DRAFT ENVIRONMENTAL ASSESSMENT

Zipline International Inc.
Drone Package Delivery Operations in
Salt Lake City, Utah (UT-1) and Surrounding Area

Prepared by:

United States Department of Transportation
Federal Aviation Administration

Washington, D.C.

October 2022

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

Notice of Availability, Notice of Public Comment Period, and Request for Comment on the Draft Environmental Assessment for Zipline International's Drone Package Delivery Operations in Salt Lake City, Utah and Surrounding Area

The Federal Aviation Administration (FAA) hereby gives Notice of Availability (NOA) for the Draft Environmental Assessment (EA) evaluating the potential effects of the FAA decision to authorize Zipline International, Inc. (Zipline) to conduct unmanned aircraft (UA) commercial package delivery operations from one location, or "nest," in South Jordan/Salt Lake City, Utah.

Zipline is seeking to amend its part 135 air carrier Operations Specifications (OpSpecs) to include package delivery operations from its nest in South Jordan/Salt Lake City to approved delivery locations within 17 communities in the operating area, which covers parts of Salt Lake County, Utah County, and Tooele County. The federal action subject to this EA is the requested FAA amendment of Zipline's OpSpecs to include a paragraph with descriptive language about the operating area boundaries, which includes the specific locations and operational profile in Zipline's request.

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

The public comment period for the Draft EA begins with the issuance of this Notice of Availability and lasts 14 days. The FAA encourages all interested parties to provide comments concerning the scope and content of the Draft EA by November 9, 2022, or 14 days from the date of publication of this Notice of Availability, whichever is later. The Draft EA is available to view/download electronically at https://www.faa.gov/uas/advanced_operations/nepa_and_drones/

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

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

Posted October 26, 2022

DAVID M MENZIMER
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ACS	American Community Survey
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
CWA	Clean Water Act
dB	Decibel
DNL	Day-Night Average Sound Level
DNR	Department of Natural Resources
DOT	Department of Transportation
EA	Environmental Assessment
EJ	Environmental Justice
EO	Executive Order
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
IPaC	Information for Planning and Consultation
IPP	UAS Integration Pilot Program
NAS	National Airspace System
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration

NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRHP	National Register of Historic Places
NRI	Nationwide Rivers Inventory
NTSB	National Transportation Safety Board
OpSpecs	Operations Specifications
PSP	Partnership for Safety Program
RPIC	Remote Pilot in Command
SHPO	State Historic Preservation Office(r)
THPO	Tribal Historic Preservation Office(r)
U.S.C.	United States Code
UA	Unmanned Aircraft
UAS	Unmanned Aircraft Systems
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WSRS	National Wild and Scenic Rivers System
Zipline	Zipline International, Inc.

1.0 PURPOSE AND NEED

1.1 Introduction

Zipline International Inc. (Zipline) seeks to amend its air carrier Operations Specifications (OpSpecs) and other Federal Aviation Administration (FAA) approvals necessary to begin unmanned aircraft (UA) commercial package delivery operations from one hub, or "nest," location in Salt Lake City, Utah, using its 49.3-pound "Zip" UA.[1] Zipline anticipates operating a maximum of 20 delivery flights per operating day from the South Jordan/Salt Lake City nest based on the scope of the Proposed Action, which is described in **Section 2.1**.

The total approximate delivery area is 1,675 square miles. At its widest point, the study area, shaped like a polygon, is approximately 45 miles east to west and 41 miles north to south. The study area is split fairly evenly among Salt Lake County (approximately 490 square miles), Tooele County (approximately 542 miles), and Utah County (approximately 643 square miles). **Figure 1** depicts the study area, which is also the study area for this EA. The proposed commercial delivery operations from the South Jordan/Salt Lake City nest would occur during daylight hours up to seven days per week.[2] No nighttime operations are anticipated or requested under the Proposed Action.

The approval of Zipline's amended OpSpecs to include this new study area would be considered a major federal action that is subject to environmental review requirements. The FAA prepared this Environmental Assessment (EA) to evaluate the potential environmental impacts that may result from FAA's approval of the Proposed Action, which would enable UA commercial delivery operations from a nest located in Salt Lake City, Utah.

The FAA 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)). Under NEPA, federal agencies are required 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. Additionally, under NEPA, federal agencies are required to consider the environmental effects of a Proposed Action, 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).[3] 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.[4]

[1] A nest is a ground-based service area where UA are assigned and where flights originate and return.
[2] Daylight hours of operation include approximately ~30 min before sunrise to ~30 min after sunset.
[3] 49 U.S.C. 44802; FAA Modernization and Reform Act of 2012, Pub. L. No. 112-95, Sec. 332. 126 Stat. 11, 73 (2012).
[4] The terms UA and drone may be used interchangeably.

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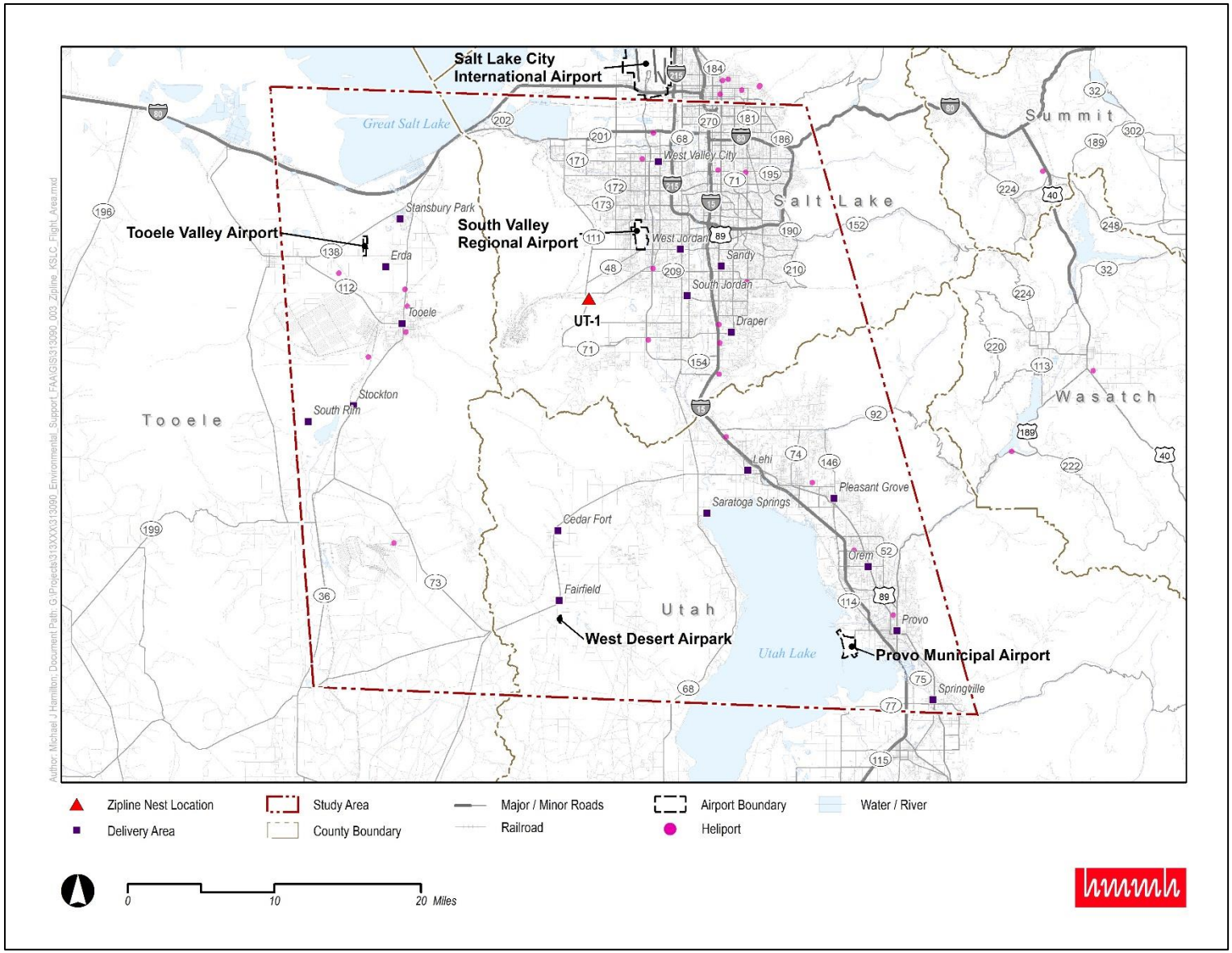

Figure 1: South Jordan/Salt Lake City Nest Location and Study Area

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Over the past several years, Zipline has been working under various FAA programs, including the UAS Integration Pilot Program (IPP),[5] the Partnership for Safety Plan (PSP) Program,[6] and the BEYOND program,[7] 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.

In June 2022, Zipline received its Part 135 Air Carrier Operating Certificate from the FAA, which allows it to carry the property of another for compensation or hire beyond visual line of sight (BVLOS). The certificate contains a stipulation that operations must be conducted in accordance with the provisions and limitations specified in the carrier's OpSpecs. Zipline's current request for amended OpSpecs to specify a new 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 study area.

The study area and Zipline's proposed 17 delivery communities within the study area are shown on **Figure 1**. The delivery communities include: Cedar Fort, Draper, Erda, Fairfield, Lehi, Orem, Pleasant Grove, Provo, Sandy, Saratoga Springs, South Jordan, Springville, Stansbury Park, Stockton Tooele, West Jordan, and West Valley City. The South Jordan/Salt Lake City study area is outlined in a red dashed line, and the nest location is identified with a red triangle. As shown on **Figure 1**, several airports exist within the study area, including the Provo Municipal Airport, South Valley Regional Airport, Tooele Airport, West Desert Airpark. Salt Lake City International Airport is located just outside of the northern limits of the study area.

Zipline proposes to conduct deliveries from this nest location to vetted delivery sites such as medical centers, healthcare facilities, private homes, and commercial facilities.

1.2.1 Nest Location

The nest is located in a capped portion of the Trans-Jordan Landfill located in South Jordan, Utah, approximately 16 miles south of I-80 in Salt Lake City. **Figure 2** shows the South Jordan/Salt Lake City nest site. Zipline worked closely with the landfill representatives on safe land re-use for pre-construction and construction practices, including design changes where relevant. Appropriate processes were implemented, including but not limited to, settlement monitoring, gas detection system, and operational and safety procedures.

The nest site is centrally located to provide deliveries to a mix of privately-owned agricultural, commercial, and residential properties within the study area. A closer view of the nest location is shown on **Figure 3**.

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 that would be addressed and describes what the FAA is trying to achieve with the Proposed Action.

[5] 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/
[6] https://www.faa.gov/uas/programs_partnerships/psp/
[7] https://www.faa.gov/uas/programs_partnerships/beyond/

1.3.1 FAA's Purpose and Need

Zipline recently received its Part 135 Air Carrier Operating Certificate and seeks to amend the OpSpecs that are necessary to begin UA BVLOS commercial package delivery operations in Salt Lake City and the surrounding area. 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 Proposed Action; however, the FAA's issuance of the OpSpecs is the approval that would ultimately enable UA commercial delivery operations in this area. Zipline's request to amend the OpSpecs to add a new area of operations requires FAA review and approval.

The FAA has a statutory obligation to review Zipline'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 with the safety of air commerce in the United States and to encourage the development of civil aeronautics. 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, including OpSpec amendments. 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 certificate 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 OpSpecs amendment.

1.3.2 Zipline's Purpose and Need

The purpose of Zipline's request is to begin UA BVLOS commercial delivery service in Salt Lake City and the surrounding region, which, in its business judgment, Zipline has determined is an appropriate market for expanded operations. In other parts of the country, such as North Carolina and Arkansas, Zipline has obtained the FAA's approval for initial commercial delivery operations. Zipline's amended OpSpecs are needed so that Zipline can begin UA BVLOS commercial delivery operations from its South Jordan/Salt Lake City nest location. The approval would offer Zipline an opportunity to further 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 Zipline gauge public demand for UA commercial delivery services and evaluate whether scalable and cost-effective UA BVLOS delivery expansion is possible in this area. In addition, the approval could provide an opportunity to assess community response to commercial delivery operations in this area.

Source: Zipline International Inc.

Figure 2: Photograph of Zipline's South Jordan/Salt Lake City Nest Site

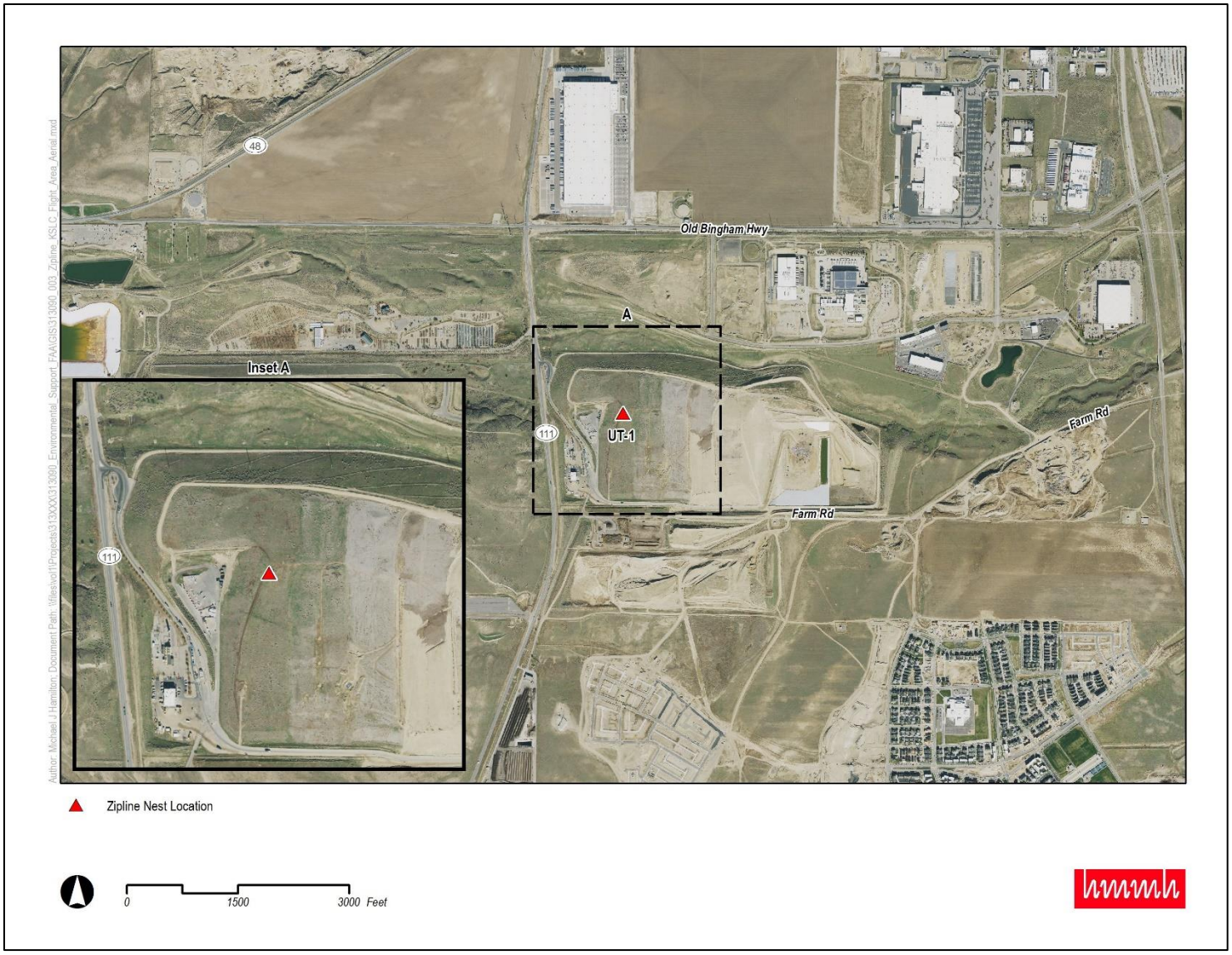

Figure 3: Zipline's South Jordan/Salt Lake City Nest Location

1.4 Public Involvement

The FAA will create a Notice of Availability (NOA) with information about the EA and provide it to local interest groups, local government officials, public park authorities, the National Park Service, the State Historic Preservation Officer (SHPO), and tribes discussed in this EA, and make the EA available to the general public on the FAA website. The NOA will provide information about the Proposed Action and request review and comments on this EA, which will be published on the FAA website in October 2022 for a 14-day comment period. Interested parties are invited to submit comments on any environmental concerns related to the Proposed Action.

