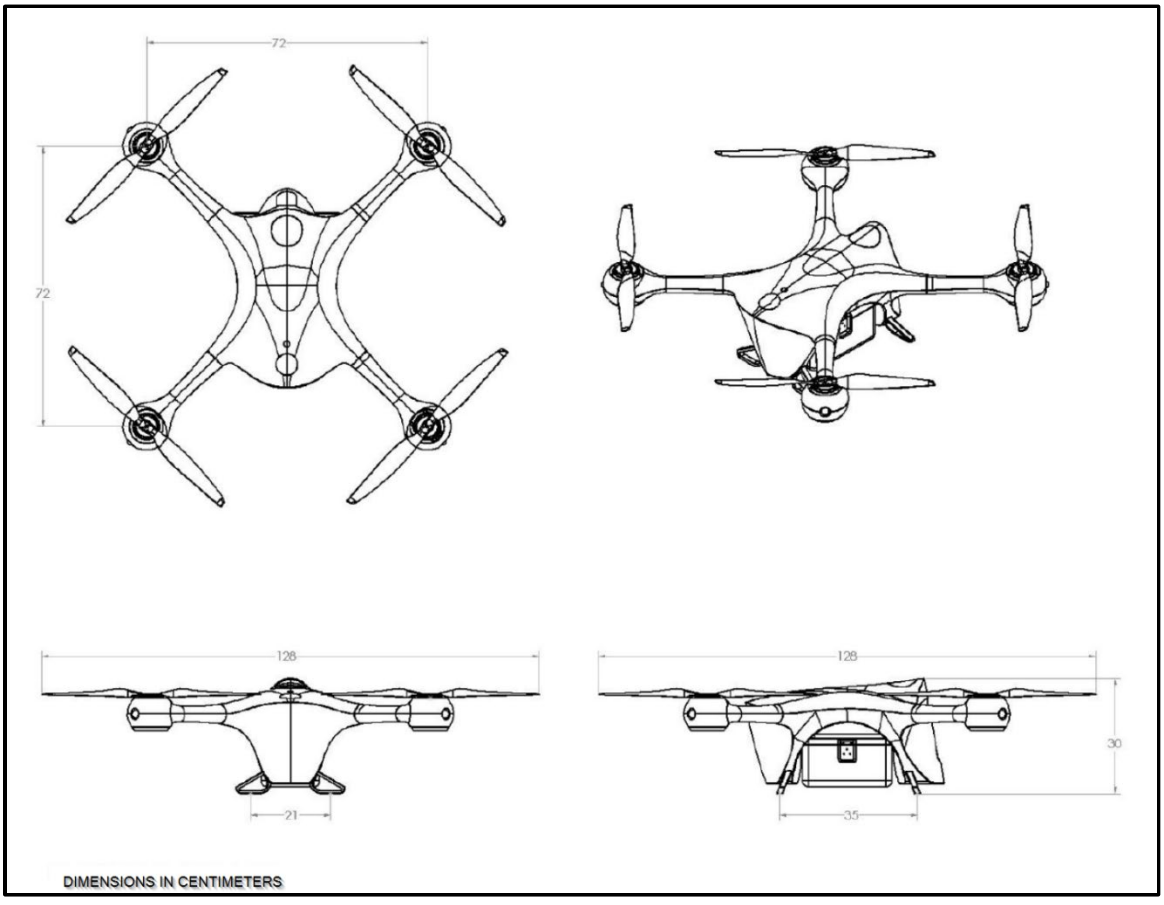

Figure 1: Matternet Model M2 Unmanned Aircraft

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.

---

[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.

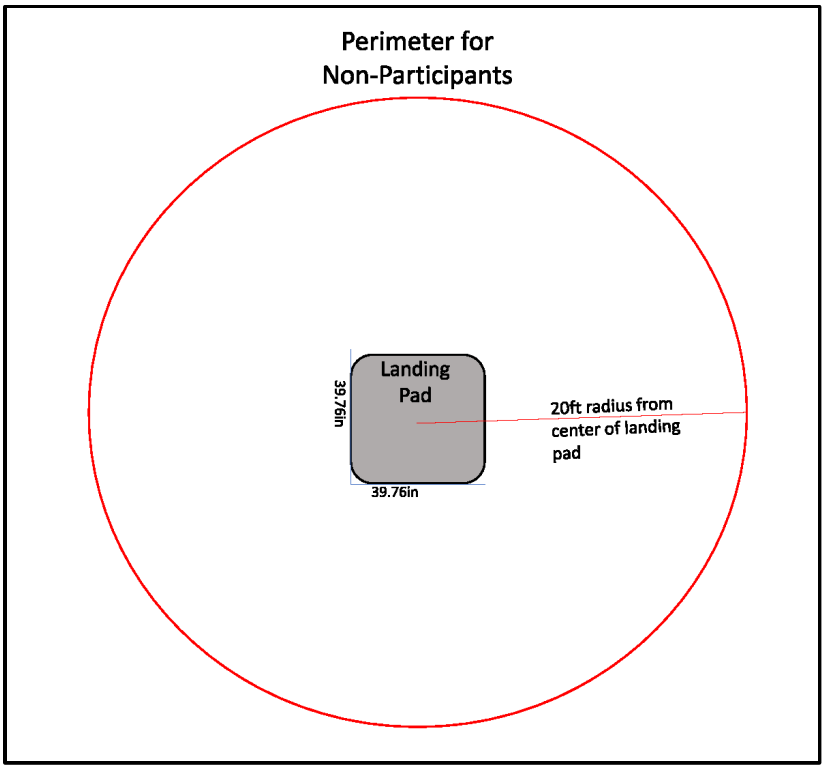

Figure 2: Takeoff and Landing Site Plan for the Proposed Operations.

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.

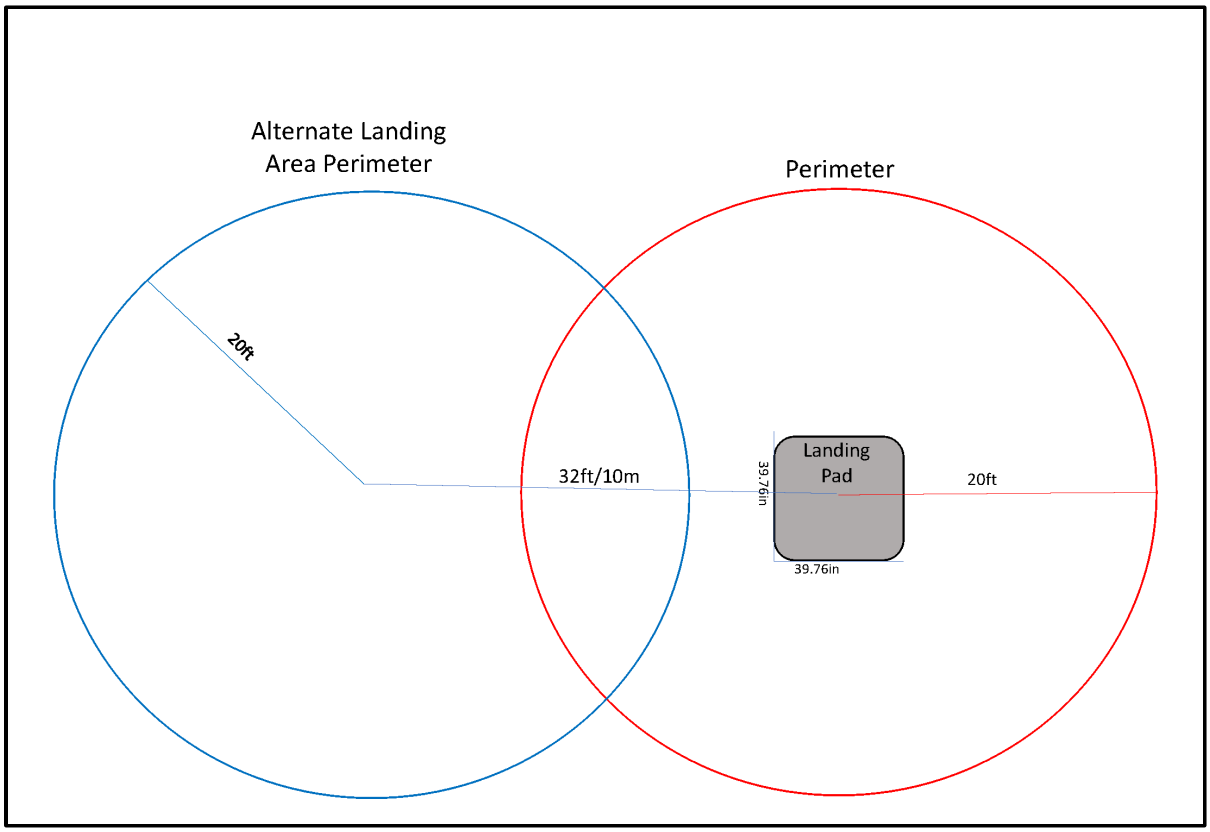

Figure 3: Takeoff Area and Landing Site Plan with Alternate Landing Area for Proposed Operations.

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.

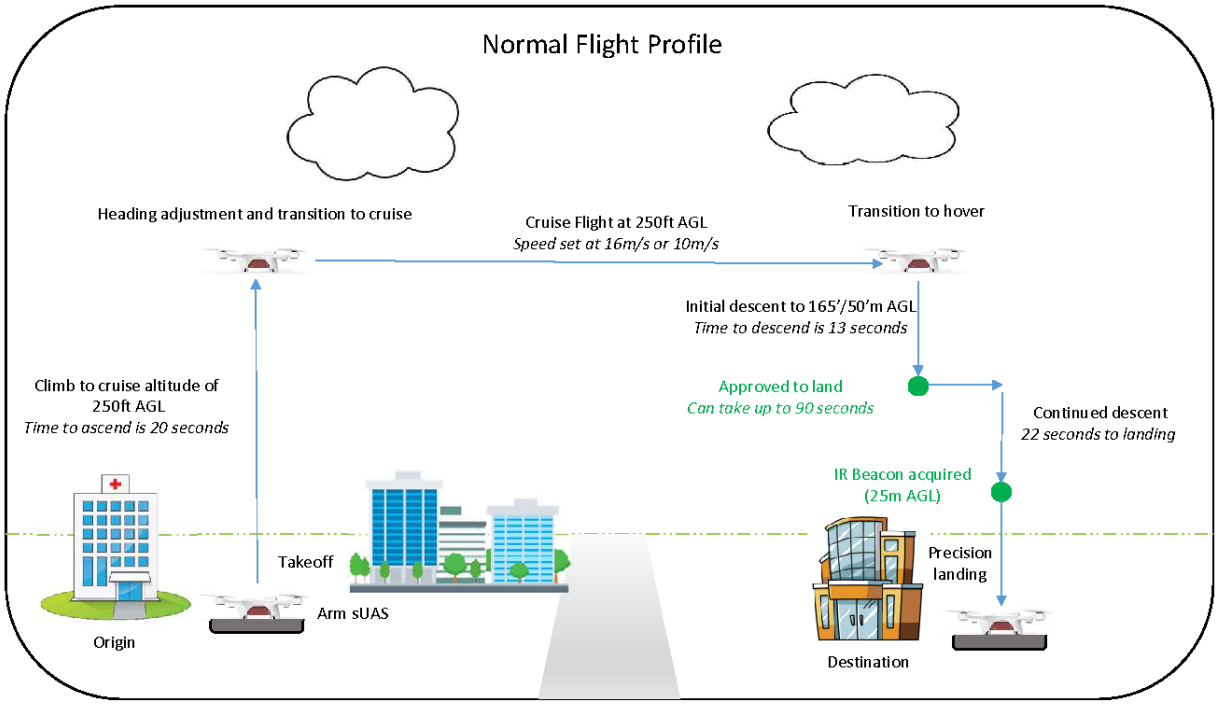

Figure 5: Graphical Depiction of the Proposed Matternet Model M2 Flight Profile to a Destination

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.

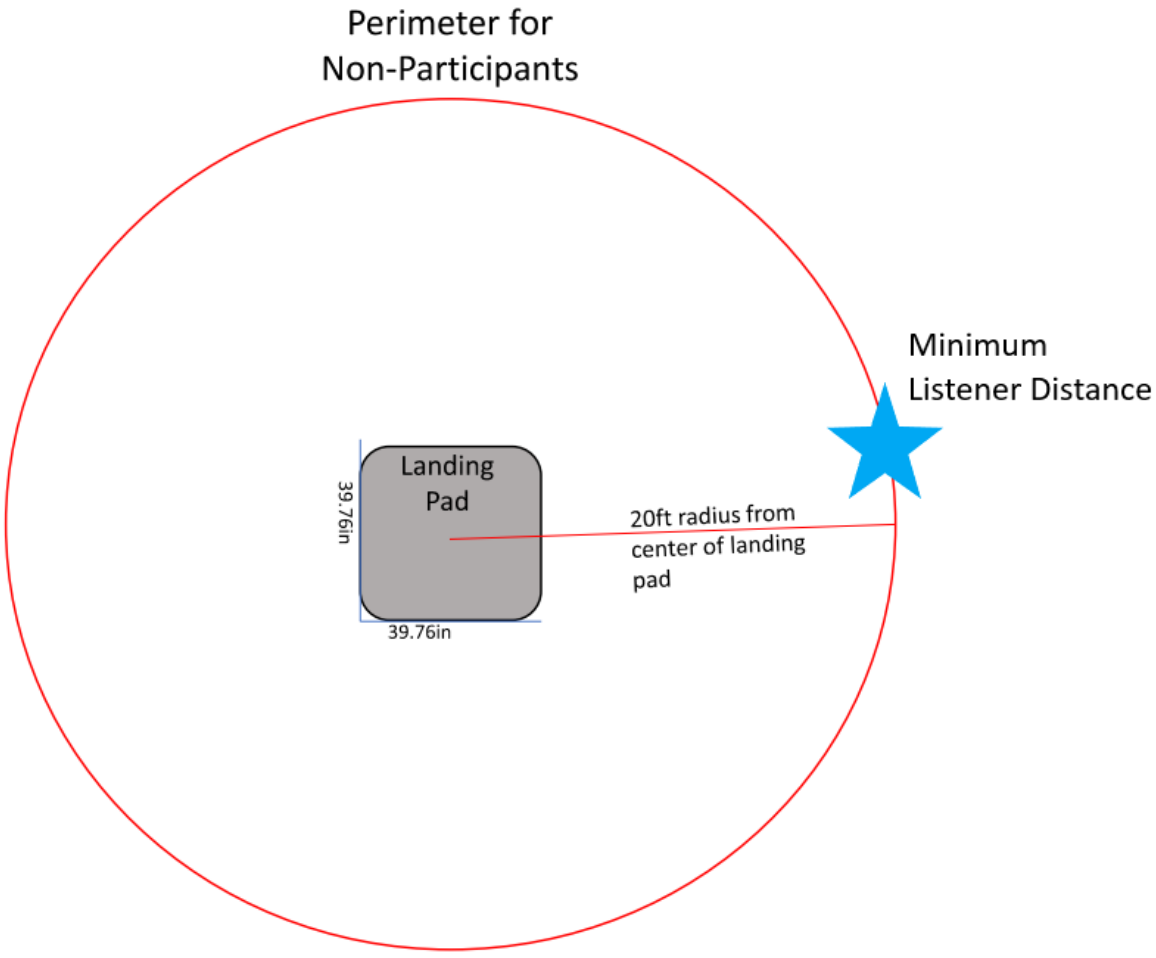


Figure 6: Representative Minimum Listener Distance Location Used for Table 7

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.

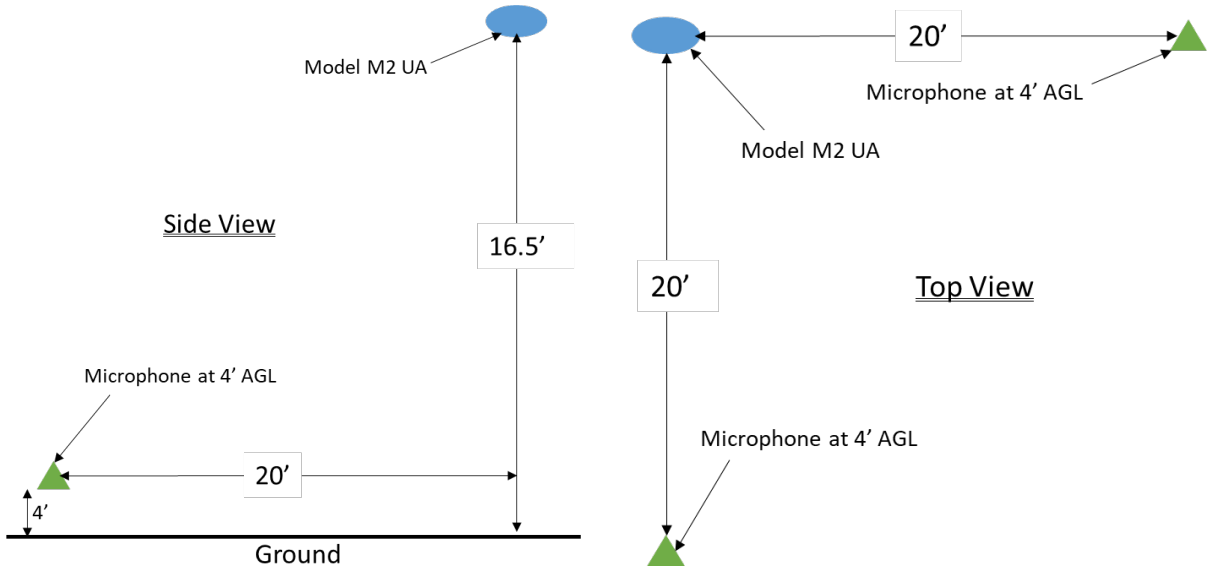


Figure 1. Microphone locations for hover measurements shown in green when Model M2 UA hovered above the ground

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.

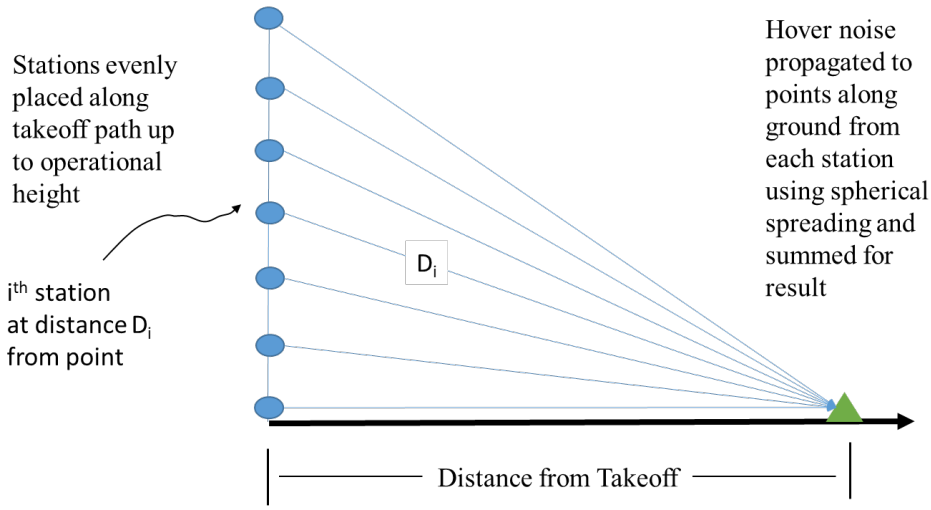


Figure 2. Graphical representation of how hover noise is used to simulate takeoff noise.

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.