2.0 PROPOSED ACTION AND ALTERNATIVES

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

2.1 Proposed Action

In order for Zipline to conduct UA BVLOS commercial 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, Zipline has requested the FAA to amend its OpSpecs so that they can begin UA BVLOS commercial delivery operations in the study area. Zipline received its Part 135 Air Carrier Certificate in June 2022. The OpSpec amendment is the FAA action that ultimately would enable commercial delivery operations in the study area, located in South Jordan/Salt Lake City, Utah.

The B050 OpSpec, *Authorized Areas of En Route Operations, Limitations, and Provisions*, includes a reference section titled Limitations, Provisions, and Special Requirements. The FAA's approval of this OpSpec – including the paragraph in the OpSpec's reference section with descriptive language about the study area boundaries, which includes the specific location and operational profile proposed in Zipline's request – is the proposed federal action for this EA. The OpSpecs would restrict Zipline 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 Zipline's A003 OpSpec, *Airplane/Aircraft Authorization*, would require additional OpSpec amendments from the FAA and would receive appropriate NEPA review at that time.

Zipline anticipates that the proposed UA commercial delivery operations would be made to locations within the 17 following communities, as shown on **Figure 1**:

- Cedar Pod
- Draper
- Erda
- Fairfield
- Lehi
- Orem
- Pleasant Grove
- Provo
- Sandy
- Saratoga Springs
- South Jordan
- Springville
- Stansbury Park
- Stockton
- Tooele
- West Jordan
- West Valley City

Zipline projects operating a maximum of 20 delivery flights per operating day from the South Jordan/Salt Lake City nest based on the scope of the Proposed Action. The operations would occur during daylight

hours up to seven days per week. The UA is capable of nighttime operations; however no nighttime deliveries are anticipated or requested under the Proposed Action. Delivery operations are anticipated to be distributed rather evenly across the 17 delivery communities.

The UA has a maximum takeoff weight of 49.3 pounds, including a maximum payload of 3.5 pounds. It is a fixed-wing drone that uses electric power from rechargeable lithium ion batteries. It launches from a catapult system and is retrieved with a wire capture line. An image of the catapult launch system is shown in **Appendix B**, Figure 4. The aircraft includes a parachute safety system that can be deployed in cases of emergency.

After launch, Zipline's UA rises to a cruising altitude between 130 feet and 400 feet above ground level (AGL) and follows a preplanned route to its delivery site. Aircraft typically fly en route between 250 feet and 400 feet AGL, and stay above 130 feet AGL except when descending to drop a package. The aircraft descends into its delivery loop and releases a package from approximately 60 feet AGL. Packages are carried internally in the aircraft's fuselage, and are dropped by opening a set of payload doors on the aircraft. Packages fall under a small parachute. Zipline's aircraft does not touch the ground in any other place than the nest (except during emergency landings), since it remains airborne while conducting deliveries.

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 to enable Zipline to conduct UA commercial package delivery operations in the study area. CEQ regulations at 40 CFR § 1502.14(c) require agencies to consider a No Action Alternative in their NEPA analyses. Under the No Action Alternative, Zipline would still be authorized to conduct BVLOS package delivery flights under Part 107 operating authorities and waivers although these existing operations are limited in that they cannot be conducted for compensation or hire. Zipline began conducting validation, calibration, and demonstration flights under its Part 107 waiver in February 2022. Its first customer delivery flight from the South Jordan/Salt Lake City nest location was conducted on August 17, 2022. Up to the time this EA was prepared, Zipline had conducted 7 flights (including test, training, and delivery flights). Under the No Action Alternative, Zipline anticipates that it will conduct 10 customer delivery flights per week by the end of 2022, with continued growth from there.

The No Action Alternative does not support the stated purpose and need.

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section 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 study area for each resource is the entire area within the red dashed lined study area shown on **Figure 1**. 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 would not generate emissions that could result in air quality impacts or climate impacts. Electricity consumed for battery charging at the nest and for overall nest operation would be minimal, especially for the limited scope of these operations. Electricity consumed for the Proposed Action would come from the power 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 since there are no coastal zones or shorelines in the area of operations.
- **Farmlands** – The Proposed Action would 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 would not result in any construction or development or any physical disturbances of the ground. In preparing the nest site for operation, Zipline worked closely with the landfill representatives on safe land re-use for pre-construction and construction practices and incorporated design changes

where relevant. Appropriate processes were implemented, including but not limited to, settlement monitoring, gas detection system, and operational and safety procedures. Therefore, the potential for impact in relation to hazardous materials, pollution prevention, and solid waste is not anticipated. Additionally, each Zipline UA is made from recoverable materials and would be properly managed at the end of its operating life in accordance with 14 CFR Part 43. No Superfund sites were identified in the study area.

- **Land Use** – The Proposed Action would not involve any changes to existing, planned, or future land uses within the area of operations.
- **Natural Resources and Energy Supply –** The Proposed Action would not require the need for unusual natural resources and materials, or those in short supply. Zipline's aircraft would be battery powered and would not directly consume fuel resources.
- **Socioeconomic Impacts and Children's Environmental Health and Safety Risks** – The Proposed Action would 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 would 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, Zipline's proposal includes avoiding operations near schools (Monday – Friday) during operational hours, which would help reduce the potential for environmental health or safety impacts to children. Zipline also identifies areas where open air gatherings of people typically occur, such as open air concert venues and school yards. Zipline avoids these properties through the creation of static keep-out areas via Zipline's route planning software, which prepares an optimized flight path from the nest to each designated delivery site.
- **Visual Effects (Light Emissions Only)** – The Proposed Action would not result in significant light emission impacts because flights would be limited to daylight only.
- **Water Resources (Wetlands, Floodplains, and Groundwater)** – The Proposed Action would 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 would not encroach upon areas designated as a 100-year flood event area as described by the Federal Emergency Management Agency (FEMA). The Proposed Action would 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 would 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.

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 Part 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 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.[8]

3.2.2 Affected Environment

This section describes the existing biological environment of the study area. The study area is predominantly located within the Great Salt Lake Major Land Resource Areas and a small portion of the

[8] U.S. Fish and Wildlife Service. 2007. National Bald Eagle Management guidelines. Available: https://www.fws.gov/media/national-bald-eagle-management-guidelines. Accessed: September 7, 2022.

eastern boundary within the Wasatch and Uinta Mountains Major Land Resource Area in Utah.[9] Within the Great Salt Lake area, there are a variety of ecoregions including salt desert, sagebrush basins and slopes, woodland and shrub covered low mountains, and moist Wasatch front foot slopes. Within the Wasatch and Uinta Mountains area, the project area is predominantly semiarid foothills.[10] These types of habitats support a variety of insects, reptiles, amphibians, mammals, and birds. There are several aquatic habitats that occur in the study area, including the southernmost portion of the Great Salt Lake, the northern portion of Utah Lake, a portion of the Provo River, and man-made water impoundment areas. Great Salt Lake is an important avian resource providing food, such as brine shrimp and brine fly, breeding habitat, and migratory staging areas for millions of birds including waterfowl, wading birds, and shorebirds.[11] Zipline does not plan to fly over Great Salt Lake or Utah Lake.

The Proposed Action would take place over urban and rural residential areas, rural farmland, natural areas, and commercially-developed properties. These areas provide habitat for many of the more common wildlife species in the region including opossums; squirrels; rabbits; groundhogs; bats; mice, voles, and other rodents; coyote, foxes, bear, raccoon, weasels, otter, skunks, bobcat, and other carnivores; deer and elk; songbirds, waterfowl, wading birds, and shorebirds; reptiles; amphibians; 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 reports and other available resources. On September 28, 2022, an Official Species List from the USFWS was acquired through the IPAC site and is included in **Appendix A**. The study area, shown in **Figure 1**, includes portions of three counties: Salt Lake, Tooele, and Utah Counties.

Based on the Official Species List, there are three ESA-listed wildlife species that could be present in the study area: the Canada lynx (*Lynx canadensis*), a threatened species; the yellow-billed cuckoo (*Coccyzus americanus*), a threatened species; and the June Sucker (*Chasmistes liorus*), a threatened species. There is also one plant that could be present, the Ute Ladies'-tresses (*Spiranthes diluvialis*), a threatened species. The Monarch butterfly (*Danaus plexippus*), a candidate for listing under the ESA, could also be present in the study area.

Canada lynx – The Canada lynx, a federally-threatened species, is a medium-sized cat that typically uses North American boreal forests in Canada, Alaska, and subalpine forests in the western U.S. and boreal/hardwood forests in the eastern U.S.[12] Five critical habitat units have been designated for this species; however, no critical habitat is designated in Utah.[13] The study area does not include boreal forest

[9] USDA Natural Resource Conservation Service Utah. Available: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ut/technical/landuse/forestry/?cid=nrcs141p2_034185. Accessed September 7, 2022.
[10] Ecological Regions. Available: http://ecologicalregions.info/htm/ecoregions.htm. Accessed September 7, 2022.
[11] Utah Department of Natural Resources (DNR) - Division of Wildlife Resources Great Salt Lake Ecosystem Program. Available: https://wildlife.utah.gov/gslep/wildlife/birds.html. Accessed September 7, 2022.
[12] U.S. Fish and Wildlife Service. ECOS Canada Lynx (Lynx canadensis). Available: https://ecos.fws.gov/ecp/species/3652. Accessed September 8, 2022.
[13] U.S Department of the Interior. 2014. Federal Register Vol. 79 No. 177. Available: https://www.govinfo.gov/content/pkg/FR-2014-09-12/pdf/2014-21013.pdf#page=1. Accessed September 8, 2022.

habitat[14] nor does it include subalpine forest habitat[15]. The study area does not overlap designated critical habitat for the Canada lynx.

Yellow-billed cuckoo – The yellow-billed cuckoo, a federally-threatened species, is a small to medium sized bird (smaller than a crow) and identifiable by its long tail, slim body, and long decurved, yellow bill. Plumage is brownish with a white chest and stomach and rufus patches on its wings. This insectivorous bird uses wooded habitats, overgrown orchards, and fallow farmlands for feeding and nesting. Their range is primarily central U.S to the east coast and further south throughout Central America, the Caribbean and South America. Their range includes small, isolated areas in the Midwest and western U.S. states including Utah.[16] USFWS threatened status applies only to the Western Distinct Population Segment of the yellow-billed cuckoo. Suitable habitat may be present in the study area along wooded riparian habitats, fallow farm fields, or other small wood patches. Critical habitat has been established for the yellow-billed cuckoo in several states including Utah; however, no critical habitat has been established in Salt Lake, Tooele, and Utah Counties.[17] Therefore, no yellow-billed cuckoo critical habitat is within the study area.

June sucker – The June sucker, a federally-threatened fish, is endemic to Utah Lake, feeder streams into Utah Lake, and portions of the Provo River. This fish is grayish brown in color, feeds on zooplankton, and has an average weight of 3.5 pounds.[18] Critical habitat was established for this species on and around Utah Lake in 1986 and includes the entirety of Utah Lake, portions of the Provo River, and surrounding feeder streams.[19] The northern portion of Utah Lake, portions of the Provo River, and surrounding feeder streams are located within the study area.

Ute Ladies'-Tresses – Ute ladies'-tresses, a federally-threatened species, are perennial herbs with basal leaves (leaves at the base of the plant near the ground) and a flowered spike with white spiraling flowers. These plants are present in Utah and other states in the Midwest U.S. and typically grow in wetland and seep areas (where ground water infiltration occurs and soils typically remain moist), along riparian edges, oxbows, and historical floodplains.[20] No critical habitat has been established for this species.

Monarch butterfly – Monarch butterflies are a large butterfly with bright orange wings surrounded by a black border containing a double row of white spots. These butterflies lay their eggs on milkweed plants, which serves as a host plant for the species. Monarchs breed year-round; however, populations in many parts of North America undergo a long-range migration to overwintering sites during the winter months, with some individuals traveling as far south as central Mexico.[21]

[14] Nature Service Explorer. Division-North American Boreal Forest & Woodland. 6/2/2022. Available at: https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.860385/Picea_glauca_-_Picea_mariana_-_Abies_balsamea_Forest_Woodland_Division. Accessed: October 14, 2022.
[15] U.S Environmental Protection Agency. Ecoregion Download Files by State – Region 8 - Utah. Available at: https://gaftp.epa.gov/EPADataCommons/ORD/Ecoregions/ut/ut_eco.pdf. Accessed: October 14, 2022.
[16] The Cornell Lab All About Birds: Yellow-billed Cuckoo. 2022. Available at: https://www.allaboutbirds.org/guide/Yellow-billed_Cuckoo/lifehistory. Accessed: September 8, 2022.
[17] U.S. Department of the Interior. 2021. Federal Register Vol. 86 No. 75. Available: https://www.govinfo.gov/content/pkg/FR-2021-04-21/pdf/2021-07402.pdf#page=1. Accessed: September 7, 2022.
[18] Region 6 USFWS. June Sucker (*Chasmistes liorus*) Recover Plan. 1999. Available at: https://ecos.fws.gov/docs/recovery_plan/990625.pdf. Retrieved on October 14, 2022.
[19] USFWS June Sucker: FWS Focus. Available at: https://www.fws.gov/species/june-sucker-chasmistes-liorus. Accessed: September 7, 2022.
[20] USDA Natural Resource Conservation Service: Plant Guide. 2009. Available at: https://plants.usda.gov/DocumentLibrary/plantguide/pdf/pg_spdi6.pdf. Accessed: September 8, 2022.
[21] Western Association of Fish and Wildlife Agencies. 2019. Western monarch butterfly conservation plan, 2019–2069. Version 1.0. Available at: https://wafwa.org/wpdm-package/western-monarch-butterfly-conservation-plan-2019-2069/. Accessed: October 7, 2022.

Declining populations of monarch butterflies have prompted USFWS review of this species as a candidate for listing under the ESA. In 2020, the USFWS determined that listing the monarch butterfly under the ESA was "warranted but precluded", meaning that the USFWS has determined that listing is warranted but does not have enough resources to complete the listing process due to higher-priority listing rules.

State Species of Concern

The Utah Department of Natural Resources (DNR) Division of Wildlife Resources lists species of greatest conservation need in their Wildlife Action Plan.[22] The goal of the Wildlife Action Plan is "To manage native wildlife species and their habitats, sufficient to prevent the need for additional listings under the Endangered Species Act." Species identified in the plan include amphibians, birds, fish, insects, mammals, mollusks, plants, and reptiles. Wildlife species are ranked according to their national (N) or state (S) levels of conservation status. State levels include:

- S1 - Critically imperiled (typically having 5 or fewer occurrences, or 1,000 or fewer individuals).
- S2 - Imperiled (typically having 6 to 20 occurrences, or 1,001 to 3,000 individuals).
- S3 - Vulnerable (rare; typically having 21 to 100 occurrences, or 3,001 to 10,000 individuals).
- S4 - Apparently secure (uncommon but not rare, but with some cause for long-term concern; typically having 101 or more occurrences, or 10,001 or more individuals).
- S5 - Secure (common, widespread, abundant, and lacking major threats or long-term concerns).

Based on information available from the Utah DNR's online mapping tools, there are 1 amphibian, 19 birds, 6 fish, 6 mammals, 13 mollusks, and 1 reptile listed in the Utah Wildlife Action Plan that have the potential to occur within the study area.[23] **Table 1** contains a list of these species.

Table 1. Utah Species of Greatest Conservation Need with the Potential to Occur in Study Area

State Species of Greatest Concern	Common Name (Scientific Name)	State Conservation Status
Amphibians	Columbia Spotted Frog (*Rana luteiventris*)	S3
	Northern Leopard Frog (*Lithobates pipiens*)	S3
	Western Toad (*Anaxyrus boreas*)	S3
Birds	American Bittern (*Botaurus lentiginosus*)	S3/S4B, S3N
	American White Pelican (*Pelecanus erythrorhynchos*)	S3B
	Bald Eagle (*Haliaeetus leucocephalus*)	S2B/S4N
	Band-tailed Pigeon (*Patagioenas fasciata*)	S3B
	Bendire's Thrasher (*Toxostoma bendirei*)	SU
	Black Rosy-finch (*Leucosticte atrata*)	S1
	Black Swift (*Cypseloides niger*)	S2B
	Burrowing Owl (*Athene cunicularia*)	S3B

State Conservation Status Codes

S1 – Critically imperiled	SH – Possibly Extirpated
S2 – Imperiled	? – Inexact Numeric Rank
S3 – Vulnerable	B – Breeding
S4 – Apparently secure	U – Unrankable
S5 – Secure	N – Range Rank

[22] Utah DNR Division of Wildlife Resources. Revised 2014. Utah Wildlife Action Plan. Available: https://wildlife.utah.gov/pdf/WAP/Utah_WAP.pdf. Accessed: September 7, 2022.
[23] Utah DNR Division of Wildlife Resources. Utah Species of Greatest Conservation Need - ArcGIS Mapper. Available: https://utahdnr.maps.arcgis.com/apps/webappviewer/index.html?id=f2a182a16a4b45698d9d96b962852302. Accessed: September 7, 2022.