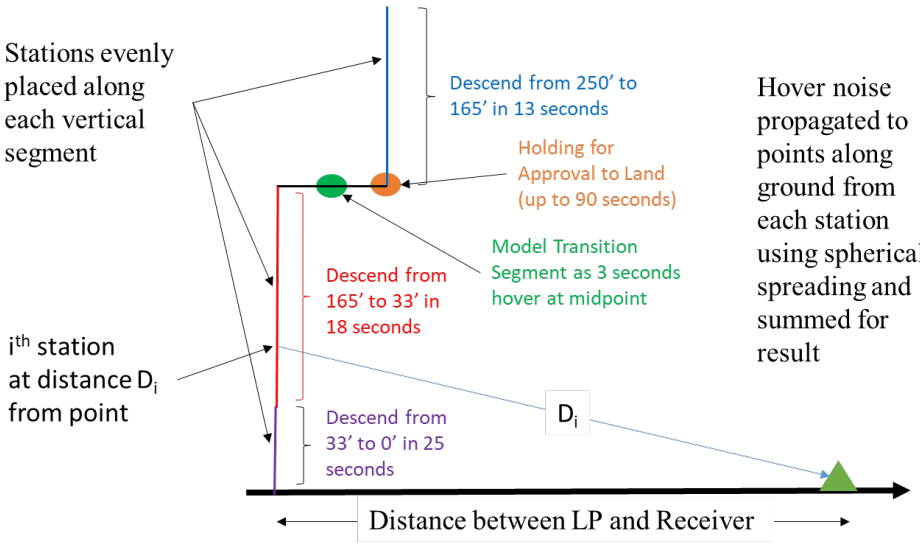


Figure 3. Graphical representation of how hover noise is used to simulate landing noise

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: July 19, 2022

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

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 Winston-Salem, NC

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 Winston-Salem, NC 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 from six sites (Meads Hall (Main Campus), Piedmont (Main Campus), Miller Infusion Center (Main Campus), Downtown Health Plaza, Shepherd Street, Country Club) located in the Winston-Salem, NC operating area. 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 112 delivery operations per day during daytime hours (7 AM to 10 PM) from Winston-Salem, NC 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**
Meads Hall (Main Campus)	See breakdown below (28 on Main Campus, 28 to DHP, 28 to SS, 28 to CC)
Piedmont (Main Campus)	14 (Meads to Piedmont)
Miller Infusion Center (Main Campus)	14 (Meads to Miller)
Downtown Health Plaza (DHP)	28 (Meads to DHP)
Shepherd Street (SS)	28 (Meads to SS)
Country Club (CC)	28 (Meads – CC)
Winston-Salem, NC Operating Area	**112 (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: July 20, 2022

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)
SL for DS

Subject: Environmental Assessment (EA) Noise Methodology Approval Request for UPS Flight Forward Commercial Package Delivery Operations with the Matternet M2 UA from Winston-Salem, North Carolina

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 Winston-Salem, North Carolina. 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 Winston-Salem and a surrounding operating area.

The Proposed Action is to use the Model M2 UA to deliver packages between six takeoff and landing sites (Meads Hall (Main Campus), Piedmont (Main Campus), Miller Infusion Center (Main Campus), Downtown Health Plaza, Shepherd Street, and Country Club) within a proposed operating area in Winstom-Salem. 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 112 delivery flight operations per day during daytime hours (7 AM to 10 PM) from Winston-Salem under the scope of this proposed action. UPSFF anticipates daily delivery operations will be distributed among the six 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 Winston-Salem, NC” dated July 19, 2022.

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)

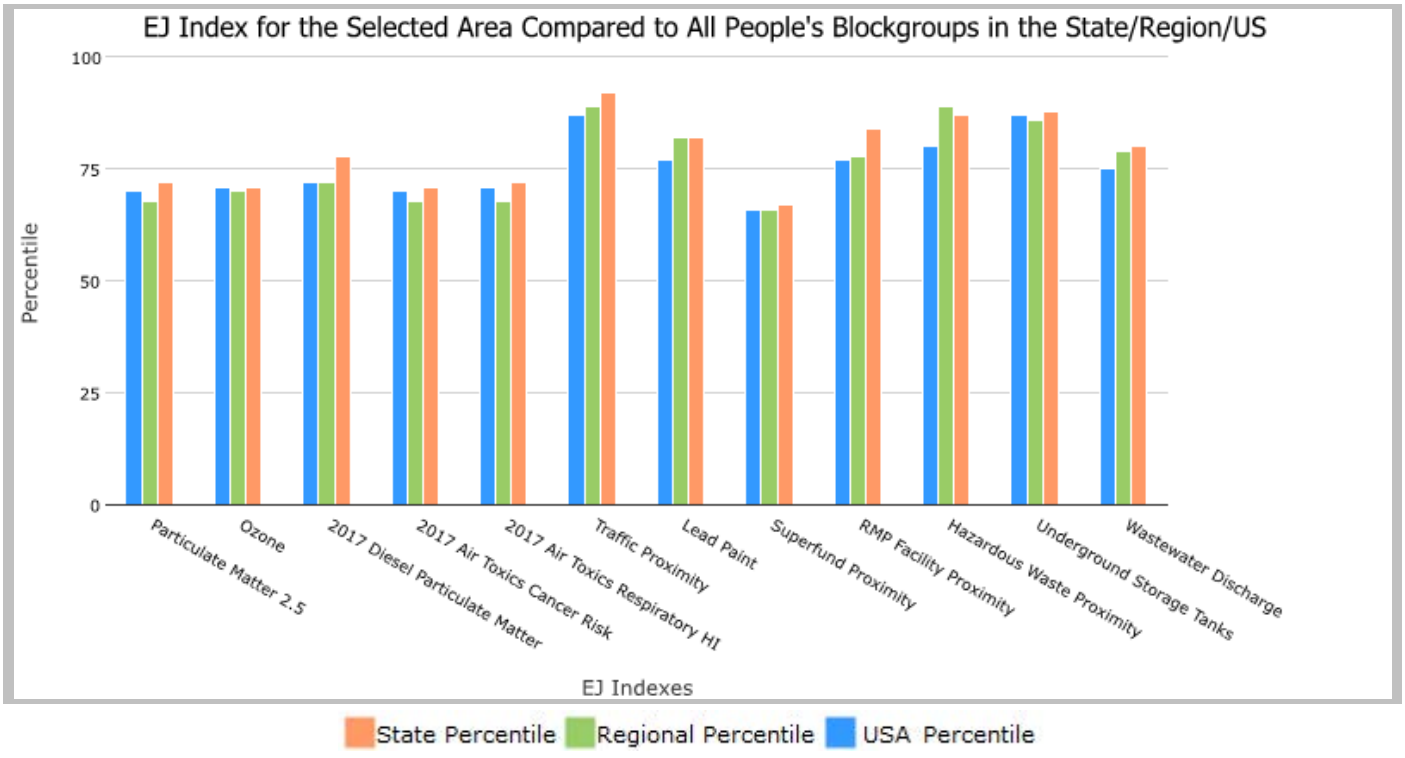
the User Specified Area, NORTH CAROLINA, EPA Region 4

Approximate Population: 90,170

Input Area (sq. miles): 40.43

Winston-Salem

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
Environmental Justice Indexes			
EJ Index for Particulate Matter 2.5	72	68	70
EJ Index for Ozone	71	70	71
EJ Index for 2017 Diesel Particulate Matter*	78	72	72
EJ Index for 2017 Air Toxics Cancer Risk*	71	68	70
EJ Index for 2017 Air Toxics Respiratory HI*	72	68	71
EJ Index for Traffic Proximity	92	89	87
EJ Index for Lead Paint	82	82	77
EJ Index for Superfund Proximity	67	66	66
EJ Index for RMP Facility Proximity	84	78	77
EJ Index for Hazardous Waste Proximity	87	89	80
EJ Index for Underground Storage Tanks	88	86	87
EJ Index for Wastewater Discharge	80	79	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.

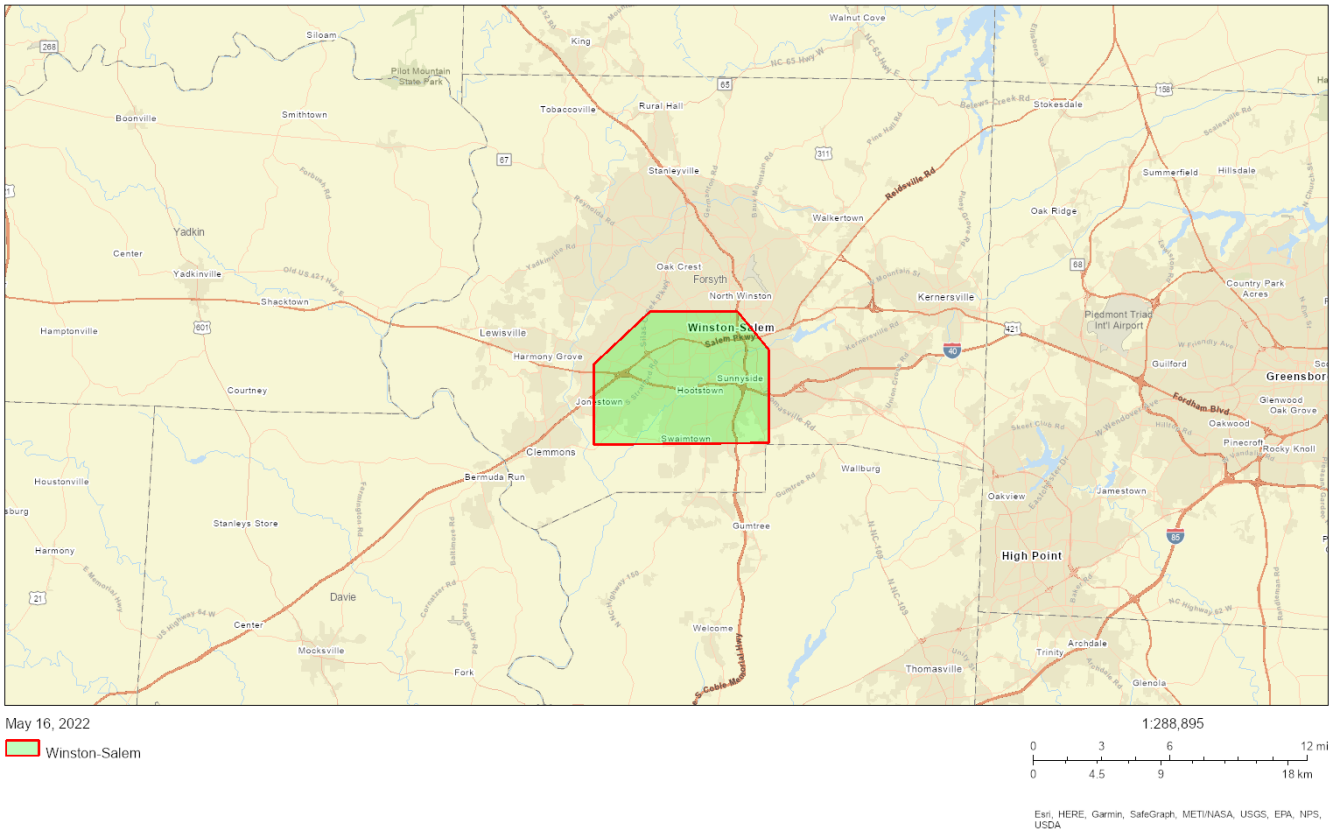
EJScreen Report (Version 2.0)

the User Specified Area, NORTH CAROLINA, EPA Region 4

Approximate Population: 90,170

Input Area (sq. miles): 40.43

Winston-Salem



Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	11

EJScreen Report (Version 2.0)