Table 1 (continued). Utah Species of Greatest Conservation Need with the Potential to Occur in Study Area

State Species of Greatest Concern	Common Name (Scientific Name)	State Conservation Status
Birds *(continued)*	Caspian Tern (*Hydroprogne caspia*)	S3B
	Flammulated Owl (*Psiloscops flammeolus*)	S3/S4B
	Golden Eagle (*Aquila chrysaetos*)	S4
	Greater Sage-grouse (*Centrocercus urophasianus*)	S3
	Lewis's Woodpecker (*Melanerpes lewis*)	S3
	Olive-sided Flycatcher (*Contopus cooperi*)	S3/S4B
	Peregrine Falcon (*Falco peregrinus*)	S3B
	Pinyon Jay (*Gymnorhinus cyanocephalus*)	S4
	Snowy Plover (*Charadrius nivosus*)	S3B
	Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)	S2B
Fish	Bluehead Sucker (*Catostomus discobolus*)	S3
	Bonneville Cutthroat Trout (*Oncorhynchus clarkii utah*)	S4
	Colorado Pikeminnow (*Ptychocheilus Lucius*)	S3
	Colorado River Cutthroat Trout (*Oncorhynchus clarkii pleuriticus*)	S3
	June Sucker (*Chasmistes liorus*)	S2
	Least Chub (*Iotichthys phlegethontis*)	S2
Mammals	American Pika (*Ochotona princeps*)	S4
	Fringed Myotis (*Myotis thysanodes*)	S2B
	Kit Fox (*Vulpes macrotis*)	S3
	Spotted Bat (*Euderma maculatum*)	S3
	Townsend's Big-eared Bat (*Corynorhinus townsendii*)	S4
	Yuma Myotis (*Myotis yumanensis*)	S3
Mollusks	Bear Lake Springsnail (*Pyrgulopsis pilsbryana*)	S1
	Brian Head Mountainsnail (*Oreohelix parawanensis*)	S1
	Coarse Rams-horn (*Planorbella binneyi*)	SH
	Desert Tryonia (*Tryonia porrecta*)	S2?
	Green River Pebblesnail (*Fluminicola coloradoensis*)	S2/S3
	Lyrate Mountainsnail (*Oreohelix haydeni*)	S2
	Mitered Vertigo (*Vertigo concinnula*)	SH
	Rustic Ambersnail (*Succinea rusticana*)	SH
	Southern Tightcoil (*Ogaridiscus subrupicola*)	SH
	Utah Physa (*Physella utahensis*)	S1
	Western Pearlshell (*Margaritifera falcata*)	S1
	Widelip Pondsnail (*Stagnicola traski*)	SH
	Winged Floater (*Anodonta nutalliana*)	S2
Reptiles	Arizona Kingsnake/Pyro Mountain Kingsnake (*Lampropeltis pyromelana*)	S3

State Conservation Status Codes

S1 – Critically imperiled
S2 – Imperiled
S3 – Vulnerable
S4 – Apparently secure
S5 – Secure
SH – Possibly Extirpated
? – Inexact Numeric Rank
B – Breeding
U – Unrankable
N – Range Rank

Sources: Utah DNR Division of Wildlife Resources. Utah's Species of Greatest Conservation Need. Updated October 2021. Available: https://wildlife.utah.gov/pdf/WAP/2021-10-sgcn-list.pdf. Accessed September 7, 2022.
Utah DNR Division of Wildlife Resources. Utah's Species of Greatest Conservation Need Mapper. Available: https://utahdnr.maps.arcgis.com/apps/webappviewer/index.html?id=f2a182a16a4b45698d9d96b962852302. Accessed September 7, 2022.

Migratory Birds

Migratory bird species found within the study 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 study area. Millions of migratory birds including waterfowl, wading birds, and shorebirds use the Great Salt Lake area for staging and breeding each year. Additionally, several dozen species of birds may potentially nest in other areas within the study area—outside of the Great Salt Lake—at certain times of the year.

The Birds of Conservation Concern (BCC) list identifies migratory and non-migratory bird species that represent the USFWS' highest conservation priority. Established through the 1988 amendment to the Fish and Wildlife Conservation Act (16 U.S.C. §§ 661-667d), the USFWS maintains this list "to stimulate coordinated, collaborative and proactive conservation actions among international, federal, state, tribal and private partners." [24]. The IPaC report identifies 23 species on the BCC that could occur in the study area, along with information on the likelihood that they may be nesting in the area (see **Appendix A** for the full list of the 23 bird species). Habitat used by BCC species listed in the study area occurs in aquatic, desert, forest, prairie, and mountain environments. No regulations or protections are associated with a species being listed on the BCC unless protected or regulated by other federal, state, or local rules.

The bald eagle (*Haliaeetus leucocephalus)* is listed by USFWS as a BCC in the study area. While the BCC listing provides no regulatory protections, the bald eagle is protected under the Bald and Golden Eagle Protection Act. Bald eagles could nest near bodies of water such as the Great Salt Lake or Utah Lake in the study area. The National Bald Eagle Management Guidelines state that aircraft should stay at least 1,000 feet from bald eagle nests during the breeding season unless the aircraft is operated by a trained wildlife biologist or where eagles have demonstrated tolerance for such activity.[25]

3.2.3 Environmental Consequences

Potential impacts to biological resources associated with the Proposed Action were considered in the operational area where drones may operate (launch, fly, and drop packages). For the purposes of biological resources, the geographic boundary of the study area and the operational area are identical with the exception of the southern portion of the Great Salt Lake and Utah Lake. Zipline has confirmed that drone operations are not anticipated over these open water habitats within the study area.

No ground construction or habitat modification would be associated with the Proposed Action. The aircraft nest (launch site) is located in a capped part of the Trans-Jordan Landfill in South Jordan, Utah. Zipline's aircraft would not touch the ground in any other place than the nest (except during emergency landings) since it remains aerial while conducting deliveries.

Flight operations would take place within airspace, and typically well above the tree line and away from sensitive habitats. After launch, Zipline's UA rises to a cruising altitude between 130 feet and 400 feet AGL and follows a preplanned route to its delivery site. Aircraft would stay above 130 feet AGL except when descending to drop a package. The aircraft descends into its delivery loop and releases a package

[24] U.S. Fish and Wildlife Service. 2021. Birds of Conservation Concern 2021. Migratory Bird Program. Available: https://www.fws.gov/sites/default/files/documents/birds-of-conservation-concern-2021.pdf. Accessed: October 10, 2022.
[25] U.S. Fish and Wildlife Service. 2007. National Bald Eagle Management Guidelines. Available: https://www.fws.gov/media/national-bald-eagle-management-guidelines. Accessed: September 7, 2022.

from approximately 60 feet AGL. Packages are carried internally in the aircraft's fuselage, and are dropped by opening a set of payload doors on the aircraft. Packages fall under a small parachute, which limits terminal velocity, toward the package drop zone at approved delivery sites. The UA will take approximately six seconds to complete a delivery, which includes the descent from en route altitude, dropping the package, and returning back to en route altitude. As a result, the duration of exposure by most wildlife on the ground to the visual or noise impacts from the UA would be of very short duration (less than a minute).

Based on the noise analysis report (see **Appendix B**), the highest noise levels associated with Zipline's operations would occur at the nest site. While Section 3.3.3 describes noise levels associated with this action in terms of cumulative noise energy exposure using the FAA's primary noise metric, DNL, the FAA determined that a single event metric, maximum sound level (L_{Amax})[26], would provide a better characterization of wildlife species' exposure to UA noise. L_{Amax} was measured at the nest site during both launch and recovery operations (86.4 dB and 76.4 dB, respectively) (see Table 1 in **Appendix B**). L_{Amax} was also measured during delivery operations at 66.5 dB. Measurements during delivery operations were used as a proxy for en route noise due to difficulties in differentiating en route noise from ambient noise during data collection. However, these measurements are conservative, as delivery operations require the vehicle to use thrust during climb out; a procedure that would not be needed during en route flight.

UA noise levels would not be expected to cause significant disturbance or behavioral response in wildlife due to the location of the nest site and low noise levels of the vehicle en route. The highest L_{Amax} would be in direct proximity to the nest site (86.4 dB); for context, the noise level of a diesel truck[27] is estimated at 84 dBA).[28] Given the location of the nest site on a landfill, this is typical of the kind of noise already present in the area, and any wildlife present at the landfill is likely to be habituated to this type of disturbance. In addition, the Proposed Action includes a maximum of 20 flights per day, which would limit the chances of wildlife being near the site during launch.

Species outside the immediate proximity of the nest site would experience lower noise levels. L_{Amax} during en route operations is expected to be less than 66.5 dB, which is comparable to the sound of an air conditioning unit at 100 feet (60 dBA); a noise level typical of the suburban locations where deliveries would be expected to occur. As a result, the low number of daily operations and nature of the flights are not expected to significantly affect wildlife behavior in the study area.

The following paragraphs describe the anticipated effects of the Proposed Action on special status species that could occur in the operational area of the Proposed Action.

Special Status Species

Federally-Listed Species

Canada lynx – The Proposed Action will not involve ground construction or habitat modification. The only stressor with the potential to effect terrestrial species is noise. However, the noise produced by en route Zipline operations is low (less than 66.5 dB, see **Appendix B**, Table 1) which is comparable to existing noise sources in a typical suburban location where deliveries are expected to occur (approximately 60 dBA).[29] Higher noise levels are expected in direct proximity to the nest site; however, Canada lynx inhabit densely forested areas and therefore would not be present in the vicinity of an

[26] A single event metric that is the highest A-weighted sound level measured during an event.
[27] This estimate is for a diesel truck at 40 miles per hour from a distance of 50 feet).
[28] Federal Agency Review of Selected Airport Noise Analysis Issues (Federal Interagency Committee on Noise), August 1992, Table B.1.
[29] Federal Agency Review of Selected Airport Noise Analysis Issues (Federal Interagency Committee on Noise), August 1992, Table B.1.

unforested landfill. As a result, the FAA determined that the Proposed Action will have *No Effect* on Canada lynx.

June Sucker – As noted above, Zipline does not plan to fly over Great Salt Lake or Utah Lake, even though portions of both water bodies may be present in the study area. As no element of the Proposed Action would take place in water or result in a change in water quality, the FAA determined that the Proposed Action will have *No Effect* on the June Sucker.

Utes' ladies-tresses – The Proposed Action will not involve ground construction or habitat modification; the only stressor produced by the Proposed Action is noise, which would not have an effect on a listed plant. As there is no plausible route of effect to this species, the FAA determined that the Proposed Action will have *No Effect* on Utes' ladies-tresses.

Yellow-billed cuckoo –Yellow-billed cuckoos have the potential to be present in the study area. This species typically use wooded habitat that includes scrub vegetation, thickets, fallow farm fields and orchards, and riparian areas.

No ground construction or habitat modification would occur under the Proposed Action and the existing Zipline nest site is located in an unforested, developed setting. Because suitable habitat for the species is not present in proximity to the nest site, no impacts to cuckoos from UA noise during takeoff or recovery would be expected.

Cuckoos could experience en route noise during vehicle deliveries. Cuckoos are known to stay "well hidden," crossing over open patches of forest below treetop level on their way from one woodlot to another in thick woodlands and are therefore rarely seen above the treeline.[30] The noise produced by en route Zipline operations is low (less than 66.5 dB, see **Appendix B**, Table 1) which is comparable to existing noise sources in a typical suburban location where deliveries are expected to occur (approximately 60 dBA). While the noise levels experienced by birds in the tree canopy may be slightly higher; the density of tree canopy would be expected to act as a sound buffer such that any noise experienced by cuckoos would still be low and unlikely to cause disturbance behaviors.

Cuckoos could also be struck by a vehicle in-flight, particularly during migration when they are more likely to fly above the tree canopy. Outside of the migration period, it is highly unlikely for a strike to occur due to this species' tendency to stay under the tree canopy in dense, wooded habitat. Even during migration, it is unlikely that a bird strike would occurs, as Zipline is required to use visual observers during operations that would monitor for all air hazards, including birds, during flight operations. Through review of the FAA National Wildlife Strike Database from 1990 through August 2022 for airports in the vicinity including Salt Lake City International Airport, Tooele Airport, and Cedar Valley Airport, the FAA determined that no yellow-billed cuckoo strike incidents have been reported during this timeframe.[31] As a result, it is very unlikely that birds would be struck as a result of UA operations.

As a result of the limited scale of operations (a maximum of 20 flights per day), the low noise levels, and the fact that yellow-billed cuckoos prefer to remain below the treeline for the majority of life cycle activities, the FAA has determined that the Proposed Action *may affect, but is not likely to adversely affect* the yellow-billed cuckoo.

Monarch butterfly –The primary drivers for declining populations of monarch butterflies is habitat loss, including the loss of breeding, migratory, and overwintering habitat. Pesticide use and climate change

[30] The Cornell Lab About Birds. Yellow-billed Cuckoo. 2022. https://www.allaboutbirds.org/guide/Yellow-billed_Cuckoo/overview. Accessed September 28, 2022.
[31] U.S. Federal Aviation Administration. FAA Wildlife Strike Database. August 11, 2022. https://wildlife.faa.gov/home. Accessed September 28, 2022.

are also drivers of species' decline.[32] While areas in the vicinity of Salt Lake City may contain potential summer breeding habitat,[33] the Proposed Action would not result in impacts to suitable breeding habitat or host plants. Insects could be struck by drones en route to and from 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 Proposed Action is not expected to have significant impacts to insect populations, including the monarch butterfly.

State Species of Concern

State-listed bird species may display disturbance behaviors towards drones, such as fleeing or attacking maneuvers; however, due to the limited scale of operations (a maximum of 20 flights per day over a distributed area), the altitude of overflights (cruising between 130 and 400 feet AGL), and minimal anticipated noise and visual impacts from the Proposed Action, no significant impacts to state protected bird species are expected.

Migratory Birds and Birds of Conservation Concern

Migratory and BBC bird species may display disturbance behaviors towards drones, such as fleeing or attacking maneuvers; however, due to the limited scale of operations, the altitude of overflights (cruising between 130 and 400 feet AGL), and minimal anticipated noise and visual impacts from the Proposed Action, no significant impacts to migratory bird species or BCCs are expected.

Bald Eagles

No bald eagle nests have been documented by state or local resource agencies within the study area. However, bald eagles have been observed and documented in online resources such as iNaturalist.[34] Bald eagles were documented in flight and perching in several locations, both natural and man-made, throughout the study area. If Zipline identifies a bald eagle nest or is notified of the presence of a nest by a state or federal regulator or naturalist group, Zipline will establish an avoidance area such that there is a 1,000-foot 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 (December 1 through August 31 in the study area) or until a qualified biologist indicates the nest has been vacated.[35]

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., federally-listed species, 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.

[32] U.S. Fish and Wildlife Service. Monarchs. https://www.fws.gov/initiative/pollinators/monarchs. Accessed September 28, 2022.
[33] Western Association of Fish and Wildlife Agencies. 2019. Western monarch butterfly conservation plan, 2019–2069. Version 1.0. Available at: Accessed: https://wafwa.org/wpdm-package/western-monarch-butterfly-conservation-plan-2019-2069/ October 7, 2022.
[34] iNaturalist. Available: https://www.inaturalist.org/. Accessed September 8, 2022.
[35] See Official Species List in Appendix A for Bald Eagle breeding dates in the study area.

3.3 Noise and Noise-Compatible Land Use

3.3.1 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 FAA Order 1050.1F, Paragraph 11-5b, 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."

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 thoise 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.

3.3.2 Affected Environment

The study area is approximately 1,675 square miles, and the estimated population within the area is roughly 1,700,000 (see **Figure 1**). The population density is approximately 1,010 persons per square mile.

3.3.3 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. Away from the actual nest property, the closest neighborhoods surrounding the nest location are likely to experience the highest noise levels as a result of the Proposed Action. This is due to noise from the catapult launch system and the lower altitudes that the UA would fly in this location during launch and recovery.

Noise Exposure

Utilizing the operational projections defined in **Sections 1.0** and **2.0** of this EA, the noise analysis methodology detailed in **Appendix B** was then used to estimate the DNL levels for the proposed Zipline

Salt Lake City operations. Noise levels were calculated for each flight phase and are presented in the following three sub-sections:

- Noise Exposure for Nest Operations
- Noise Exposure for En Route Operations
- Noise Exposure for Delivery Operations

Noise Exposure for Nest Operations

Based on the anticipated average daily maximum number of deliveries provided by Zipline, the extent of DNL 45 dB associated with nest operations is shown in **Figure 4**. This region was determined by reviewing the layout of the South Jordan/Salt Lake City nest location, including the orientation of launch and recovery equipment, and using the noise level information presented in Tables 2 and 3 of **Appendix B**.