the User Specified Area, NORTH CAROLINA, EPA Region 4

Approximate Population: 90,170

Input Area (sq. miles): 40.43

Winston-Salem

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)	8.73	7.74	90	8.18	72	8.74	53
Ozone (ppb)	45	41.7	91	37.9	97	42.6	74
2017 Diesel Particulate Matter* (µg/m^3)	0.305	0.182	91	0.261	60-70th	0.295	60-70th
2017 Air Toxics Cancer Risk* (lifetime risk per million)	30	29	95	31	80-90th	29	80-90th
2017 Air Toxics Respiratory HI*	0.4	0.37	94	0.4	70-80th	0.36	80-90th
Traffic Proximity (daily traffic count/distance to road)	1000	350	91	430	90	710	83
Lead Paint (% Pre-1960 Housing)	0.34	0.16	87	0.15	87	0.28	66
Superfund Proximity (site count/km distance)	0.027	0.082	29	0.083	40	0.13	24
RMP Facility Proximity (facility count/km distance)	0.54	0.39	80	0.6	68	0.75	61
Hazardous Waste Proximity (facility count/km distance)	3	0.83	94	0.62	96	2.2	79
Underground Storage Tanks (count/km^2)	12	3.4	93	3.5	92	3.9	91
Wastewater Discharge (toxicity-weighted concentration/m distance)	0.00024	0.25	50	0.45	49	12	37
Socioeconomic Indicators							
Demographic Index	47%	36%	72	37%	70	36%	70
People of Color	50%	37%	70	39%	67	40%	65
Low Income	45%	34%	71	35%	69	31%	74
Unemployment Rate	6%	6%	64	6%	63	5%	65
Linguistically Isolated	2%	2%	71	3%	67	5%	60
Less Than High School Education	12%	12%	56	13%	56	12%	61
Under Age 5	6%	6%	56	6%	56	6%	54
Over Age 64	14%	16%	44	17%	43	16%	47

*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:

Summary of ACS Estimates	2015 - 2019
Population	90,111
Population Density (per sq. mile)	2,298
People of Color Population	45,502
% People of Color Population	50%
Households	37,197
Housing Units	42,652
Housing Units Built Before 1950	8,261
Per Capita Income	30,066
Land Area (sq. miles) (Source: SF1)	39.22
% Land Area	100%
Water Area (sq. miles) (Source: SF1)	0.16
% Water Area	0%

	2015 - 2019 ACS Estimates	Percent	MOE (±)
Population by Race			
Total	90,111	100%	1,022
Population Reporting One Race	87,514	97%	2,172
White	54,728	61%	859
Black	27,602	31%	630
American Indian	214	0%	57
Asian	2,759	3%	329
Pacific Islander	0	0%	12
Some Other Race	2,211	2%	285
Population Reporting Two or More Races	2,596	3%	317
Total Hispanic Population	13,302	15%	870
Total Non-Hispanic Population	76,808		
White Alone	44,609	50%	528
Black Alone	27,103	30%	630
American Indian Alone	161	0%	34
Non-Hispanic Asian Alone	2,759	3%	329
Pacific Islander Alone	0	0%	12
Other Race Alone	120	0%	56
Two or More Races Alone	2,057	2%	293
Population by Sex			
Male	41,666	46%	1,109
Female	48,445	54%	485
Population by Age			
Age 0-4	5,427	6%	171
Age 0-17	19,613	22%	328
Age 18+	70,497	78%	796
Age 65+	12,339	14%	179

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:

	2015 - 2019 ACS Estimates	Percent	MOE (±)
Population 25+ by Educational Attainment			
Total	59,816	100%	476
Less than 9th Grade	3,016	5%	145
9th - 12th Grade, No Diploma	4,183	7%	173
High School Graduate	14,641	24%	263
Some College, No Degree	12,269	21%	327
Associate Degree	4,611	8%	233
Bachelor's Degree or more	21,096	35%	296
Population Age 5+ Years by Ability to Speak English			
Total	84,684	100%	1,022
Speak only English	69,614	82%	877
Non-English at Home[1+2+3+4]	15,070	18%	593
[1]Speak English "very well"	9,562	11%	427
[2]Speak English "well"	2,661	3%	198
[3]Speak English "not well"	1,804	2%	159
[4]Speak English "not at all"	1,043	1%	213
[3+4]Speak English "less than well"	2,847	3%	246
[2+3+4]Speak English "less than very well"	5,508	7%	289
Linguistically Isolated Households*			
Total	919	100%	95
Speak Spanish	643	70%	94
Speak Other Indo-European Languages	118	13%	67
Speak Asian-Pacific Island Languages	131	14%	50
Speak Other Languages	27	3%	28
Households by Household Income			
Household Income Base	37,197	100%	207
< $15,000	6,453	17%	164
$15,000 - $25,000	4,524	12%	142
$25,000 - $50,000	10,156	27%	165
$50,000 - $75,000	6,129	16%	171
$75,000 +	9,936	27%	173
Occupied Housing Units by Tenure			
Total	37,197	100%	207
Owner Occupied	17,692	48%	171
Renter Occupied	19,505	52%	207
Employed Population Age 16+ Years			
Total	72,542	100%	1,022
In Labor Force	44,242	61%	477
Civilian Unemployed in Labor Force	2,684	4%	148
Not In Labor Force	28,299	39%	787

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:

	2015 - 2019 ACS Estimates	Percent	MOE (±)
Population by Language Spoken at Home*			
Total (persons age 5 and above)	84,469	100%	1,017
English	69,470	82%	876
Spanish	11,015	13%	649
French	246	0%	131
French Creole	N/A	N/A	N/A
Italian	N/A	N/A	N/A
Portuguese	N/A	N/A	N/A
German	151	0%	44
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	1,264	1%	181
Chinese	591	1%	112
Japanese	N/A	N/A	N/A
Korean	157	0%	62
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	250	0%	163
Other Asian	223	0%	135
Tagalog	486	1%	312
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	157	0%	111
Hebrew	N/A	N/A	N/A
African	N/A	N/A	N/A
Other and non-specified	298	0%	134
Total Non-English	14,999	18%	1,342

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

Winston-Salem Operation Area Block Group ACS 2020 5-Year Estimate Data

STATE	COUNTY	NAME	Population Total	Population Minority	Percent Minority	Population Low-Income	Percent Low-income
NC	Forsyth County	Block Group 1, Census Tract 9, Forsyth County, North Carolina	601	250	41.6	255	42.4
NC	Forsyth County	Block Group 2, Census Tract 22, Forsyth County, North Carolina	1374	342	24.9	169	12.4
NC	Forsyth County	Block Group 2, Census Tract 25.02, Forsyth County, North Carolina	1615	64	4	20	1.2
NC	Forsyth County	Block Group 4, Census Tract 36, Forsyth County, North Carolina	2630	1937	73.7	352	13.4
NC	Forsyth County	Block Group 2, Census Tract 11, Forsyth County, North Carolina	761	246	32.3	230	30.2
NC	Forsyth County	Block Group 4, Census Tract 18, Forsyth County, North Carolina	850	829	97.5	155	18.2
NC	Forsyth County	Block Group 3, Census Tract 38.04, Forsyth County, North Carolina	903	235	26	150	16.6
NC	Forsyth County	Block Group 2, Census Tract 39.05, Forsyth County, North Carolina	1234	452	36.6	77	6.2
NC	Forsyth County	Block Group 2, Census Tract 25.01, Forsyth County, North Carolina	608	11	1.8	51	8.4
NC	Forsyth County	Block Group 4, Census Tract 9, Forsyth County, North Carolina	1253	566	45.2	22	3.1
NC	Forsyth County	Block Group 3, Census Tract 37.02, Forsyth County, North Carolina	1934	1316	68	246	12.7
NC	Forsyth County	Block Group 1, Census Tract 36, Forsyth County, North Carolina	821	444	54.1	17	2.1
NC	Forsyth County	Block Group 3, Census Tract 39.04, Forsyth County, North Carolina	1604	564	35.2	36	2.2
NC	Forsyth County	Block Group 1, Census Tract 18, Forsyth County, North Carolina	1847	1719	93.1	454	24.6
NC	Forsyth County	Block Group 2, Census Tract 19.02, Forsyth County, North Carolina	837	217	25.9	59	7
NC	Forsyth County	Block Group 3, Census Tract 10, Forsyth County, North Carolina	1434	203	14.2	144	10
NC	Forsyth County	Block Group 3, Census Tract 4, Forsyth County, North Carolina	2609	2601	99.7	1272	50
NC	Forsyth County	Block Group 2, Census Tract 38.03, Forsyth County, North Carolina	1283	545	42.5	167	13
NC	Forsyth County	Block Group 2, Census Tract 6, Forsyth County, North Carolina	734	734	100	436	59.4
NC	Forsyth County	Block Group 3, Census Tract 37.01, Forsyth County, North Carolina	1762	1138	64.6	765	43.4
NC	Forsyth County	Block Group 5, Census Tract 35, Forsyth County, North Carolina	1692	1353	80	336	20.1
NC	Forsyth County	Block Group 2, Census Tract 39.06, Forsyth County, North Carolina	543	74	13.6	0	0
NC	Forsyth County	Block Group 4, Census Tract 17, Forsyth County, North Carolina	1139	1096	96.2	479	42.1
NC	Forsyth County	Block Group 2, Census Tract 39.03, Forsyth County, North Carolina	2204	1401	63.6	572	26
NC	Forsyth County	Block Group 1, Census Tract 19.02, Forsyth County, North Carolina	1147	642	56	338	29.5
NC	Forsyth County	Block Group 1, Census Tract 12, Forsyth County, North Carolina	1920	204	10.6	103	5.7
NC	Forsyth County	Block Group 1, Census Tract 8.01, Forsyth County, North Carolina	3400	2923	86	458	72.8
NC	Forsyth County	Block Group 1, Census Tract 25.02, Forsyth County, North Carolina	1460	124	8.5	125	8.6
NC	Forsyth County	Block Group 2, Census Tract 5, Forsyth County, North Carolina	728	728	100	406	55.8
NC	Forsyth County	Block Group 1, Census Tract 21, Forsyth County, North Carolina	1076	267	24.8	206	21.7
NC	Forsyth County	Block Group 2, Census Tract 1, Forsyth County, North Carolina	2249	884	39.3	217	14.5
NC	Forsyth County	Block Group 2, Census Tract 35, Forsyth County, North Carolina	1050	942	89.7	486	46.3
NC	Forsyth County	Block Group 1, Census Tract 38.06, Forsyth County, North Carolina	1825	518	28.4	203	11.1
NC	Forsyth County	Block Group 1, Census Tract 3.01, Forsyth County, North Carolina	666	648	97.3	277	41.6
NC	Forsyth County	Block Group 1, Census Tract 11, Forsyth County, North Carolina	1119	153	13.7	153	13.7
NC	Forsyth County	Block Group 2, Census Tract 20.01, Forsyth County, North Carolina	1330	918	69	362	27.2
NC	Forsyth County	Block Group 3, Census Tract 18, Forsyth County, North Carolina	773	763	98.7	97	13
NC	Forsyth County	Block Group 2, Census Tract 37.02, Forsyth County, North Carolina	2209	1455	65.9	203	9.2
NC	Forsyth County	Block Group 2, Census Tract 7, Forsyth County, North Carolina	966	951	98.4	292	30.2
NC	Forsyth County	Block Group 3, Census Tract 9, Forsyth County, North Carolina	399	182	45.6	85	21.6
NC	Forsyth County	Block Group 2, Census Tract 20.02, Forsyth County, North Carolina	1965	1461	74.4	357	18.2
NC	Forsyth County	Block Group 4, Census Tract 38.04, Forsyth County, North Carolina	839	294	35	133	15.9
NC	Forsyth County	Block Group 1, Census Tract 25.01, Forsyth County, North Carolina	914	19	2.1	8	0.9
NC	Forsyth County	Block Group 2, Census Tract 39.04, Forsyth County, North Carolina	1458	612	42	116	8.1
NC	Forsyth County	Block Group 1, Census Tract 20.01, Forsyth County, North Carolina	924	692	74.9	591	64
NC	Forsyth County	Block Group 2, Census Tract 8.02, Forsyth County, North Carolina	1838	1299	70.7	454	42.9
NC	Forsyth County	Block Group 2, Census Tract 37.01, Forsyth County, North Carolina	1883	1046	55.5	565	30
NC	Forsyth County	Block Group 1, Census Tract 22, Forsyth County, North Carolina	745	182	24.4	89	11.9
NC	Forsyth County	Block Group 2, Census Tract 10, Forsyth County, North Carolina	1515	995	65.7	348	23
NC	Forsyth County	Block Group 1, Census Tract 39.03, Forsyth County, North Carolina	2136	748	35	282	13.3
NC	Forsyth County	Block Group 3, Census Tract 25.01, Forsyth County, North Carolina	1069	255	23.9	6	0.6
NC	Forsyth County	Block Group 1, Census Tract 2, Forsyth County, North Carolina	1077	604	56.1	450	42.1
NC	Forsyth County	Block Group 3, Census Tract 35, Forsyth County, North Carolina	1451	857	59.1	813	57.9
NC	Forsyth County	Block Group 1, Census Tract 33.09, Forsyth County, North Carolina	599	483	80.6	164	27.4
NC	Forsyth County	Block Group 3, Census Tract 39.06, Forsyth County, North Carolina	1964	401	20.4	158	8
NC	Forsyth County	Block Group 3, Census Tract 38.05, Forsyth County, North Carolina	989	482	48.7	178	18
NC	Forsyth County	Block Group 1, Census Tract 1, Forsyth County, North Carolina	640	124	19.4	47	7.3
NC	Forsyth County	Block Group 1, Census Tract 34.03, Forsyth County, North Carolina	1982	1411	71.2	351	17.7
NC	Forsyth County	Block Group 2, Census Tract 38.05, Forsyth County, North Carolina	1434	464	32.4	209	14.6
NC	Forsyth County	Block Group 1, Census Tract 38.03, Forsyth County, North Carolina	2485	1234	49.7	229	9.2
NC	Forsyth County	Block Group 3, Census Tract 36, Forsyth County, North Carolina	1944	857	44.1	261	13.4
NC	Forsyth County	Block Group 3, Census Tract 39.05, Forsyth County, North Carolina	768	420	54.7	27	3.5
NC	Forsyth County	Block Group 2, Census Tract 38.04, Forsyth County, North Carolina	1504	381	25.3	145	9.6
NC	Forsyth County	Block Group 1, Census Tract 34.04, Forsyth County, North Carolina	2281	1964	86.1	1569	68.8