Figure 4: DNL 45 dB or Greater Noise Exposure at South Jordan/Salt Lake City Nest Location

Noise Exposure for En Route Operations

Based on the information provided by Zipline, it is anticipated that the UA would cruise at altitudes between 250 to 400 feet AGL at an airspeed of 50 to 56 knots during en route flight. However, to provide a conservative estimate for en route noise exposure, the noise exposure was calculated assuming operations at 250 feet AGL and at an airspeed of 40 knots. The en route noise exposure can be determined by referencing Table 4 of **Appendix B**. This analysis shows that en route noise levels would not exceed DNL 45 dB in any location within the study area.

Noise Exposure for Delivery Operations

Due to the inherent uncertainty of the exact delivery site locations and characteristics, the noise analysis assumes that all deliveries would occur at a single delivery location within each delivery community in order to provide a conservative estimate of potential delivery noise exposure. Assuming Zipline's projected maximum number of 20 delivery flight operations per day (7,300 annual operations), distributed evenly over the 17 anticipated delivery communities, an average of 1.17 daily deliveries to each community (approximately 427 annual deliveries) is expected. A conservative estimate of delivery noise exposure can then be determined by referencing Table 6 of **Appendix B**. This analysis shows that delivery noise levels would not exceed DNL 45 dB in any of the communities where Zipline anticipates providing deliveries.

Total Noise Exposure Results

The maximum noise exposure levels within the study area would occur at the nest site; where noise levels at or above DNL 45 dB would extend 75 feet to the northwest and southeast of the South Jordan/Salt Lake City nest, and 50 feet to the northeast and southwest of the nest, respectively. Based on these dimensions, the DNL 45 dB would remain almost entirely within the vicinity of the nest infrastructure on the Trans-Jordan Landfill property and is well below the FAA's significance threshold of DNL 65 dB. Additionally, the estimated noise exposure for en route and delivery operations at locations away from the South Jordan/Salt Lake City nest would not exceed DNL 45 dB at any location within the study area.

As shown on **Figure 1**, several airstrips and small airports are located in the study area, including the South Valley Regional Airport. However, Zipline follows detailed processes and procedures to avoid conflict with other aircraft, which include routes planned with consideration of airport location to maintain a set distance from airports. Any noise from Zipline's operations would not be expected to add to the cumulative noise exposure around airports in the study area.

Based on the FAA's noise analysis, the Proposed Action would not have a significant impact.

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 tribe or 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 study area where Zipline plans to conduct UA package deliveries, as shown on **Figure 1**. The FAA identified historic sites that were listed on the National Archives and Records Administration (NARA) website, which includes NRHP-listed properties.[36] The 583 NRHP-listed properties identified within the APE include 506 buildings, 8 structures, 2 objects, 18 sites, and 48 districts. The FAA also reviewed the Historic Utah Buildings online database to identify NRHP-eligible properties, which includes thousands of properties, most of which are residential buildings.

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 Zipline is proposing—20 delivery operations per day in the first year of operations from the South Jordan/Salt Lake City nest—and the even distribution of flights means that any historic or cultural resource 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 nest property. 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 no historic properties would be adversely affected by the proposed operations.

In accordance with 36 CFR § 800.4(a)(1), the FAA consulted with the Utah SHPO and tribes that may potentially attach religious or cultural significance to resources in the APE. The FAA sent a consultation letter to the Utah SHPO on August 24, 2022, requesting concurrence with the FAA's determination that no historic properties would be affected by the Proposed Action. In response, the Utah SHPO provided additional information to the FAA regarding the identification of historic properties in the APE and with a recommendation that a no adverse effect determination would be more appropriate for the undertaking. Based on this correspondence, the FAA revised its determination to a no adverse effect finding for the undertaking, and the Utah SHPO replied in concurrence on September 2, 2022.

The FAA also consulted with the Northwestern Band of Shoshone Nation; the Ute Indian Tribe of the Uintah and Ouray Reservation, Utah; the Confederated Tribes of the Goshute Reservation, Nevada and Utah; the Shoshone-Bannock Tribes of the Fort Hall Reservation; and the Skull Valley Band of Goshute Indians of Utah. As of the date of this EA, no responses from any tribes have been received.

The FAA's historic and tribal outreach letters are included in **Appendix A**.

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

3.5.1 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[37] that, subject to exceptions for de minimis impacts: "The Secretary

[36] NARA, National Archives Catalog. Available: National Register of Historic Places and National Historic Landmarks Program Records: Utah (archives.gov). Accessed July 20, 2022.

[37] 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.

may approve a transportation program or project requiring the use of [4(f) resources]…only if—(1) there is no prudent and feasible alternative to using that land; and (2) the program or project includes all possible planning to minimize harm to the park, recreation area, wildlife and waterfowl refuge, or historic site resulting from the use."

The term "use" includes both direct or physical and indirect or "constructive" impacts to Section 4(f) resources. Direct use is the physical occupation or alteration of a Section 4(f) property or any portion of a Section 4(f) property. A constructive use does not require direct physical impacts or occupation of a Section 4(f) resource. A constructive use would occur when a Proposed Action would result in substantial impairment of a resource to the degree that the protected activities, features, or attributes of the resource that contribute to its significance or enjoyment are substantially diminished. The determination of use must consider the entire property and not simply the portion of the property used for a proposed project.[38]

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.

3.5.2 Affected Environment

The FAA identified many properties that could meet the definition of a Section 4(f) resource within the study area, including public parks and historic sites. Section 4(f) resources within the study area include the Timpanagos Cave National Monument, American Fork Canyon, Utah Lake State Park, Wardle Fields Regional Park, Parleys Historic Nature Park, to name a few.

Numerous historic sites listed on the Utah Division of State History website and NARA National Archives are located within the study area; however, most of these properties are considered for architectural or other purposes that are not typically affected by UA operations. Also, as discussed in **Section 3.4**, the FAA consulted with the Utah SHPO for Zipline's proposed operations to determine whether historic and traditional cultural properties would be affected by the Proposed Action.

3.5.3 Environmental Consequences

There would be no physical use of Section 4(f) resources because there would be no construction on any Section 4(f) resource. The FAA has determined that infrequent UAS overflights as described in the Proposed Action are not considered a constructive use of any Section 4(f) resource and would not cause substantial impairment to any of the Section 4(f) resources in the study area. As described in **Section 3.3** and **Appendix B**, the proposed operations would not result in significant noise levels at any location in the study area. Noise and visual effects from Zipline's occasional overflights are not expected to diminish the activities, features, or attributes of the resources that contribute to their significance or enjoyment.

[38] 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

Additionally, Zipline identifies areas where open air gatherings of people typically occur, such as open air concert venues and school yards, and avoids these properties through the creation of static keep-out areas via Zipline's route planning software, which prepares an optimized flight path from the nest to each designated delivery site. The software ensures that each route integrates and respects all of the restrictions entered into the database, and including Section 4(f) properties, which can be automatically avoided based on the time of day and other factors. The FAA has determined that there would be no significant impacts to Section 4(f) resources as a result of the Proposed Action.

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 (EJ) 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.

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.

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

The FAA has not established a significance threshold for EJ. 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 EJ population in a way that the FAA determines are unique to the EJ 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 EJ 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 appreciably 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 populations, both racial and ethnic, were mapped using the Decennial Census down to the Census Block. At the Census Block level, separate data is provided for racial minority and Hispanic

populations; therefore, this analysis addresses these populations separately. DOT Order 5610.2C accounts for both of these populations in addressing EJ impacts. 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. (A Census Block Group consists of one or more Census Blocks). The ACS 5-year estimates were compared to the Department of Health and Human Services (HHS) "poverty guidelines"[39] to calculate the percentage of households below the poverty threshold for each Census Block Group.

A "Reference Community" was selected to determine an initial benchmark for identifying areas of EJ concern within the study area. This allows the demographics of localized populations (i.e., individual Census Blocks or Block Groups) to be compared to the aggregate population within the overall study area., Tailoring the Reference Community to the area within which impacts would potentially occur (i.e., the study area) is preferred to using other existing Census geographies such as a county, the entire state or the US, in order to better determine whether minority or low-income populations would be disproportionately impacted. For this analysis, all Census Blocks (for race and ethnicity) and Block Groups (for poverty status) within the study area were chosen to comprise the Reference Community. The aggregated demographic characteristics of the Reference Community were then compared to each individual constituent Census Block/Block Group's demographic characteristics to determine whether a specific Census Block/Block Group's EJ population exceeds that of the Reference Community as a whole. The study area is selected as the reference community because it encompasses the large area of the proposed operations and is very similar in size and population to the three counties (Tooele, Salt Lake, Utah).

Communities (i.e., Census Blocks or Block Groups) where the racial/ethnic demographics or poverty status of the population exceed those of the Reference Community as a whole, by a "meaningfully greater" amount, are considered areas of EJ concern. To ensure that any potential EJ communities were included in the analysis a threshold value of 0 percent or greater than the average of the Reference Community as a whole was selected to define the "meaningfully greater" amount. As a result, any Census Block or Block Group whose percentage of minority populations or households below the poverty threshold is higher than that of the Reference Community would be considered a minority or low income community for the purpose of this EJ analysis. Identifying these areas of EJ concern involves a comparison of specific Census Blocks and Block Groups to the Reference Community in order to assess whether the Census Block or Block Group's EJ population is "meaningfully greater" than that of the Reference Community as a whole.

In addition, communities where EJ populations predominate (i.e., the population is equal to or greater than 50 percent) are also considered areas of EJ concern. Reviews of the racial/ethnic demographics of Census Blocks and the poverty status of Census Block Groups were made to assess whether EJ populations make up the majority of the Census Block or Block Group. A total of 2,273 Census Blocks within the study area are comprised of predominately (50% or greater) minority populations. A total of 2 Census Block Groups within the study area are comprised of predominately (50% or greater) low-income populations.

Tables 2 and **3** show the demographic information of the Reference Community, as well as other geographies for context. The percentage of racial minorities, collected by the Census as "All Other Races," residing within the study area at the Census Block level is approximately **24.6 percent**. This is slightly higher than that of the state of Utah, while lower than the national average. The percentage of ethnic minorities, those identifying as Hispanic, is **17.1** percent which, like the racial demographics, is higher

[39] DOT Order 5610.2C requires the use of HHS data.

than the state average but less than that of the nation. For purposes of identifying a "meaningfully greater" threshold, any Census Block whose percentage of All Other Races equals or exceeds 24.6 percent or whose percentage of Hispanic population equals or exceeds 17.1 percent was identified as an area of EJ concern.

Table 3 presents the income and poverty data for each geography. Based on HHS guidelines, the poverty threshold is proportional to the household size, also presented in **Table 3**. Overall, the study area had a poverty level of **8.9 percent**, a value lower than both the state and national levels. Similar to what was done for race and ethnicity, a 0 percent threshold was used to identify low-income populations in order to assess the potential for effects that may be disproportionate, or appreciably more severe or greater in magnitude, or which disproportionately fall on a low-income population. Therefore, any Census Block Group whose percentage of households below poverty equals or exceeds **8.9** percent was identified as an area of EJ concern.

Figure 5 shows the 20,281 Census Blocks in the study area, 8,530 of which have populations that would be considered areas of EJ concern with respect to racial minorities, ethnic minorities, or both as shown in **Table 3**. A total population of approximately 1,700,000 people live within the study area, 417,000 of whom are racial minorities and 290,000 of whom are Hispanic or ethnic minorities.

Figure 6 shows the 1,032 Census Block Groups, 394 of which would be considered areas of EJ concern, as shown in **Table 4**. The study area contains about 510,000 housing units, approximately 45,000 of which have incomes below the poverty threshold for their Census Block Group.

Table 2. Selected Demographic Characteristics (Race/Ethnicity) of the Study Area

Census Geography	Total Population	White	% White	All Other Races	% All Other Races	Hispanic	% Hispanic	Non-Hispanic	% Non-Hispanic
United States	331,449,281	204,277,273	61.6%	127,172,008	38.4%	62,080,044	18.7%	269,369,237	81.3%
Utah	3,271,616	2,573,413	78.7%	698,203	21.3%	492,912	15.1%	2,778,704	84.9%
Salt Lake County	1,185,238	847,970	71.5%	337,268	28.5%	232,088	19.6%	953,150	80.4%
Tooele County	72,698	61,011	83.9%	11,687	16.1%	9,522	13.1%	63,176	86.9%
Utah County	659,399	537,757	81.6%	121,642	18.5%	88,531	13.4%	570,868	86.6%
Study Area	1,692,641	1,275,723	75.4%	416,918	24.6%	289,610	17.1%	1,403,031	82.9%
*Reference Community (shaded) – Threshold Values are enclosed in box									

Source: USBC 2020 Decennial Census

Table 3. Selected Demographic Characteristics (Poverty) of the Study Area

Census Geography	# of Households	Average Household Size	Average Household Income	2020 HHS Poverty Guideline	# Households Below Poverty	% Households Below Poverty
United States	122,354,219	2.6	$79,890.53	$19,928	17,123,637	14.0%
Utah	1,003,345	3.2	$85,367.40	$22,616	109,068	10.9%
Salt Lake County	383,324	3.0	$89,109.74	$21,720	38,214	10.0%
Tooele County	21,147	3.2	$86,116.45	$22,616	1,667	7.9%
Utah County	171,899	3.6	$87,513.45	$24,408	19,026	11.1%
Study Area	508,560	3.2	$89,279.53	$22,616	45,453	8.9%
*Reference Community (shaded) – Threshold Values are enclosed in box						

Source: HMMH 2022; HHS 2020; USCB 2020 ACS

Notes: Poverty guidelines are rounded up to the nearest interval (income band) in the Census data (e.g., $29,999 or $34,999) at which household income is reported to estimate the number of households below the poverty level.

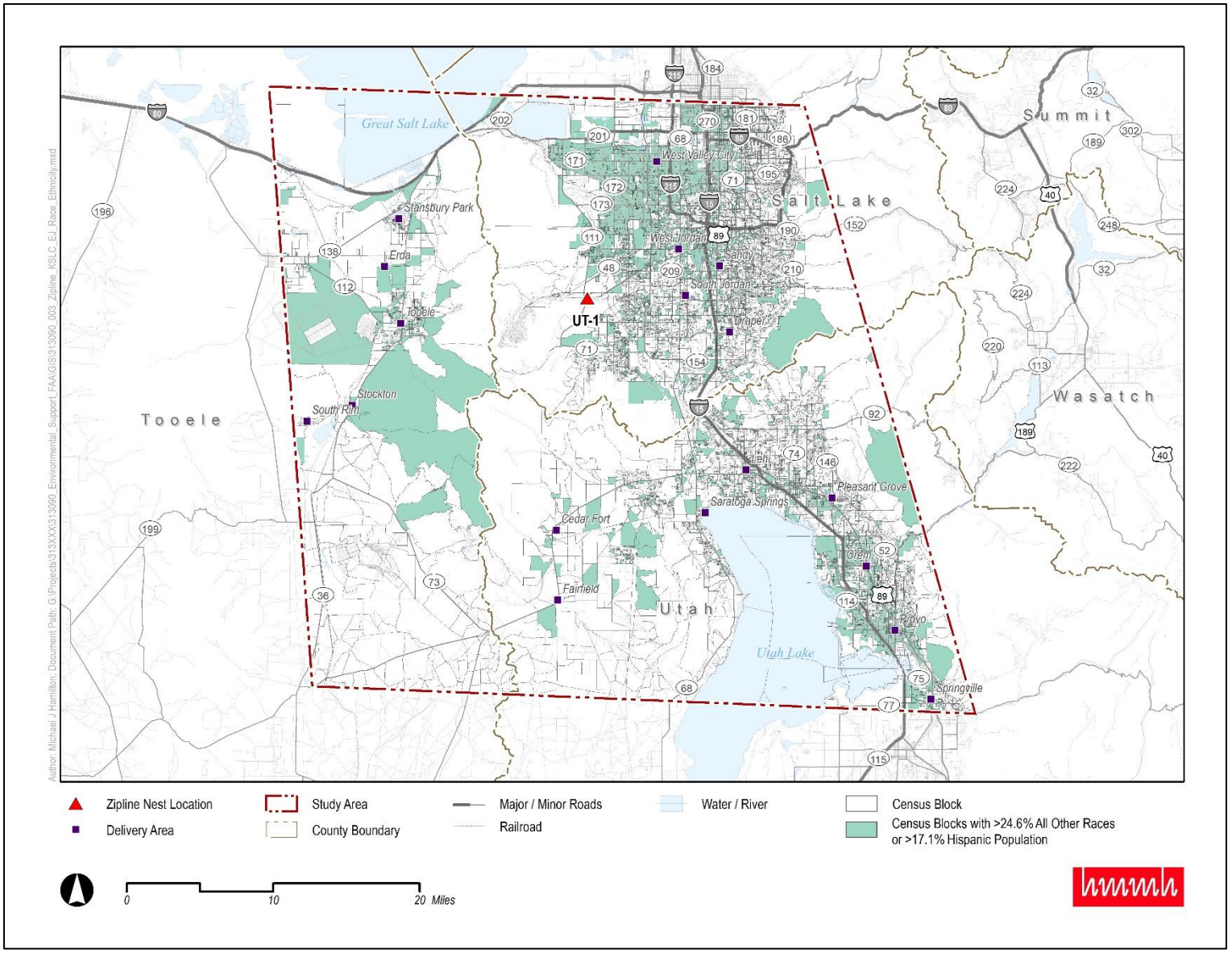

Figure 5: Census Blocks of Potential EJ Concern with Respect to Race or Ethnicity