NC	Forsyth County	Block Group 4, Census Tract 38.05, Forsyth County, North Carolina	1409	476	33.8	30	2.1
NC	Forsyth County	Block Group 2, Census Tract 36, Forsyth County, North Carolina	1971	1070	54.3	343	17.4
NC	Forsyth County	Block Group 1, Census Tract 6, Forsyth County, North Carolina	1717	1700	99	752	43.8
NC	Forsyth County	Block Group 4, Census Tract 37.02, Forsyth County, North Carolina	701	74	10.6	35	5
NC	Forsyth County	Block Group 4, Census Tract 35, Forsyth County, North Carolina	1891	486	25.7	204	11.1
NC	Forsyth County	Block Group 1, Census Tract 39.05, Forsyth County, North Carolina	2420	613	25.3	172	7.1
NC	Forsyth County	Block Group 1, Census Tract 19.01, Forsyth County, North Carolina	1708	1475	86.4	719	42.2
NC	Forsyth County	Block Group 1, Census Tract 8.02, Forsyth County, North Carolina	463	455	98.3	274	59.2
NC	Forsyth County	Block Group 1, Census Tract 37.03, Forsyth County, North Carolina	2610	909	34.8	52	2
NC	Forsyth County	Block Group 2, Census Tract 3.01, Forsyth County, North Carolina	1331	1241	93.2	627	47.1
NC	Forsyth County	Block Group 2, Census Tract 21, Forsyth County, North Carolina	1242	165	13.3	101	8.1
NC	Forsyth County	Block Group 1, Census Tract 10, Forsyth County, North Carolina	818	514	62.8	184	22.5
NC	Forsyth County	Block Group 1, Census Tract 37.01, Forsyth County, North Carolina	580	522	90	343	59.1
NC	Forsyth County	Block Group 2, Census Tract 38.06, Forsyth County, North Carolina	1815	755	41.6	363	20
NC	Forsyth County	Block Group 4, Census Tract 10, Forsyth County, North Carolina	635	34	5.4	40	6.3
NC	Forsyth County	Block Group 2, Census Tract 18, Forsyth County, North Carolina	803	754	93.9	249	31
NC	Forsyth County	Block Group 1, Census Tract 38.04, Forsyth County, North Carolina	1321	139	10.5	71	5.9
NC	Forsyth County	Block Group 1, Census Tract 37.02, Forsyth County, North Carolina	1041	259	24.9	0	0
NC	Forsyth County	Block Group 2, Census Tract 9, Forsyth County, North Carolina	1365	1105	81	398	30
NC	Forsyth County	Block Group 1, Census Tract 7, Forsyth County, North Carolina	908	868	95.6	414	45.6
NC	Forsyth County	Block Group 1, Census Tract 20.02, Forsyth County, North Carolina	2218	1865	84.1	1005	45.3
NC	Forsyth County	Block Group 3, Census Tract 38.03, Forsyth County, North Carolina	1029	589	57.2	223	21.7
NC	Forsyth County	Block Group 3, Census Tract 22, Forsyth County, North Carolina	1394	130	9.3	27	1.9
NC	Forsyth County	Block Group 1, Census Tract 39.06, Forsyth County, North Carolina	1223	32	2.6	40	3.3
NC	Forsyth County	Block Group 3, Census Tract 11, Forsyth County, North Carolina	866	368	42.5	183	27.2
NC	Forsyth County	Block Group 1, Census Tract 35, Forsyth County, North Carolina	1518	1366	90	797	52.5
NC	Forsyth County	Block Group 1, Census Tract 4, Forsyth County, North Carolina	625	625	100	80	12.8
NC	Forsyth County	Block Group 1, Census Tract 38.05, Forsyth County, North Carolina	2066	1011	48.9	804	38.9
NC	Forsyth County	Block Group 4, Census Tract 37.03, Forsyth County, North Carolina	1210	823	68	0	0
NC	Forsyth County	Block Group 3, Census Tract 37.03, Forsyth County, North Carolina	1760	926	52.6	289	16.4
NC	Forsyth County	Block Group 5, Census Tract 37.03, Forsyth County, North Carolina	1149	735	64	65	5.7
NC	Forsyth County	Block Group 2, Census Tract 37.03, Forsyth County, North Carolina	1461	522	35.7	61	4.2
			132261	70530	52.634375	26970	21.96770833