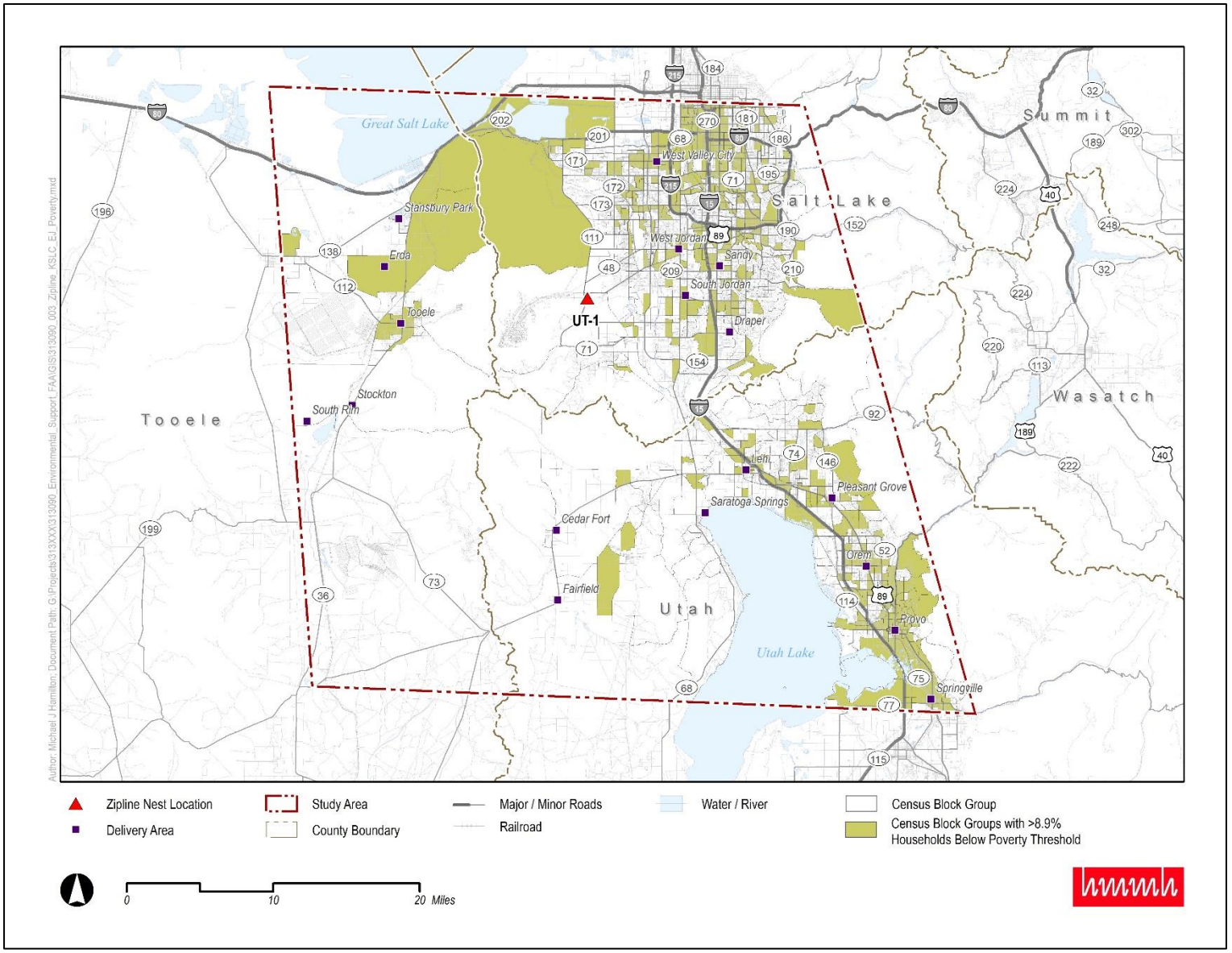

Figure 6: Census Block Groups of Potential EJ Concern with Respect to Poverty

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3.6.3 Environmental Consequences

The Proposed Action would not result in adverse or significant impacts in any environmental resource category. As noted in **Section 3.3** and **Appendix B**, the drone's noise emissions could be perceptible in areas within the study area but would stay well below the level determined to constitute a significant impact. Since implementation of the Proposed Action would not create impacts exceeding thresholds of significance in other environmental impacts, and since it also would not generate 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, the likelihood of significant impacts is remote.

Additionally, Zipline's operations would occur throughout the study area and, due to the large size of the area, the low number daily operations, and the dispersal of minority and low-income populations, it is unlikely that EJ populations would be disparately impacted by the proposed action. The FAA determined that the Proposed Action would not result in disproportionately high and adverse human health or environmental effects on a minority or low-income 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 study area. Visual impacts can be difficult to define and evaluate because the analysis is generally subjective, but are normally related to the extent that the Proposed Action would contrast with, or detract from, the visual resources and/or the visual character of the existing environment. In this case, visual effects would be limited to the introduction of a visual intrusion – a UA in flight – which could be out of character with the suburban or natural landscapes.

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

3.7.2 Affected Environment

The Proposed Action would take place over urban and rural residential areas, rural farmland, natural areas, and commercially-developed properties. As noted in **Section 3.5**, there are some public parks that could be valued for aesthetic attributes within the study area. Zipline's proposal is to avoid overflights of large open-air gatherings of people during the scope of the Proposed Action, which includes public parks and other public properties that may be covered under Section 4(f).

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 operations will be happening in airspace only. 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. The Proposed Action would involve airspace operations that are unlikely to result in visual impacts anywhere in the study area, including sensitive areas such as Section 4(f) properties where the visual setting is an important resource of the property. This is due in part to Zipline's flight planning system discussed above. Additionally, the short duration that each drone flight could be seen from any

resource in the study area, approximately six seconds in total, and the low number of proposed flights per day spread throughout the 1,200-square-mile study area, would minimize any potential for significant visual impacts at any location in the study area. Any visual effects are expected to be similar to existing air traffic in the vicinity of the study 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 (CWA) 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 (U.S.) and requires a permit under Section 402 of the CWA. Waters of the U.S. are defined by the CWA and are protected by various regulations and permitting programs administered by the U.S. Environmental Protection Agency (USEPA) 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 168 square miles of surface waters occur within the study area, or approximately ten percent of the area (**Figure 7**). Notable surface waters include the southernmost portion of Great Salt Lake and the majority of Utah Lake, as well as rivers such as the Provo River, Utah and Salt Lake Canal, Mill Creek, Big Cottonwood Creek, Jordan River, American Fork Canyon, and tributary streams that are also protected by the CWA. Zipline's operations would not require an NPDES permit or any other authorization under the CWA.

3.8.3 Environmental Consequences

While it is highly unlikely for one of Zipline'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 CWA.

Zipline would be a certificated air carrier and must comply 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. Zipline's FAA-accepted checklists include procedures to notify local emergency services in the event of an accident or incident. In accordance with 14 CFR § 135.23(d), Zipline 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 nest, or terminate the flight via the emergency parachute system, which may also automatically deploy if the Zipline 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.

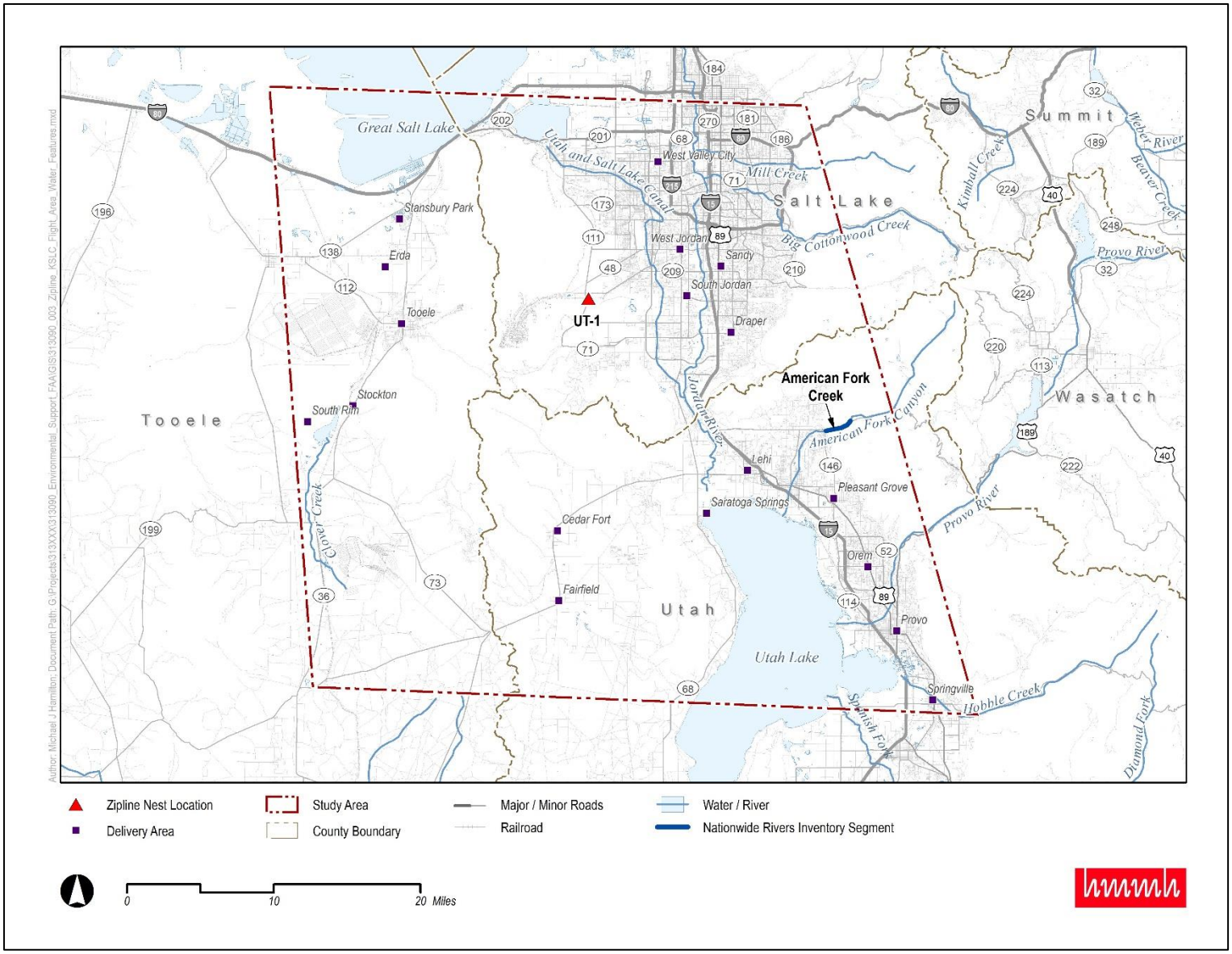

Figure 7: Surface Waters within the Study Area

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No construction activities would be 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. The Proposed Action would not cause an exceedance of water quality standards established by federal, state, local, and tribal regulatory agencies, and the Proposed Action would not contaminate public drinking water supply such that public health may be adversely affected.

3.9 Water Resources - Wild and Scenic Rivers

3.9.1 Regulatory Setting

The Wild and Scenic Rivers Act (Public Law 90-542; 16 U.S.C. §§ 1271-1287) preserves certain river areas eligible to be included in a national system that possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values in free-flowing condition for the benefit and enjoyment of present and future generations.[40] Rivers or river segments selected for inclusion in the National Wild and Scenic Rivers System (National System) are river systems, designated by Congress or the Secretary of the Interior, with outstandingly remarkable values. Classifications are based on the degree of development present along the river, and whether the river is wild, scenic, or recreational.[41] The Nationwide Rivers Inventory (NRI) are river segments identified by the National Park Service (NPS) as potential candidates for listing in the National System.[42] Federal agencies must seek to avoid or mitigate actions that would adversely affect designated Wild and Scenic Rivers and NRI river segments.

3.9.2 Affected Environment

One NRI river segment, American Fork Creek, occurs within the study area.[43] The NRI river segment, depicted in **Figure 7**, is located in the western portion of the study area and extends from the Timpanogos Cave National Monument boundary to the mouth of the American Fork Canyon, which is one of the most heavily used recreation areas along the Wasatch Front.[44] There are no Wild and Scenic River segments within the study area.[45]

3.9.3 Environmental Consequences

Zipline delivery flights would not overfly NRI river segments at an intensity that could cause any detrimental impacts to the values of these resources. Currently, UA operations can occur over these river segments under existing regulatory authorities. Consultation with the NPS is only necessary for water resources projects that could impact an NRI river segment. Zipline's limited overflights would not introduce any visual, audible, or other sensory intrusions that are out of character with the river segments or alter their settings. Therefore, the potential for impacts to surface waters, including NRI river segments, would not be significant.

[40] Wild and Scenic Rivers Act. Available: https://www.rivers.gov/documents/wsr-act.pdf. Accessed September 13, 2022.
[41] National Wild and Scenic Rivers System. Available: https://www.rivers.gov/wsr-act.php. Accessed: September 13, 2022.
[42] National Park Service Nationwide Rivers Inventory. Available: https://www.nps.gov/subjects/rivers/nationwide-rivers-inventory.htm. Accessed: September 13, 2022.
[43] National Park Service Nationwide Rivers Inventory (NRI) Interactive Map. Available: https://www.nps.gov/maps/full.html?mapId=8adbe798-0d7e-40fb-bd48-225513d64977. Accessed: September 13, 2022.
[44] NPS Rivers. Available: https://www.nps.gov/subjects/rivers/utah.htm. Accessed: September 13, 2022.
[45] National Wild and Scenic Rivers System. Available: https://www.rivers.gov/utah.php. Accessed: September 13, 2022.

3.10 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 the first commercial package delivery operations by drone within the operating areas, 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 areas.

4.0 LIST OF PREPARERS AND CONTRIBUTORS

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

Table 4. List of Preparers and Contributors

FAA Contributors	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
Adam Scholten, FAA Office of Environment and Energy	11	Noise Analysis and Document Review

Contractor Contributors	Years of Industry Experience	EA Responsibility
Kurt M. Hellauer, Federal Programs, HMMH, Inc.	35	Program Management, NEPA Subject Matter Expert, Airspace Analysis, Environmental Justice Analysis, and Document Review
Jason R. Stoddard, Federal Programs, HMMH, Inc.	14	Project Management, Airspace Analysis
Brandon L. Robinette, Federal Programs, HMMH, Inc.	18	Noise Analysis Subject Matter Expert
Christopher P. Emma, Federal Programs, HMMH, Inc.	3	Noise and Environmental Justice Analyst
Michael J. Hamilton, Aviation Environmental Services, HMMH, Inc.	22	GIS Specialist
Avery J. Pecci, Aviation Environmental Services, HMMH, Inc.	1	GIS Specialist
Missi Shumer, NEPA Specialist, Shumer Consulting, LLC	22	NEPA Subject Matter Expert, Section 4(f) Analysis, Water Resources, and Document Preparation/Review
Sarah Brammell, NEPA/Environmental Specialist, Blue Wing Environmental, LLC	20	NEPA Subject Matter Expert, Biological Resources
Jackie Tyson, Cultural Resources Specialist, New South Associates, Inc.	12	Cultural Resources Specialist, Document Review

5.0 LIST OF AGENCIES CONSULTED

Federal Agencies

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

State Agencies

Utah Division of State History, State Historic Preservation Office

Tribes

Confederated Tribes of the Goshute Reservation, Nevada and Utah

Northwestern Band of Shoshone Nation

Shoshone-Bannock Tribes of the Fort Hall Reservation

Skull Valley Band of Goshute Indians of Utah

Ute Indian Tribe of the Uintah and Ouray Reservation, Utah

APPENDICES

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APPENDIX A

Agency Coordination

USFWS Official Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Utah Ecological Services Field Office
2369 West Orton Circle, Suite 50
West Valley City, UT 84119-7603
Phone: (801) 975-3330 Fax: (801) 975-3331
https://fws.gov/office/utah-ecological-services

In Reply Refer To: September 28, 2022
Project Code: 2022-0090056
Project Name: Zipline International Inc. Drone Package Delivery Operations in Salt Lake City, Utah (UT-1)

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

To Whom It May Concern:

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

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

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

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

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

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

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

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

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

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of

this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

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

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:

Utah Ecological Services Field Office
2369 West Orton Circle, Suite 50
West Valley City, UT 84119-7603
(801) 975-3330

Project Summary

Project Code: 2022-0090056

Project Name: Zipline International Inc. Drone Package Delivery Operations in Salt Lake City, Utah (UT-1)

Project Type: Drones - Use/Operation of Unmanned Aerial Systems

Project Description: Zipline International Inc. (Zipline) seeks to amend its air carrier Operations Specifications (OpSpecs) and other Federal Aviation Administration (FAA) approvals necessary to begin unmanned aircraft (UA) commercial package delivery operations from one hub, or "nest," location in Salt Lake City, Utah, using its 49.3-pound "Zip" UA. Zipline anticipates operating a maximum of 20 delivery flights per operating day from the Salt Lake City/South Jordan nest based on the scope of the Proposed Action. The total approximate delivery area is 1,675 square miles. At its widest point, the flight study area, shaped like a polygon, is approximately 45 miles east to west and 41 miles north to south. The flight study area is split fairly evenly among Salt Lake County (approximately 490 square miles), Tooele County (approximately 542 miles), and Utah County (approximately 643 square miles). The proposed commercial delivery operations from the Salt Lake City/South Jordan nest would occur during daylight hours up to seven days per week, with no flights on holidays. No nighttime operations are anticipated or requested under the Proposed Action.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@40.4591379,-112.05540086263042,14z

Counties: Salt Lake , Tooele , and Utah counties, Utah

Endangered Species Act Species

There is a total of 5 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
Canada Lynx *Lynx canadensis* Population: Wherever Found in Contiguous U.S. There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3652	Threatened

Birds

NAME	STATUS
Yellow-billed Cuckoo *Coccyzus americanus* Population: Western U.S. DPS There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3911	Threatened

Fishes

NAME	STATUS
June Sucker *Chasmistes liorus* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/4133	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
Ute Ladies'-tresses *Spiranthes diluvialis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2159	Threatened

Critical habitats

There is 1 critical habitat wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
June Sucker *Chasmistes liorus* https://ecos.fws.gov/ecp/species/4133#crithab	Final

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
American White Pelican *pelecanus erythrorhynchos* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/6886	Breeds Apr 1 to Aug 31
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 Dec 1 to Aug 31

NAME	BREEDING SEASON
Black Rosy-finch *Leucosticte atrata* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9460	Breeds Jun 15 to Aug 31
Black Swift *Cypseloides niger* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8878	Breeds Jun 15 to Sep 10
Black Tern *Chlidonias niger* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3093	Breeds May 15 to Aug 20
Bobolink *Dolichonyx oryzivorus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Jul 31
Brown-capped Rosy-finch *Leucosticte australis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 15 to Sep 15
Cassin's Finch *Carpodacus cassinii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9462	Breeds May 15 to Jul 15
Clark's Grebe *Aechmophorus clarkii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31
Clark's Nutcracker *Nucifraga columbiana* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Jan 15 to Jul 15
Evening Grosbeak *Coccothraustes vespertinus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 15 to Aug 10
Franklin's Gull *Leucophaeus pipixcan* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Lesser Yellowlegs *Tringa flavipes* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere

NAME	BREEDING SEASON
Lewis's Woodpecker *Melanerpes lewis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9408	Breeds Apr 20 to Sep 30
Long-eared Owl *asio otus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3631	Breeds Mar 1 to Jul 15
Marbled Godwit *Limosa fedoa* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9481	Breeds elsewhere
Olive-sided Flycatcher *Contopus cooperi* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3914	Breeds May 20 to Aug 31
Pinyon Jay *Gymnorhinus cyanocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9420	Breeds Feb 15 to Jul 15
Rufous Hummingbird *selasphorus rufus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8002	Breeds Apr 15 to Jul 15
Sage Thrasher *Oreoscoptes montanus* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9433	Breeds Apr 15 to Aug 10
Virginia's Warbler *Vermivora virginiae* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9441	Breeds May 1 to Jul 31
Western Grebe *aechmophorus occidentalis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/6743	Breeds Jun 1 to Aug 31
Willet *Tringa semipalmata* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Apr 20 to Aug 5

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.

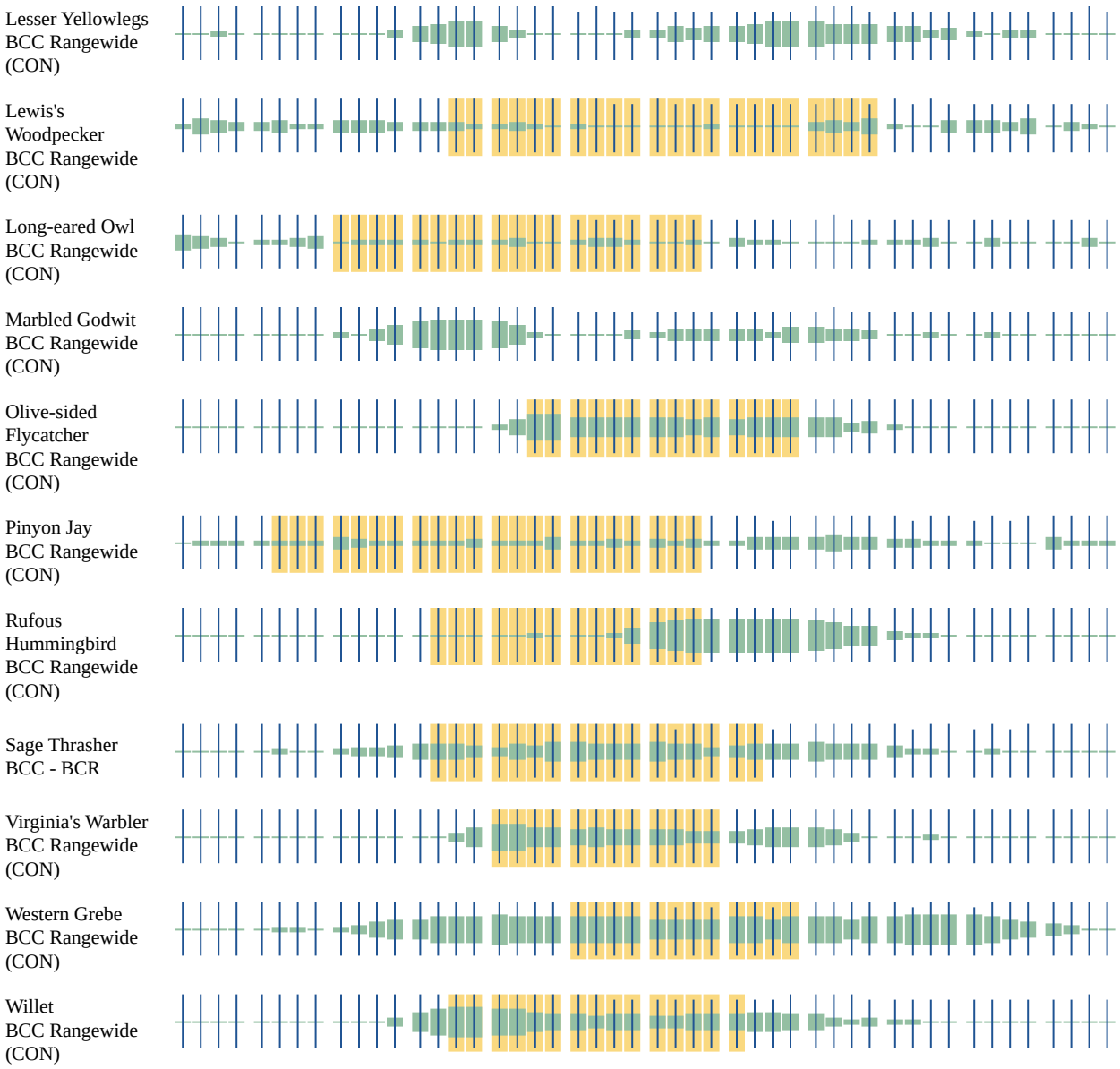
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

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 list of migratory birds that potentially occur 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 Rapid Avian Information Locator (RAIL) 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 or migrating in my 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 query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. 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.

IPaC User Contact Information

Agency: Blue Wing Environmental
Name: Sarah Brammell
Address: 19607 Lake Osceola Ln
City: Odessa
State: FL
Zip: 33556
Email sbrammell@bluewingenv.com
Phone: 8134043963

Lead Agency Contact Information

Lead Agency: Federal Aviation Administration
Name: Shawna Barry
Email: shawna.m.barry@faa.gov

SHPO Coordination

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

Aviation Safety

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

Utah State History
State Historic Preservation Office
300 Rio Grande St.
Salt Lake City, UT 84101

Via electronic submission to https://utahdha.force.com/e106/s/

To whom it may concern:

The purpose of this letter is to inform you of a proposal under consideration by the Federal Aviation Administration (FAA) for the approval of a Certificate of Waiver and/or Exemption for an Unmanned Aircraft System (UAS) delivery operation in Salt Lake City, UT. The FAA has determined that this proposed action is a Federal undertaking as defined in 36 CFR § 800.16 (y). Therefore, the FAA is initializing consultation with the State Historic Preservation Officer (SHPO) pursuant to § 800.4(d), Finding of no historic properties affected.

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

The UAS operation will be flown by an unmanned aircraft weighing 49.6 lbs., including a 3.9 lb. payload, at approximately 250 feet, but no more than 400 feet above ground level (AGL) in Salt Lake City, UT (see attached operations area map). The purpose is for package delivery, consisting of up to 20 flights maximum each day, five days per week, with each flight lasting approximately 15 minutes. Flights will occur primarily Mon-Sun, no holidays, with operating hours from 8 am until 6 pm, 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, there are approximately 583 historic properties within the UAS operations area. The FAA determined that the undertaking will have no historic properties affected. The UAS operation will have no affects to the ground. All flights will takeoff from, and return to the launch and recovery site located on the South Jordan Landfill at 10473 South Bacchus Hwy., South Jordan, UT 84009 (40.556793°, -112.060973°).

Consultation
Based on the results of the FAA's search of the National Park Service online database of the National Register of Historic Places, the FAA has determined that this undertaking will have no historic properties affected. In accordance with § 800.4(d) please review this finding and the enclosed documentation, and provide either your concurrence or non-concurrence within the 30 day regulatory time frame.

If you have any comments or questions or need additional information regarding the proposed operation, 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
Aviation Safety
Manager, General Aviation Operations Branch,
Flight Standards Service

Enclosure

From: noreply@salesforce.com on behalf of Christopher Hansen
To: 9-AWA-AVS-AFS-ENVIRONMENTAL (FAA)
Subject: RE: Salt Lake City Unmanned Aircraft System Delivery Area
Date: Thursday, August 25, 2022 2:36:25 PM

Hi Mike,
Thank you for submitting information for this proposed project. I was wondering if you could elaborate more on the identification of historic properties efforts. It appears National Register listings were looked at with 583 listings, does that include contributing buildings within historic districts and was our Historic Utah Buildings online database consulted too (we look at Eligible buildings, not just Listed)?

https://shpo.utah.gov/portal/apps/webappviewer/index.html?id=8e218e18c2b74477b5f520e5617bebaf

Also, it appears that the more appropriate finding would be No Adverse Effect on historic properties, rather than No Historic Properties Affected, as their is the potential for auditory and visual impacts from the action.

Chris Hansen
Preservation Planner, Deputy SHPO
clhansen@utah.gov
ref:_00D7088Eu._5004u2kSY4Q:ref

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

Aviation Safety

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

Utah State History
State Historic Preservation Office
300 Rio Grande St.
Salt Lake City, UT 84101

Via electronic submission to https://utahdha.force.com/e106/s/

To whom it may concern:

The purpose of this letter is to inform you of a proposal under consideration by the Federal Aviation Administration (FAA) for the approval of a Certificate of Waiver and/or Exemption for an Unmanned Aircraft System (UAS) delivery operation in Salt Lake City, UT. The FAA has determined that this proposed action is a Federal undertaking as defined in 36 CFR § 800.16 (y). Therefore, the FAA is initializing consultation with the State Historic Preservation Officer (SHPO) pursuant to § 800.11(e), Finding of No Adverse Effect on historic properties.

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

The UAS operation will be flown by an unmanned aircraft weighing 49.6 lbs., including a 3.9 lb. payload, at approximately 250 feet, but no more than 400 feet above ground level (AGL) in Salt Lake City, UT (see attached operations area map). The purpose is for package delivery, consisting of up to 20 flights maximum each day, five days per week, with each flight lasting approximately 15 minutes. Flights will occur primarily Mon-Sun, no holidays, with operating hours from 8 am until 6 pm, 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, there are approximately 583 historic properties within the UAS operations area. We also reviewed the Historic Utah Buildings online database, to include eligible buildings and contributing buildings within historic districts.
The FAA determined that the undertaking will have No Adverse Effect on historic properties based on the nature of potential UAS effects on historic properties - namely limited to nonphysical, reversible impacts (visibility of the UAS overflying a point on the ground is estimated to be 6 seconds or less) - and the limited number of daily flights in conjunction with

the FAA's noise exposure analysis described below. Additionally, there would be no known effect on known cultural resources from this action. Therefore, the action will not have a significant impact to historic, architectural, archaeological, or cultural resources.

The UAS operation will have no affects to the ground. All flights will takeoff from, and return to the launch and recovery site located on the South Jordan Landfill at 10473 South Bacchus Hwy., South Jordan, UT 84009 (40.556793°, -112.060973°). The maximum noise exposure levels will occur at the landfill nest site; where noise levels at or above DNL 45 dB would extend 50 to 75 feet of the nest. Based on these dimensions, the DNL 45 dB would remain almost entirely within the vicinity of the nest infrastructure on the landfill property and is well below the FAA's threshold of DNL 65 dB for compatible land use. Additionally, the estimated noise exposure for en-route and delivery operations at locations away from the nest would not exceed DNL 45 dB at any location within the operating area.

Consultation

Based on the results of the FAA's search of the National Park Service online database of the National Register of Historic Places and the Historic Utah Buildings online database the FAA has determined that this undertaking will have No Adverse Effect on historic properties. In accordance with § 800.4(d) please review this finding and the enclosed documentation, and provide either your concurrence or non-concurrence within the 30 day regulatory time frame.

If you have any comments or questions or need additional information regarding the proposed operation, 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,

for

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

Enclosure

Spencer J. Cox
Governor

Deidre M. Henderson
Lieutenant Governor

Jill Remington Love
Executive Director
Utah Department of Cultural and Community Engagement

Christopher Merritt
State Historic Preservation Officer
Utah State Historic Preservation Office

September 2, 2022

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

RE: Salt Lake City Unmanned Aircraft System Delivery Area

For future correspondence, please reference Case No. 22-1576

Dear Mr. Menzimer,

The Utah State Historic Preservation Office received your submission and request for our comment on the above-referenced project on August 24, 2022 (with additional documentation provided on Sept. 2). Based on the information provided to our office, we concur with your determinations of eligibility and with a finding of No Adverse Effect for the proposed undertaking.

This information is provided to assist with Section 106 responsibilities as per §36CFR800. If you have questions, please contact me at (801) 245-7239 or by email at clhansen@utah.gov.

Sincerely,

Christopher Hansen
Preservation Planner/Utah SHPO

Tribal Coordination

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

Aviation Safety

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

Chairman Virgil Johnson
Confederated Tribes of the
Goshute Reservation, Nevada and Utah
HC 61, Box 6104
Ibapah, UT 84034-6104

Dear Chairman Johnson:

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

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

The UAS operation will be flown by an unmanned aircraft weighing 49.6 lbs., including a 3.9 lb. payload, at approximately 200 feet, but no more than 400 feet above ground level (AGL) in Salt Lake City, UT (see attached operations area map). The purpose is for package delivery, consisting of no greater than approximately 20 flights each day, with each flight lasting approximately 15 minutes. Flights will occur primarily Mon-Fri, no holidays, with operating hours from 8 am until 6 pm, during daylight hours. The dimension of the UAS area defines the Area of Potential Effect (APE). The UAS operation will have no affects to the ground. All flights will takeoff from, and return to the launch and recovery site located on the South Jordan Landfill at 10473 South Bacchus Hwy., South Jordan, UT 84009 (40.556793°, -112.060973°).