Forsyth County Block Group ACS 2020 5-Year Estimate Data

STATE	COUNTY	NAME	Population Total	Population Minority	Percent Minority	Population Low-Income	Percent Low-income
NC	Forsyth County	Block Group 1, Census Tract 38.05, Forsyth County, North Carolina	2066	1011	48.9	804	38.9
NC	Forsyth County	Block Group 1, Census Tract 4, Forsyth County, North Carolina	625	625	100	80	12.8
NC	Forsyth County	Block Group 3, Census Tract 11, Forsyth County, North Carolina	866	368	42.5	183	27.2
NC	Forsyth County	Block Group 3, Census Tract 17, Forsyth County, North Carolina	3052	2112	69.2	70	2.3
NC	Forsyth County	Block Group 1, Census Tract 39.04, Forsyth County, North Carolina	1786	513	28.7	115	6.4
NC	Forsyth County	Block Group 1, Census Tract 39.06, Forsyth County, North Carolina	1223	32	2.6	40	3.3
NC	Forsyth County	Block Group 3, Census Tract 22, Forsyth County, North Carolina	1394	130	9.3	27	1.9
NC	Forsyth County	Block Group 3, Census Tract 38.03, Forsyth County, North Carolina	1029	589	57.2	223	21.7
NC	Forsyth County	Block Group 1, Census Tract 26.01, Forsyth County, North Carolina	2937	1001	34.1	302	10.3
NC	Forsyth County	Block Group 1, Census Tract 20.02, Forsyth County, North Carolina	2218	1865	84.1	1005	45.3
NC	Forsyth County	Block Group 2, Census Tract 9, Forsyth County, North Carolina	1365	1105	81	398	30
NC	Forsyth County	Block Group 1, Census Tract 7, Forsyth County, North Carolina	908	868	95.6	414	45.6
NC	Forsyth County	Block Group 1, Census Tract 37.02, Forsyth County, North Carolina	1041	259	24.9	0	0
NC	Forsyth County	Block Group 1, Census Tract 38.04, Forsyth County, North Carolina	1321	139	10.5	71	5.9
NC	Forsyth County	Block Group 4, Census Tract 10, Forsyth County, North Carolina	635	34	5.4	40	6.3
NC	Forsyth County	Block Group 1, Census Tract 2, Forsyth County, North Carolina	1077	604	56.1	450	42.1
NC	Forsyth County	Block Group 2, Census Tract 38.06, Forsyth County, North Carolina	1815	755	41.6	363	20
NC	Forsyth County	Block Group 1, Census Tract 39.08, Forsyth County, North Carolina	1505	203	13.5	66	4.4
NC	Forsyth County	Block Group 2, Census Tract 16.02, Forsyth County, North Carolina	1605	1542	96.1	616	38.4
NC	Forsyth County	Block Group 4, Census Tract 40.11, Forsyth County, North Carolina	1108	177	16	0	0
NC	Forsyth County	Block Group 4, Census Tract 39.04, Forsyth County, North Carolina	1095	128	11.7	49	4.5
NC	Forsyth County	Block Group 2, Census Tract 41.02, Forsyth County, North Carolina	1746	262	15	62	3.6
NC	Forsyth County	Block Group 1, Census Tract 37.01, Forsyth County, North Carolina	580	522	90	343	59.1
NC	Forsyth County	Block Group 2, Census Tract 21, Forsyth County, North Carolina	1242	165	13.3	101	8.1
NC	Forsyth County	Block Group 1, Census Tract 10, Forsyth County, North Carolina	818	514	62.8	184	22.5
NC	Forsyth County	Block Group 2, Census Tract 3.01, Forsyth County, North Carolina	1331	1241	93.2	627	47.1
NC	Forsyth County	Block Group 1, Census Tract 37.03, Forsyth County, North Carolina	2610	909	34.8	52	2
NC	Forsyth County	Block Group 3, Census Tract 25.01, Forsyth County, North Carolina	1069	255	23.9	6	0.6
NC	Forsyth County	Block Group 1, Census Tract 8.02, Forsyth County, North Carolina	463	455	98.3	274	59.2
NC	Forsyth County	Block Group 2, Census Tract 30.02, Forsyth County, North Carolina	1354	842	62.2	258	19.1
NC	Forsyth County	Block Group 3, Census Tract 40.14, Forsyth County, North Carolina	999	199	19.9	73	7.3
NC	Forsyth County	Block Group 1, Census Tract 39.03, Forsyth County, North Carolina	2136	748	35	282	13.3
NC	Forsyth County	Block Group 2, Census Tract 14, Forsyth County, North Carolina	1599	1283	80.2	669	52
NC	Forsyth County	Block Group 1, Census Tract 17, Forsyth County, North Carolina	820	820	100	223	27.2
NC	Forsyth County	Block Group 1, Census Tract 39.05, Forsyth County, North Carolina	2420	613	25.3	172	7.1
NC	Forsyth County	Block Group 4, Census Tract 37.02, Forsyth County, North Carolina	701	74	10.6	35	5
NC	Forsyth County	Block Group 2, Census Tract 10, Forsyth County, North Carolina	1515	995	65.7	348	23
NC	Forsyth County	Block Group 1, Census Tract 6, Forsyth County, North Carolina	1717	1700	99	752	43.8
NC	Forsyth County	Block Group 2, Census Tract 40.14, Forsyth County, North Carolina	1152	160	13.9	34	3
NC	Forsyth County	Block Group 1, Census Tract 22, Forsyth County, North Carolina	745	182	24.4	89	11.9
NC	Forsyth County	Block Group 1, Census Tract 26.05, Forsyth County, North Carolina	1834	691	37.7	246	13.5
NC	Forsyth County	Block Group 2, Census Tract 37.01, Forsyth County, North Carolina	1883	1046	55.5	565	30
NC	Forsyth County	Block Group 2, Census Tract 8.02, Forsyth County, North Carolina	1838	1299	70.7	454	42.9
NC	Forsyth County	Block Group 1, Census Tract 27.02, Forsyth County, North Carolina	1004	846	84.3	42	4.2
NC	Forsyth County	Block Group 2, Census Tract 39.04, Forsyth County, North Carolina	1458	612	42	116	8.1
NC	Forsyth County	Block Group 3, Census Tract 16.01, Forsyth County, North Carolina	735	659	89.7	137	18.6
NC	Forsyth County	Block Group 1, Census Tract 25.01, Forsyth County, North Carolina	914	19	2.1	8	0.9
NC	Forsyth County	Block Group 4, Census Tract 38.04, Forsyth County, North Carolina	839	294	35	133	15.9
NC	Forsyth County	Block Group 3, Census Tract 40.15, Forsyth County, North Carolina	1808	534	29.5	329	18.2
NC	Forsyth County	Block Group 2, Census Tract 41.04, Forsyth County, North Carolina	700	34	4.9	56	8
NC	Forsyth County	Block Group 4, Census Tract 38.05, Forsyth County, North Carolina	1409	476	33.8	30	2.1
NC	Forsyth County	Block Group 2, Census Tract 20.02, Forsyth County, North Carolina	1965	1461	74.4	357	18.2
NC	Forsyth County	Block Group 3, Census Tract 9, Forsyth County, North Carolina	399	182	45.6	85	21.6
NC	Forsyth County	Block Group 1, Census Tract 5, Forsyth County, North Carolina	301	290	96.3	135	44.9
NC	Forsyth County	Block Group 2, Census Tract 30.03, Forsyth County, North Carolina	2193	771	35.2	521	23.8
NC	Forsyth County	Block Group 2, Census Tract 7, Forsyth County, North Carolina	966	951	98.4	292	30.2
NC	Forsyth County	Block Group 2, Census Tract 37.02, Forsyth County, North Carolina	2209	1455	65.9	203	9.2
NC	Forsyth County	Block Group 2, Census Tract 27.02, Forsyth County, North Carolina	1008	822	81.5	228	22.6
NC	Forsyth County	Block Group 2, Census Tract 38.04, Forsyth County, North Carolina	1504	381	25.3	145	9.6
NC	Forsyth County	Block Group 1, Census Tract 11, Forsyth County, North Carolina	1119	153	13.7	153	13.7
NC	Forsyth County	Block Group 1, Census Tract 3.01, Forsyth County, North Carolina	666	648	97.3	277	41.6
NC	Forsyth County	Block Group 3, Census Tract 13, Forsyth County, North Carolina	885	316	35.7	97	11
NC	Forsyth County	Block Group 2, Census Tract 39.08, Forsyth County, North Carolina	2010	279	13.9	12	0.6
NC	Forsyth County	Block Group 1, Census Tract 29.01, Forsyth County, North Carolina	1632	753	46.1	373	22.9