Consultation
The FAA is soliciting the opinion of the tribe(s) concerning any tribal lands, or sites of religious or cultural significance that may be affected by the proposed operation area. Based on a review of the area, 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 historic properties affected. FAA expects that drone operations will continue to grow and that we all will continue to learn more about this emerging technology.

FAA is amenable 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 comments or questions or need additional information regarding the proposed operation, 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
Manager, General Aviation Operations Section
General Aviation and Commercial Division
Office of Safety Standards, Flight Standards Service

Enclosure

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

Aviation Safety

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

Chairperson Dennis Alex
Northwestern Band of Shoshoni Nation
707 N. Main Street
Brigham City, UT 84302-1449

Dear Chairperson Alex:

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

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

The UAS operation will be flown by an unmanned aircraft weighing 49.6 lbs., including a 3.9 lb. payload, at approximately 200 feet, but no more than 400 feet above ground level (AGL) in Salt Lake City, UT (see attached operations area map). The purpose is for package delivery, consisting of no greater than approximately 20 flights each day, with each flight lasting approximately 15 minutes. Flights will occur primarily Mon-Fri, no holidays, with operating hours from 8 am until 6 pm, during daylight hours. The dimension of the UAS area defines the Area of Potential Effect (APE). The UAS operation will have no affects to the ground. All flights will takeoff from, and return to the launch and recovery site located on the South Jordan Landfill at 10473 South Bacchus Hwy., South Jordan, UT 84009 (40.556793°, -112.060973°).

Consultation
The FAA is soliciting the opinion of the tribe(s) concerning any tribal lands, or sites of religious or cultural significance that may be affected by the proposed operation area. Based on a review of the area, 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 historic properties affected. FAA expects that drone operations will continue to grow and that we all will continue to learn more about this emerging technology.

FAA is amenable 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 comments or questions or need additional information regarding the proposed operation, 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
Manager, General Aviation Operations Section
General Aviation and Commercial Division
Office of Safety Standards, Flight Standards Service

Enclosure

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

Aviation Safety

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

Chairman Tino Batt
Shoshone-Bannock Tribes
P.O. Box 306
Fort Hall, ID 83203-0306

Dear Chairman Batt:

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

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

The UAS operation will be flown by an unmanned aircraft weighing 49.6 lbs., including a 3.9 lb. payload, at approximately 200 feet, but no more than 400 feet above ground level (AGL) in Salt Lake City, UT (see attached operations area map). The purpose is for package delivery, consisting of no greater than approximately 20 flights each day, with each flight lasting approximately 15 minutes. Flights will occur primarily Mon-Fri, no holidays, with operating hours from 8 am until 6 pm, during daylight hours. The dimension of the UAS area defines the Area of Potential Effect (APE). The UAS operation will have no affects to the ground. All flights will takeoff from, and return to the launch and recovery site located on the South Jordan Landfill at 10473 South Bacchus Hwy., South Jordan, UT 84009 (40.556793°, -112.060973°).

Consultation
The FAA is soliciting the opinion of the tribe(s) concerning any tribal lands, or sites of religious or cultural significance that may be affected by the proposed operation area. Based on a review of the area, 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 historic properties affected. FAA expects that drone operations will continue to grow and that we all will continue to learn more about this emerging technology.

FAA is amenable 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 comments or questions or need additional information regarding the proposed operation, 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
Manager, General Aviation Operations Section
General Aviation and Commercial Division
Office of Safety Standards, Flight Standards Service

Enclosure

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

Aviation Safety

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

Chairwoman Lori Bear
Skull Valley Band of Goshute Indians of Utah
P.O. Box 448
Grantsville, UT 84029-0448

Dear Chairwoman Bear:

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

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

The UAS operation will be flown by an unmanned aircraft weighing 49.6 lbs., including a 3.9 lb. payload, at approximately 200 feet, but no more than 400 feet above ground level (AGL) in Salt Lake City, UT (see attached operations area map). The purpose is for package delivery, consisting of no greater than approximately 20 flights each day, with each flight lasting approximately 15 minutes. Flights will occur primarily Mon-Fri, no holidays, with operating hours from 8 am until 6 pm, during daylight hours. The dimension of the UAS area defines the Area of Potential Effect (APE). The UAS operation will have no affects to the ground. All flights will takeoff from, and return to the launch and recovery site located on the South Jordan Landfill at 10473 South Bacchus Hwy., South Jordan, UT 84009 (40.556793°, -112.060973°).

Consultation
The FAA is soliciting the opinion of the tribe(s) concerning any tribal lands, or sites of religious or cultural significance that may be affected by the proposed operation area. Based on a review of the area, 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 historic properties affected. FAA expects that drone operations will continue to grow and that we all will continue to learn more about this emerging technology.

FAA is amenable 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 comments or questions or need additional information regarding the proposed operation, 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
Manager, General Aviation Operations Section
General Aviation and Commercial Division
Office of Safety Standards, Flight Standards Service

Enclosure

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

Aviation Safety

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

Chairperson Luke Duncan
Ute Indian Tribe of the Uintah and Ouray Reservation
P.O. Box 190
Fort Duchesne, UT 84026-0190

Dear Chairperson Duncan:

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

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

The UAS operation will be flown by an unmanned aircraft weighing 49.6 lbs., including a 3.9 lb. payload, at approximately 200 feet, but no more than 400 feet above ground level (AGL) in Salt Lake City, UT (see attached operations area map). The purpose is for package delivery, consisting of no greater than approximately 20 flights each day, with each flight lasting approximately 15 minutes. Flights will occur primarily Mon-Fri, no holidays, with operating hours from 8 am until 6 pm, during daylight hours. The dimension of the UAS area defines the Area of Potential Effect (APE). The UAS operation will have no affects to the ground. All flights will takeoff from, and return to the launch and recovery site located on the South Jordan Landfill at 10473 South Bacchus Hwy., South Jordan, UT 84009 (40.556793°, -112.060973°).

Consultation
The FAA is soliciting the opinion of the tribe(s) concerning any tribal lands, or sites of religious or cultural significance that may be affected by the proposed operation area. Based on a review of the area, 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 historic properties affected. FAA expects that drone operations will continue to grow and that we all will continue to learn more about this emerging technology.

FAA is amenable 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 comments or questions or need additional information regarding the proposed operation, 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,

for

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

Enclosure

APPENDIX B

Noise Analysis Report

Noise Assessment for Zipline Proposed Package Delivery Operations with Sparrow Unmanned Aircraft

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

Final

HMMH Report No. 309990.003-4

January 5, 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 Zipline Proposed Package Delivery Operations with Sparrow Unmanned Aircraft

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

Final

HMMH Report No. 309990.003-4

January 5, 2022

Prepared for:

JD RoVolus, LLC
121 Pearl Street
Ypsilanti, MI 48197

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

Prepared by:
David Crandall

HMMH
700 District Avenue, Suite 800
Burlington, MA 01803
T 781.229.0707
F 781.229.7937

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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 Zipline as a commercial operator under the provisions of 14 CFR Part 135. Zipline is proposing to perform package delivery operations at multiple potential locations in the continental United States utilizing an operational model that involves a central distribution center (a "nest") and supporting route network to transport packages to delivery locations ("delivery sites") in the surrounding communities such as medical centers, health facilities, and private homes.

Nest and delivery sites are driven by partnerships Zipline has established with health organizations, retailers, and other businesses to deliver medical supplies and retail goods to surrounding communities. Flight paths to and from the nest and delivery sites use a network or route plans, with a structure of common flight path segments near the nest and various branches to deliver to individual locations.[1] Delivery sites are selected by Zipline after potential customers are identified and their specific locations have been surveyed and satisfy various criteria.

The Zipline Sparrow Unmanned Aircraft is unique to Zipline, and often referred to as a "Zip."[2] The UA is a fixed-wing design powered by two electric motors, mounted on a single pylon above the fuselage, turning three-bladed propellers. The wingspan is 10 feet, 10 inches, with a fuselage length of 6 feet, 2 inches. The maximum takeoff weight is listed as 49.3 pounds. Figure 1 depicts the UA considered in this report.

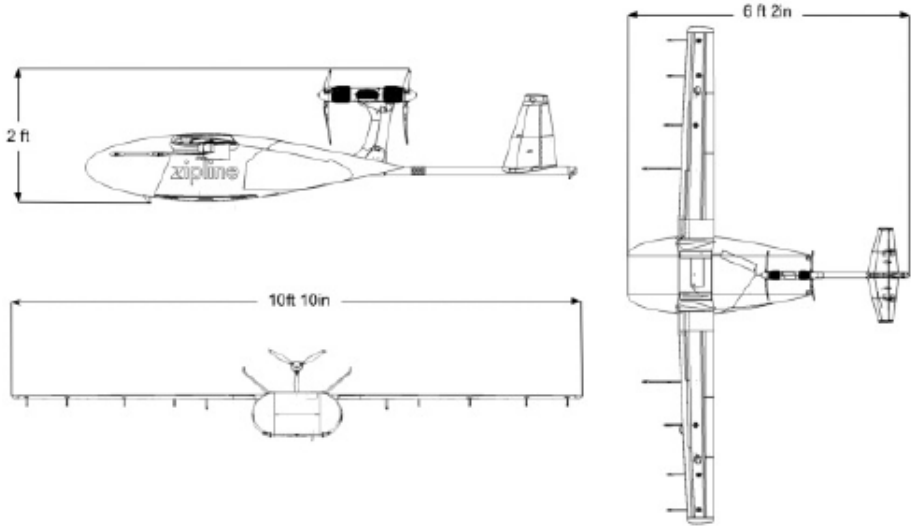

Figure 1. Sparrow Unmanned Aircraft

[1] Zipline materials defined "route plan" as "Standardized and static end to end path of a [UA] to and from a delivery location (originating from a nest) that includes considerations for altitude, keep-out areas, etc."
[2] According to the definitions in Zipline's CONOPS dated June 7, 2021, regulatory technical documents regarding the UA are titled "Sparrow Unmanned Aircraft Flight Manual" and "Sparrow Unmanned Aircraft Maintenance Manual." Therefore Sparrow is used in this document for consistency.

As a fixed-wing design, the UA needs forward airspeed to remain in controlled flight, and general operating airspeeds are expected to be in the range of 45 to 60 knots. The UA is launched via catapult at the nest and then climbs to en route altitude, at which point it navigates along a defined path from the nest to the intended delivery site. The en route portion of the flight would generally be operated at an altitude of 250 feet Above Ground Level (AGL) and is always below an altitude of 400 feet AGL. Approaching the delivery site, the UA flies a pattern near the delivery point, descends to 60 feet AGL, drops the package via parachute at a pre-defined drop zone, climbs to en route altitude, and then flies along a defined path for recovery at the nest via a recovery system.

The methodology proposed in this document provides quantitative guidance to FAA Environmental Specialists to inform environmental decision making on UA noise exposure from proposed Zipline 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, the anticipated use of this report is 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.[3]

The methodology has been developed with data provided by Zipline and FAA to date and therefore is limited to Zipline operations with the Sparrow 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 Zipline and reviewed by FAA. 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 made available by Zipline and FAA. Section 3 describes the approach to developing noise exposure estimates for the various UA flight phases associated with typical operations from the available data. Section 4 presents the estimated DNL levels for various flight phases based on varying levels of typical operations as described by Zipline to date.

[3] 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

[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

Six data sets formed the basis of the noise assessment for the proposed Zipline delivery operations. The data sets include the CONOPS dated June 7, 2021, Noise Test Data report dated September 24, 2021, sample flight track data received on October 29, 2021, and correspondence to FAA's Office of Environment and Energy (AEE) dated April 27, 2021, September 30, 2021, and October 20, 2021.[5] These data sets form the basis for conducting the noise analysis for proposed UA delivery operations. The following subsections provide additional detail on each data source.

2.1 Operations, Flight Paths, and Flight Profile Data

Operations and flight profile data for the UA provided by Zipline were reviewed to determine the characteristics of typical operations for a proposed operating area. Based on this review, the following subsections detail the operations and flight profile assumptions that were used to inform the development of the inputs for calculating 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 3.5 and Section 4 provide techniques to apply the operational weighting and to calculate effective operations for analysis with the DNL metric.

2.1.2 Flight Paths and Profiles

The UA will fly a network of defined flight paths between a central distribution center (known as a "nest") and delivery sites that are developed on an "as-needed basis." Each delivery site is based on customer demand and a suitability survey specific to each candidate location. The nest includes a launcher and recovery apparatus for the UA, along with a building to recharge, pack, and prepare the UAs for deliveries. After launch from the nest, the UA will use the defined flight paths to navigate on

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

both the outbound (nest to delivery) and inbound (post-delivery to recovery) legs. The UA uses the United States Global Positioning System (GPS) for navigation.

Analysis of flight profile data provided by Zipline revealed that a typical profile for operations of the UA can be broken into four discrete phases as described below, in the following sub-sections, and depicted in Figure 2 and Figure 3:

- Launch and climb: Includes launch from the nest and climb to en route altitude.
- En route: Includes flight of the UA to and from the nest at en route altitude. The UA will use the same flight path to and from the nest to a delivery site and may include circular or oval patterns along the route, as needed, for weather and operational conditions.
- Delivery: This includes a unique delivery flight pattern, with orientation dependent upon wind direction and the delivery site.
- Descent and recovery: This includes inbound descent from en route flight and recovery at the nest.