NC	Forsyth County	Block Group 3, Census Tract 39.05, Forsyth County, North Carolina	768	420	54.7	27	3.5
NC	Forsyth County	Block Group 1, Census Tract 16.01, Forsyth County, North Carolina	1336	1153	86.3	196	14.7
NC	Forsyth County	Block Group 1, Census Tract 28.07, Forsyth County, North Carolina	2736	1436	52.5	109	4
NC	Forsyth County	Block Group 3, Census Tract 28.04, Forsyth County, North Carolina	1645	1198	72.8	480	29.2
NC	Forsyth County	Block Group 1, Census Tract 38.06, Forsyth County, North Carolina	1825	518	28.4	203	11.1
NC	Forsyth County	Block Group 1, Census Tract 41.02, Forsyth County, North Carolina	1257	175	13.9	255	20.3
NC	Forsyth County	Block Group 2, Census Tract 1, Forsyth County, North Carolina	2249	884	39.3	217	14.5
NC	Forsyth County	Block Group 2, Census Tract 40.13, Forsyth County, North Carolina	1451	170	11.7	160	11
NC	Forsyth County	Block Group 1, Census Tract 21, Forsyth County, North Carolina	1076	267	24.8	206	21.7
NC	Forsyth County	Block Group 2, Census Tract 5, Forsyth County, North Carolina	728	728	100	406	55.8
NC	Forsyth County	Block Group 1, Census Tract 25.02, Forsyth County, North Carolina	1460	124	8.5	125	8.6
NC	Forsyth County	Block Group 2, Census Tract 27.04, Forsyth County, North Carolina	910	774	85.1	190	20.9
NC	Forsyth County	Block Group 3, Census Tract 40.11, Forsyth County, North Carolina	2081	320	15.4	910	43.7
NC	Forsyth County	Block Group 1, Census Tract 8.01, Forsyth County, North Carolina	3400	2923	86	458	72.8
NC	Forsyth County	Block Group 2, Census Tract 27.01, Forsyth County, North Carolina	2460	1662	67.6	417	17
NC	Forsyth County	Block Group 1, Census Tract 29.03, Forsyth County, North Carolina	754	546	72.4	139	18.4
NC	Forsyth County	Block Group 1, Census Tract 38.03, Forsyth County, North Carolina	2485	1234	49.7	229	9.2
NC	Forsyth County	Block Group 2, Census Tract 4, Forsyth County, North Carolina	734	730	99.5	341	46.5
NC	Forsyth County	Block Group 1, Census Tract 12, Forsyth County, North Carolina	1920	204	10.6	103	5.7
NC	Forsyth County	Block Group 2, Census Tract 38.05, Forsyth County, North Carolina	1434	464	32.4	209	14.6
NC	Forsyth County	Block Group 1, Census Tract 19.02, Forsyth County, North Carolina	1147	642	56	338	29.5
NC	Forsyth County	Block Group 2, Census Tract 39.03, Forsyth County, North Carolina	2204	1401	63.6	572	26
NC	Forsyth County	Block Group 1, Census Tract 15, Forsyth County, North Carolina	2536	2366	93.3	784	30.9
NC	Forsyth County	Block Group 4, Census Tract 17, Forsyth County, North Carolina	1139	1096	96.2	479	42.1
NC	Forsyth County	Block Group 2, Census Tract 39.06, Forsyth County, North Carolina	543	74	13.6	0	0
NC	Forsyth County	Block Group 2, Census Tract 26.01, Forsyth County, North Carolina	794	57	7.2	13	1.6
NC	Forsyth County	Block Group 3, Census Tract 27.05, Forsyth County, North Carolina	510	220	43.1	91	17.8
NC	Forsyth County	Block Group 1, Census Tract 40.15, Forsyth County, North Carolina	1430	397	27.8	121	8.5
NC	Forsyth County	Block Group 3, Census Tract 37.01, Forsyth County, North Carolina	1762	1138	64.6	765	43.4
NC	Forsyth County	Block Group 2, Census Tract 6, Forsyth County, North Carolina	734	734	100	436	59.4
NC	Forsyth County	Block Group 2, Census Tract 38.03, Forsyth County, North Carolina	1283	545	42.5	167	13
NC	Forsyth County	Block Group 1, Census Tract 1, Forsyth County, North Carolina	640	124	19.4	47	7.3
NC	Forsyth County	Block Group 3, Census Tract 4, Forsyth County, North Carolina	2609	2601	99.7	1272	50
NC	Forsyth County	Block Group 3, Census Tract 10, Forsyth County, North Carolina	1434	203	14.2	144	10
NC	Forsyth County	Block Group 1, Census Tract 13, Forsyth County, North Carolina	1319	459	34.8	322	50.9
NC	Forsyth County	Block Group 2, Census Tract 19.02, Forsyth County, North Carolina	837	217	25.9	59	7
NC	Forsyth County	Block Group 3, Census Tract 38.05, Forsyth County, North Carolina	989	482	48.7	178	18
NC	Forsyth County	Block Group 2, Census Tract 28.08, Forsyth County, North Carolina	1656	224	13.5	0	0
NC	Forsyth County	Block Group 3, Census Tract 39.04, Forsyth County, North Carolina	1604	564	35.2	36	2.2
NC	Forsyth County	Block Group 3, Census Tract 39.06, Forsyth County, North Carolina	1964	401	20.4	158	8
NC	Forsyth County	Block Group 1, Census Tract 28.04, Forsyth County, North Carolina	1042	404	38.8	102	10
NC	Forsyth County	Block Group 1, Census Tract 16.02, Forsyth County, North Carolina	1482	1342	90.6	565	38.1
NC	Forsyth County	Block Group 1, Census Tract 33.09, Forsyth County, North Carolina	599	483	80.6	164	27.4
NC	Forsyth County	Block Group 3, Census Tract 37.02, Forsyth County, North Carolina	1934	1316	68	246	12.7
NC	Forsyth County	Block Group 1, Census Tract 26.04, Forsyth County, North Carolina	716	573	80	106	14.8
NC	Forsyth County	Block Group 4, Census Tract 9, Forsyth County, North Carolina	1253	566	45.2	22	3.1
NC	Forsyth County	Block Group 1, Census Tract 40.11, Forsyth County, North Carolina	1921	114	5.9	69	3.6
NC	Forsyth County	Block Group 4, Census Tract 40.12, Forsyth County, North Carolina	1098	21	1.9	0	0
NC	Forsyth County	Block Group 2, Census Tract 25.01, Forsyth County, North Carolina	608	11	1.8	51	8.4
NC	Forsyth County	Block Group 2, Census Tract 31.05, Forsyth County, North Carolina	1964	329	16.8	169	8.9
NC	Forsyth County	Block Group 2, Census Tract 39.05, Forsyth County, North Carolina	1234	452	36.6	77	6.2
NC	Forsyth County	Block Group 1, Census Tract 3.02, Forsyth County, North Carolina	1541	1467	95.2	396	25.7
NC	Forsyth County	Block Group 5, Census Tract 27.02, Forsyth County, North Carolina	881	599	68	362	42.4
NC	Forsyth County	Block Group 3, Census Tract 38.04, Forsyth County, North Carolina	903	235	26	150	16.6
NC	Forsyth County	Block Group 2, Census Tract 29.01, Forsyth County, North Carolina	993	176	17.7	93	9.5
NC	Forsyth County	Block Group 4, Census Tract 26.04, Forsyth County, North Carolina	1060	105	9.9	0	0
NC	Forsyth County	Block Group 4, Census Tract 18, Forsyth County, North Carolina	850	829	97.5	155	18.2
NC	Forsyth County	Block Group 2, Census Tract 11, Forsyth County, North Carolina	761	246	32.3	230	30.2
NC	Forsyth County	Block Group 1, Census Tract 39.09, Forsyth County, North Carolina	1455	197	13.5	54	3.7
NC	Forsyth County	Block Group 1, Census Tract 28.01, Forsyth County, North Carolina	1350	77	5.7	0	0
NC	Forsyth County	Block Group 2, Census Tract 17, Forsyth County, North Carolina	654	654	100	378	57.8
NC	Forsyth County	Block Group 1, Census Tract 14, Forsyth County, North Carolina	2312	2245	97.1	569	24.7
NC	Forsyth County	Block Group 2, Census Tract 28.07, Forsyth County, North Carolina	1625	527	32.4	231	14.3
NC	Forsyth County	Block Group 1, Census Tract 28.06, Forsyth County, North Carolina	640	446	69.7	38	6.9
NC	Forsyth County	Block Group 2, Census Tract 31.03, Forsyth County, North Carolina	2072	683	33	26	1.3
NC	Forsyth County	Block Group 1, Census Tract 40.05, Forsyth County, North Carolina	1268	28	2.2	27	2.1
NC	Forsyth County	Block Group 2, Census Tract 41.03, Forsyth County, North Carolina	2506	438	17.5	328	13.7
NC	Forsyth County	Block Group 3, Census Tract 5, Forsyth County, North Carolina	1219	1207	99	680	55.8
NC	Forsyth County	Block Group 3, Census Tract 30.02, Forsyth County, North Carolina	1216	247	20.3	49	4
NC	Forsyth County	Block Group 1, Census Tract 40.14, Forsyth County, North Carolina	1139	25	2.2	52	4.6
NC	Forsyth County	Block Group 1, Census Tract 27.05, Forsyth County, North Carolina	1527	1106	72.4	575	37.7
NC	Forsyth County	Block Group 2, Census Tract 22, Forsyth County, North Carolina	1374	342	24.9	169	12.4
NC	Forsyth County	Block Group 2, Census Tract 25.02, Forsyth County, North Carolina	1615	64	4	20	1.2
NC	Forsyth County	Block Group 1, Census Tract 9, Forsyth County, North Carolina	601	250	41.6	255	42.4
NC	Forsyth County	Block Group 1, Census Tract 26.06, Forsyth County, North Carolina	1382	626	45.3	122	8.8

NC	Forsyth County	Block Group 1, Census Tract 40.12, Forsyth County, North Carolina	1696	331	19.5	103	6.1
NC	Forsyth County	Block Group 2, Census Tract 40.09, Forsyth County, North Carolina	2454	295	12	244	9.9
NC	Forsyth County	Block Group 3, Census Tract 41.04, Forsyth County, North Carolina	766	354	46.2	5	0.7
NC	Forsyth County	Block Group 3, Census Tract 31.06, Forsyth County, North Carolina	1603	110	6.9	322	20.2
NC	Forsyth County	Block Group 1, Census Tract 31.05, Forsyth County, North Carolina	1495	268	17.9	303	20.4
NC	Forsyth County	Block Group 3, Census Tract 40.12, Forsyth County, North Carolina	1185	750	63.3	65	5.7
NC	Forsyth County	Block Group 3, Census Tract 40.05, Forsyth County, North Carolina	816	68	8.3	6	0.7
NC	Forsyth County	Block Group 1, Census Tract 28.08, Forsyth County, North Carolina	2230	753	33.8	384	17.2
NC	Forsyth County	Block Group 2, Census Tract 31.06, Forsyth County, North Carolina	1166	52	4.5	0	0
NC	Forsyth County	Block Group 3, Census Tract 39.09, Forsyth County, North Carolina	1450	316	21.8	225	15.5
NC	Forsyth County	Block Group 3, Census Tract 40.07, Forsyth County, North Carolina	1154	532	46.1	30	2.6
NC	Forsyth County	Block Group 1, Census Tract 29.04, Forsyth County, North Carolina	2130	257	12.1	305	14.5
NC	Forsyth County	Block Group 3, Census Tract 26.04, Forsyth County, North Carolina	2333	401	17.2	0	0
NC	Forsyth County	Block Group 1, Census Tract 31.06, Forsyth County, North Carolina	687	23	3.3	87	12.7
NC	Forsyth County	Block Group 1, Census Tract 40.13, Forsyth County, North Carolina	1968	906	46	129	6.6
NC	Forsyth County	Block Group 2, Census Tract 26.04, Forsyth County, North Carolina	1382	375	27.1	98	7.1
NC	Forsyth County	Block Group 2, Census Tract 40.10, Forsyth County, North Carolina	1686	174	10.3	40	2.4
NC	Forsyth County	Block Group 2, Census Tract 40.07, Forsyth County, North Carolina	2096	290	13.8	58	2.8
NC	Forsyth County	Block Group 3, Census Tract 15, Forsyth County, North Carolina	558	375	67.2	135	24.2
NC	Forsyth County	Block Group 3, Census Tract 28.01, Forsyth County, North Carolina	2741	545	19.9	343	12.5
NC	Forsyth County	Block Group 1, Census Tract 28.09, Forsyth County, North Carolina	2865	952	33.2	171	6
NC	Forsyth County	Block Group 3, Census Tract 29.03, Forsyth County, North Carolina	1229	181	14.7	394	32.1
NC	Forsyth County	Block Group 2, Census Tract 13, Forsyth County, North Carolina	2767	1022	36.9	4	4.3
NC	Forsyth County	Block Group 2, Census Tract 37.03, Forsyth County, North Carolina	1461	522	35.7	61	4.2
NC	Forsyth County	Block Group 1, Census Tract 40.09, Forsyth County, North Carolina	2515	987	39.2	122	4.9
NC	Forsyth County	Block Group 1, Census Tract 41.03, Forsyth County, North Carolina	2466	593	24	97	3.9
NC	Forsyth County	Block Group 2, Census Tract 40.05, Forsyth County, North Carolina	2697	537	19.9	48	1.8
NC	Forsyth County	Block Group 3, Census Tract 28.07, Forsyth County, North Carolina	1715	484	28.2	118	6.9
NC	Forsyth County	Block Group 2, Census Tract 39.09, Forsyth County, North Carolina	955	243	25.4	36	3.8
NC	Forsyth County	Block Group 4, Census Tract 27.02, Forsyth County, North Carolina	855	448	52.4	99	12.7
NC	Forsyth County	Block Group 3, Census Tract 29.01, Forsyth County, North Carolina	2408	1532	63.6	728	30.2
NC	Forsyth County	Block Group 1, Census Tract 27.01, Forsyth County, North Carolina	3212	2794	87	604	18.8
NC	Forsyth County	Block Group 3, Census Tract 26.06, Forsyth County, North Carolina	1407	442	31.4	51	3.6
NC	Forsyth County	Block Group 1, Census Tract 27.04, Forsyth County, North Carolina	1102	920	83.5	221	20.1
NC	Forsyth County	Block Group 2, Census Tract 40.11, Forsyth County, North Carolina	1190	93	7.8	85	7.1
NC	Forsyth County	Block Group 4, Census Tract 40.07, Forsyth County, North Carolina	2486	786	31.6	30	1.2
NC	Forsyth County	Block Group 2, Census Tract 28.04, Forsyth County, North Carolina	1319	934	70.8	58	4.4
NC	Forsyth County	Block Group 2, Census Tract 28.06, Forsyth County, North Carolina	2389	1486	62.2	452	20.3
NC	Forsyth County	Block Group 1, Census Tract 30.02, Forsyth County, North Carolina	1390	1136	81.7	249	17.9
NC	Forsyth County	Block Group 3, Census Tract 27.02, Forsyth County, North Carolina	1389	888	63.9	496	35.7
NC	Forsyth County	Block Group 2, Census Tract 26.06, Forsyth County, North Carolina	960	229	23.9	95	9.9
NC	Forsyth County	Block Group 2, Census Tract 40.12, Forsyth County, North Carolina	1784	328	18.4	66	3.7
NC	Forsyth County	Block Group 2, Census Tract 27.05, Forsyth County, North Carolina	1111	538	48.4	466	54.7
NC	Forsyth County	Block Group 1, Census Tract 40.10, Forsyth County, North Carolina	2575	937	36.4	60	2.3
NC	Forsyth County	Block Group 1, Census Tract 40.07, Forsyth County, North Carolina	2106	321	15.2	174	8.3
NC	Forsyth County	Block Group 1, Census Tract 41.04, Forsyth County, North Carolina	2533	567	22.4	200	7.9
NC	Forsyth County	Block Group 2, Census Tract 40.15, Forsyth County, North Carolina	1663	441	26.5	70	4.2
NC	Forsyth County	Block Group 2, Census Tract 16.01, Forsyth County, North Carolina	1279	1279	100	141	11
NC	Forsyth County	Block Group 2, Census Tract 15, Forsyth County, North Carolina	1537	1140	74.2	251	16.3
NC	Forsyth County	Block Group 2, Census Tract 28.01, Forsyth County, North Carolina	574	76	13.2	53	9.4
NC	Forsyth County	Block Group 3, Census Tract 27.01, Forsyth County, North Carolina	1847	1249	67.6	63	3.4
NC	Forsyth County	Block Group 2, Census Tract 29.03, Forsyth County, North Carolina	1812	1012	55.8	261	15.1
NC	Forsyth County	Block Group 2, Census Tract 36, Forsyth County, North Carolina	1971	1070	54.3	343	17.4
NC	Forsyth County	Block Group 5, Census Tract 37.03, Forsyth County, North Carolina	1149	735	64	65	5.7
NC	Forsyth County	Block Group 5, Census Tract 35, Forsyth County, North Carolina	1692	1353	80	336	20.1
NC	Forsyth County	Block Group 3, Census Tract 37.03, Forsyth County, North Carolina	1760	926	52.6	289	16.4
NC	Forsyth County	Block Group 1, Census Tract 34.02, Forsyth County, North Carolina	734	38	5.2	175	23.8
NC	Forsyth County	Block Group 1, Census Tract 35, Forsyth County, North Carolina	1518	1366	90	797	52.5
NC	Forsyth County	Block Group 2, Census Tract 18, Forsyth County, North Carolina	803	754	93.9	249	31
NC	Forsyth County	Block Group 2, Census Tract 34.03, Forsyth County, North Carolina	653	587	89.9	288	44.1
NC	Forsyth County	Block Group 1, Census Tract 19.01, Forsyth County, North Carolina	1708	1475	86.4	719	42.2
NC	Forsyth County	Block Group 4, Census Tract 35, Forsyth County, North Carolina	1891	486	25.7	204	11.1
NC	Forsyth County	Block Group 2, Census Tract 34.02, Forsyth County, North Carolina	2427	537	22.1	430	17.7
NC	Forsyth County	Block Group 1, Census Tract 20.01, Forsyth County, North Carolina	924	692	74.9	591	64
NC	Forsyth County	Block Group 1, Census Tract 33.13, Forsyth County, North Carolina	1454	319	21.9	210	15.3
NC	Forsyth County	Block Group 2, Census Tract 33.09, Forsyth County, North Carolina	1962	1527	77.8	309	15.9
NC	Forsyth County	Block Group 2, Census Tract 33.12, Forsyth County, North Carolina	2524	597	23.7	65	2.6
NC	Forsyth County	Block Group 1, Census Tract 34.04, Forsyth County, North Carolina	2281	1964	86.1	1569	68.8
NC	Forsyth County	Block Group 2, Census Tract 20.01, Forsyth County, North Carolina	1330	918	69	362	27.2
NC	Forsyth County	Block Group 3, Census Tract 18, Forsyth County, North Carolina	773	763	98.7	97	13
NC	Forsyth County	Block Group 1, Census Tract 33.14, Forsyth County, North Carolina	1137	304	26.7	90	7.9
NC	Forsyth County	Block Group 3, Census Tract 36, Forsyth County, North Carolina	1944	857	44.1	261	13.4
NC	Forsyth County	Block Group 3, Census Tract 33.09, Forsyth County, North Carolina	2312	1186	51.3	669	29
NC	Forsyth County	Block Group 2, Census Tract 35, Forsyth County, North Carolina	1050	942	89.7	486	46.3
NC	Forsyth County	Block Group 1, Census Tract 33.11, Forsyth County, North Carolina	2041	742	36.4	128	6.3

NC	Forsyth County	Block Group 4, Census Tract 33.08, Forsyth County, North Carolina	1831	398	21.7	16	0.9
NC	Forsyth County	Block Group 1, Census Tract 34.03, Forsyth County, North Carolina	1982	1411	71.2	351	17.7
NC	Forsyth County	Block Group 2, Census Tract 33.08, Forsyth County, North Carolina	2811	891	31.7	111	3.9
NC	Forsyth County	Block Group 1, Census Tract 18, Forsyth County, North Carolina	1847	1719	93.1	454	24.6
NC	Forsyth County	Block Group 1, Census Tract 33.15, Forsyth County, North Carolina	1288	93	7.2	67	5.2
NC	Forsyth County	Block Group 2, Census Tract 33.10, Forsyth County, North Carolina	1579	710	45	60	3.8
NC	Forsyth County	Block Group 2, Census Tract 33.14, Forsyth County, North Carolina	2173	701	32.3	108	5
NC	Forsyth County	Block Group 3, Census Tract 33.08, Forsyth County, North Carolina	631	272	43.1	26	4.2
NC	Forsyth County	Block Group 1, Census Tract 33.12, Forsyth County, North Carolina	1116	139	12.5	211	18.9
NC	Forsyth County	Block Group 1, Census Tract 36, Forsyth County, North Carolina	821	444	54.1	17	2.1
NC	Forsyth County	Block Group 2, Census Tract 34.04, Forsyth County, North Carolina	1725	1461	84.7	652	37.8
NC	Forsyth County	Block Group 1, Census Tract 33.10, Forsyth County, North Carolina	3220	2397	74.4	510	15.8
NC	Forsyth County	Block Group 4, Census Tract 36, Forsyth County, North Carolina	2630	1937	73.7	352	13.4
NC	Forsyth County	Block Group 3, Census Tract 35, Forsyth County, North Carolina	1451	857	59.1	813	57.9
NC	Forsyth County	Block Group 3, Census Tract 33.15, Forsyth County, North Carolina	1107	378	34.1	109	9.8
NC	Forsyth County	Block Group 2, Census Tract 33.15, Forsyth County, North Carolina	1018	326	32	138	13.6
NC	Forsyth County	Block Group 1, Census Tract 33.07, Forsyth County, North Carolina	2224	632	28.4	105	4.7
NC	Forsyth County	Block Group 1, Census Tract 31.07, Forsyth County, North Carolina	1224	342	27.9	89	7.3
NC	Forsyth County	Block Group 1, Census Tract 32.02, Forsyth County, North Carolina	1007	236	23.4	244	24.2
NC	Forsyth County	Block Group 1, Census Tract 31.08, Forsyth County, North Carolina	2922	1368	46.8	669	23.5
NC	Forsyth County	Block Group 1, Census Tract 33.08, Forsyth County, North Carolina	3631	922	25.4	331	9.1
NC	Forsyth County	Block Group 2, Census Tract 32.01, Forsyth County, North Carolina	974	380	39	17	1.7
NC	Forsyth County	Block Group 1, Census Tract 31.03, Forsyth County, North Carolina	1288	132	10.2	109	8.5
NC	Forsyth County	Block Group 4, Census Tract 32.01, Forsyth County, North Carolina	613	162	26.4	195	31.8
NC	Forsyth County	Block Group 2, Census Tract 31.07, Forsyth County, North Carolina	2912	565	19.4	243	8.3
NC	Forsyth County	Block Group 3, Census Tract 32.02, Forsyth County, North Carolina	2619	1188	45.4	537	20.5
NC	Forsyth County	Block Group 1, Census Tract 32.01, Forsyth County, North Carolina	1425	350	24.6	72	5.1
NC	Forsyth County	Block Group 2, Census Tract 30.04, Forsyth County, North Carolina	1865	259	13.9	94	5.2
NC	Forsyth County	Block Group 2, Census Tract 32.02, Forsyth County, North Carolina	437	289	66.1	125	28.6
NC	Forsyth County	Block Group 2, Census Tract 31.08, Forsyth County, North Carolina	1135	221	19.5	70	6.2
NC	Forsyth County	Block Group 1, Census Tract 30.03, Forsyth County, North Carolina	1425	450	31.6	18	1.3
NC	Forsyth County	Block Group 3, Census Tract 31.03, Forsyth County, North Carolina	2155	354	16.4	148	6.9
NC	Forsyth County	Block Group 2, Census Tract 33.07, Forsyth County, North Carolina	1728	517	29.9	133	7.7
NC	Forsyth County	Block Group 3, Census Tract 32.01, Forsyth County, North Carolina	1952	814	41.7	365	18.8
NC	Forsyth County	Block Group 1, Census Tract 30.04, Forsyth County, North Carolina	1686	366	21.7	197	11.7
			377289	165367	44.65943775	58180	17.17188755

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

Country Club - Country Club Road DC

CWA - Clean Water Act

CZMP - Coastal Zone Management Plan

dB - Decibel

DC - Distribution Center

DNL - Day-Night Average Sound Level

DOT - Department of Transportation

Downtown - Downtown Health Plaza DC

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

FONSI - Finding of No Significant Impact

IPaC - Information for Planning and Consultation

IPP - UAS Integration Pilot Program

Miller - Miller Infusion Center/Miller Medical Plaza DC

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

OpSpecs - Operations Specifications

Piedmont - Piedmont Plaza DC

PSP - Partnership for Safety Program

ROD - Record of Decision

RPIC - Remote Pilot in Command

Shepherd - Shepherd Street DC

SHPO - State Historic Preservation Office(r)

The Commission - North Carolina Wildlife Resources Commission

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