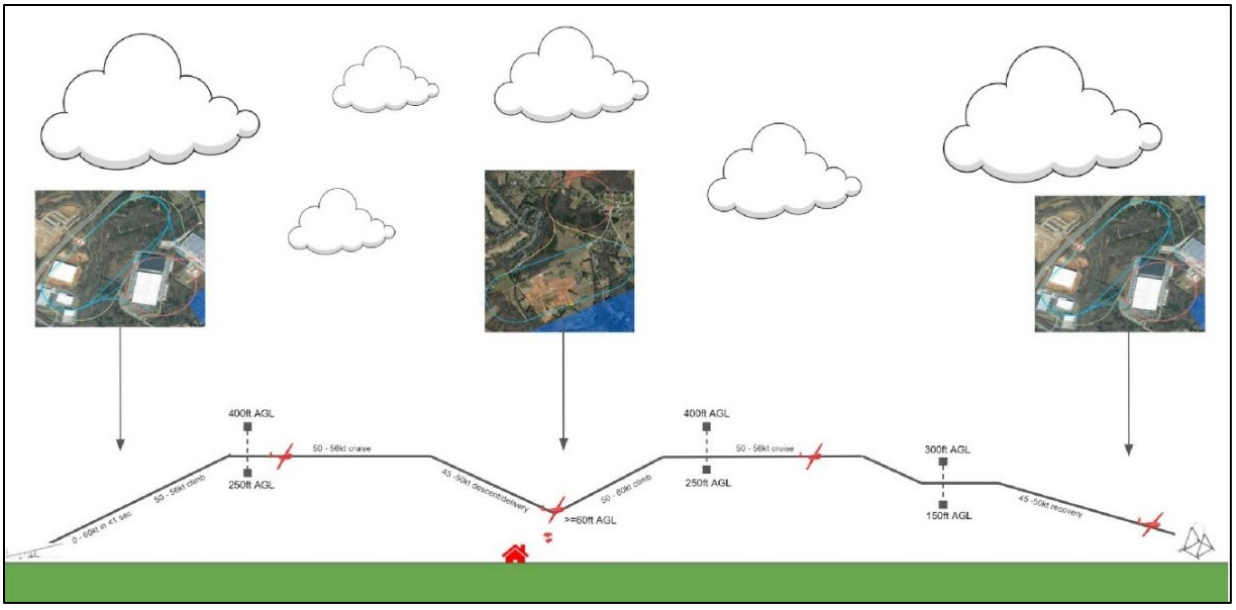

Figure 2. Flight Profile Example

Source: Zipline, September 30, 2021

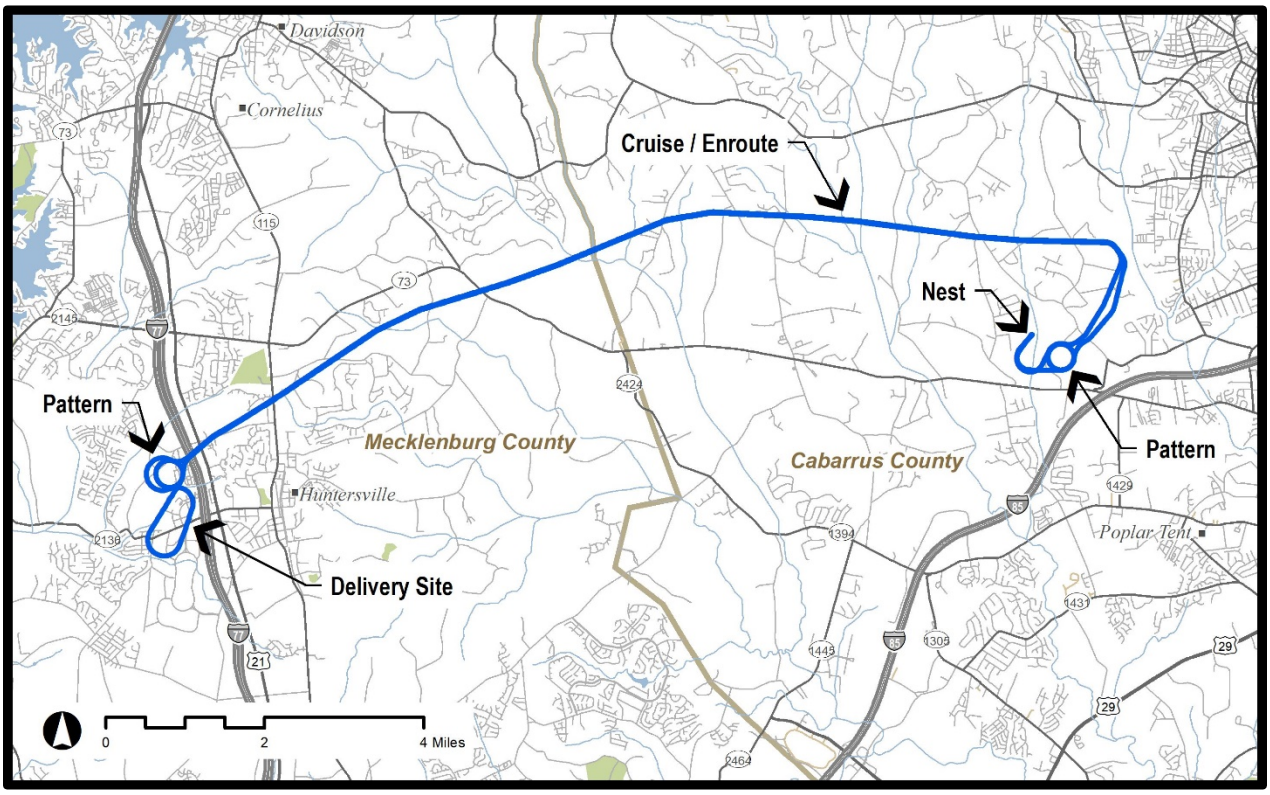

Figure 3. Annotated Example Delivery Flight Path

Sources: Zipline, October 29, 2021; Annotations by HMMH

2.1.2.1 Launch and Climb

During the launch and climb phase, the UA is launched from the nest using a catapult mechanism (a "launcher") as depicted in Figure 4. The launcher is expected to launch the aircraft to 60 knots ground speed, at which point the UA will separate from the launcher and then maintain a nominal climb trajectory at an airspeed of 50 to 56 knots and a climb angle of approximately 8 to 11 degrees until reaching en route altitude.

Figure 4. UA on the Launcher

Source: Zipline, CONOPS, June 7, 2021

2.1.2.2 En route

En route is defined as the phase of flight where the UA transits to and from the nest to delivery sites on a defined network of flight paths. During this flight phase, the UA will typically operate at an altitude of 250 ft Above Ground Level (AGL) and a nominal airspeed of 56 knots. However, the UA may operate at altitudes as low as 130 ft AGL or as high as 400 ft AGL, and with possible ground speeds as low as 40 knots.

Once defined, a particular en route path is expected to be flown consistently, as the UA uses GPS for navigation. As shown in Figure 3, the en route paths are the same for the inbound and outbound legs. A single en route path may support a handful of delivery sites at the edges of the operational area or may, very close to the nest, support the majority of the delivery sites.

In some instances, the UA may enter a circular holding pattern en route to or from a delivery. Holding may occur at a series of defined static holding points or at ad-hoc holding dictated as necessary along the route. Duration spent in holding, the size of the holding pattern, and orientation of the holding pattern is dictated based on operational necessity, weather, and terrain. However, the radius of the

holding pattern flown by the UA is not expected to exceed approximately 820 feet for static holds and approximately 1,640 feet for ad-hoc holds, respectively. When holding is conducted within the en route path, the UA is anticipated to maintain altitudes and speeds consistent with typical en route operations.

2.1.2.3 Delivery

The delivery phase of flight is defined by descent from the en route phase to a delivery site to deliver a package. The delivery occurs within a 40 foot by 40-foot square drop zone in a designated area pre-surveyed by Zipline for suitability before use. The flight path flown by the UA during the delivery phase is chosen at the time of the flight such that the UA is flying into the wind to minimize ground speed at the time of the package release.

During the delivery phase, both prior to and after delivery, there are several associated "pattern" turns flown by the UA that could occur within approximately 1 to 1.5 statute miles of the drop zone. Figure 5 and Figure 6 show the top-down view of a typical delivery pattern and the altitude profile information, respectively.

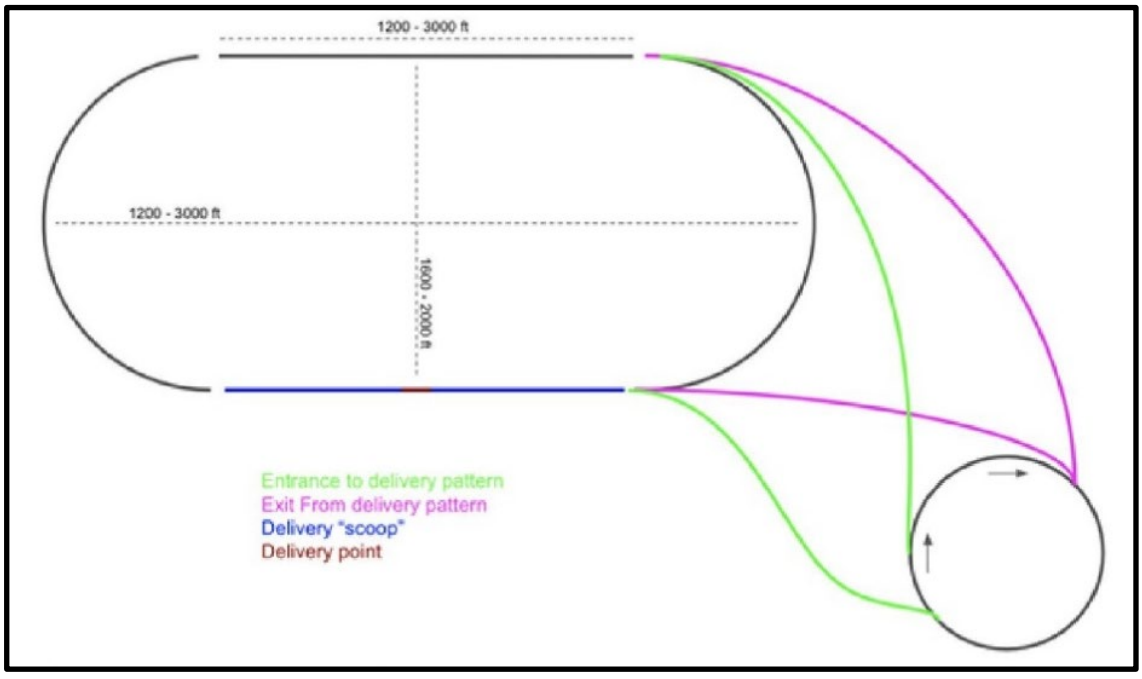

Figure 5. Top Down Diagram of Nominal Delivery Pattern Dimensions
Source: Zipline, April 27, 2021

Figure 6 depicts typical altitude profiles of the UA while in the delivery pattern. The package release during delivery is preceded by a straight segment descending from approximately 130 ft AGL or higher at a descent angle of approximately eight degrees to the package release altitude. The actual package release occurs at or above 60 ft AGL at a ground speed of 40 knots. After package release, the UA climbs to an altitude of at least 130 ft AGL at a climb angle of approximately eight degrees. The UA will then

commence one or more turns to rejoin the en route flight path, as described in Section 2.1.2.2, for return to the nest and recovery.

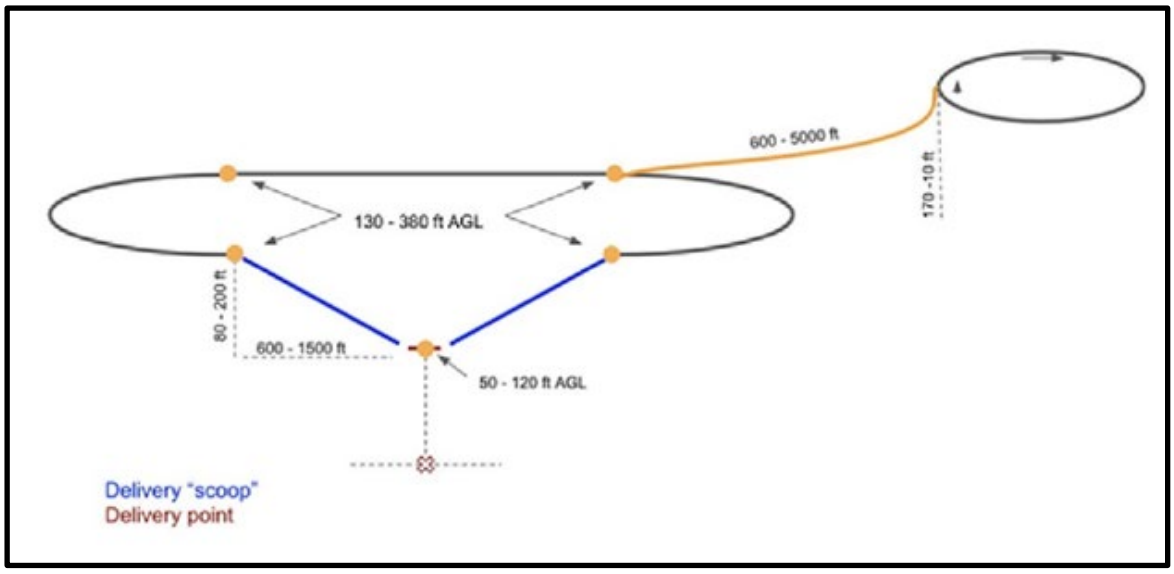

Figure 6. Profile View of Delivery Patterns
Source: Zipline, April 27, 2021

2.1.2.4 Descent and Recovery

The recovery phase of flight is defined as descent from the en route flight phase and recovery of the UA at the nest. The UA is recovered at the nest using a cable recovery mechanism as depicted in Figure 7. Approaching the nest, the UA will descend from en route altitude to 36 feet AGL, at a descent angle of approximately six degrees and an airspeed of 50 to 56 knots. The UA will then be arrested and quickly decelerate via a hook engaging a cable as part of the recovery infrastructure and then lowered to the ground for reuse.

Figure 7. The Recovery System Raising to Recover a Returning UA
Source: Zipline, CONOPS, 6/7/2021

2.2 Acoustical Data

Noise measurement data were provided by Zipline, representative of each phase of the flight (launch, en route, delivery, and recovery). The noise measurements were performed at a Zipline facility near Esparto, California, between August 10, 2021, and September 14, 2021 and provided in a September 24, 2021 document.

In some cases, the data set provided multiple samples of the same operating conditions; the more conservative sample is used for this analysis. The provided documentation does not fully describe the test setup for all measurements. In instances where the distances between the microphone and the noise source are not stated, they are estimated based on the geometry described in the measurement narrative.

Table 1 presents the various measurements of SEL and L_{Amax} that are used in this analysis.

Table 1. SEL and L_{Amax} Relationship Relative to Distance

Source: Zipline, September 24, 2021

Measurement	Distance between Source and Microphone (ft)	SEL (dB)	L_{Amax} (dB)	Note
Launch Under Track	15.0*	81.9	86.4	Nest launch/departure measurement with the microphone positioned under flightpath. Assume this includes launch and launcher noise; distance estimated because altitude over microphone was not provided.
Launch Sideline	50.0	75.5	78.3	Nest launch/departure measurement with microphone positioned sideline/lateral/perpendicular to launcher orientation and flightpath; assume this includes launch and launcher noise.
Recovery	59.4*	72.8	76.4	Nest Recovery Noise. Distance estimated based on 50 ft from recovery location and oriented sideline/perpendicular of aircraft approach path; assume a recover altitude of 32 ft relative to the microphone.
Delivery	56.0*	68.1	66.5	Delivery Noise Distance estimated based on indicated flight altitude of 60 ft AGL and estimated microphone height of 4 feet AGL; assume delivery speed is 45 knots based on the middle of the ranges presented.
Notes: *Distance between sound source microphone not provided explicitly. These values are estimated distances as discussed in the Note field.				

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 Zipline delivery operations originating at a single nest within a proposed single area of operations, with each nest operating up to seven days a week with varying levels of daily and equivalent annual delivery operations. 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 following subsections describe that 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).[6]

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

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.

[6] Equation (1) has 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

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

3.2 Nest Infrastructure

As noted in Section 1 and Section 2.1.2, Zipline's central operation facility is called a nest. The nest includes the launcher (Section 2.1.2.1), the recovery mechanism (Section 2.1.2.4), along with a building/facility to recharge, pack, and prepare the UAs. For the purpose of this noise analysis methodology, the Nest Extents depicted in Figure 8 refer to the portion of the property in which the launcher and recovery gear could be positioned. The Nest Extents, for the noise analysis shall be a rectangle, circle, or other polygon that includes all the possible locations for the launcher and the recovery gear.[7]

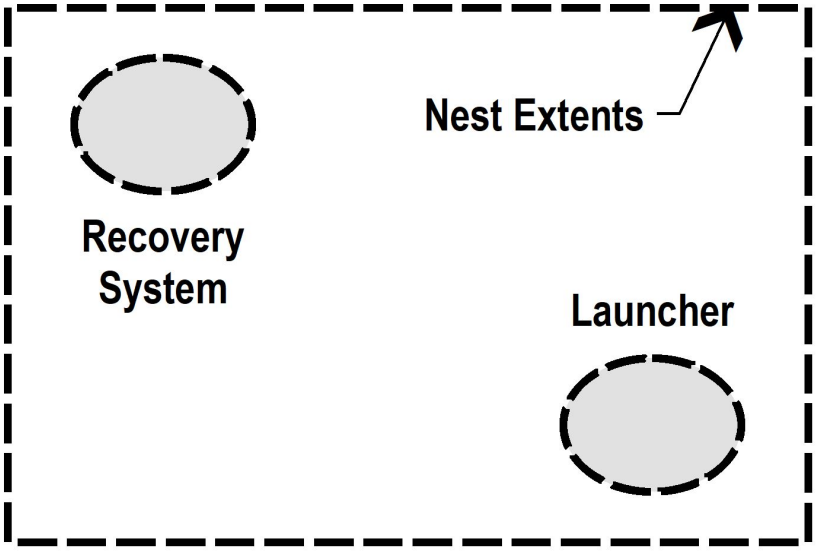

Figure 8. Conceptual Nest Extents
Source: HMMH

3.3 Launch and Climb

As noted in Section 2.1.2.1, the launcher is expected to launch the aircraft to 60 knots ground speed. Nominal climb trajectory after launch is stated to have an angle of approximately 8 to 11 degrees at an airspeed of 50 to 56 knots. For noise estimation, the eight-degree value is used as it places aircraft close to the ground, yielding a conservative/louder noise estimate. Since the en route portion is described as being level flight at 250 ft AGL, the climb phase associated with a launch extends about 1,800 feet ground track distance from the launcher.[8] The aircraft ground speed will be assumed to be initially 40

[7] Materials indicate that the launcher and recovery gear are made to be moved as needed.
[8] To reach an altitude of 250 ft with a 8 degree climb 250 ft/tan(8 deg) = 1,778 ft.

knots based on the 56-knot nominal airspeed and an assumed 16-knot headwind. This lower ground speed will increase event duration and provide a slightly more conservative noise level estimate compared to a faster ground speed.

3.4 Application of Acoustical Data

The Day-Night Average Sound Levels (DNLs) can be estimated with a summation of the Sound Exposure Levels (SELs). For the purpose of calculating SEL, three specific activities are considered:

- Launch related activities at the nest
- Flight of the aircraft including climb, en route, delivery, and descent at various altitudes and speeds
- Recovery related activities at the nest

3.4.1 General Assumptions

The following assumptions have been made in the application of acoustical data unless noted otherwise.

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

In this analysis, the knowns include reference sound levels at known distances. Those reference levels will be adjusted for spherical spreading to develop the sound levels at various points. For a stationary point source, the relationship of the level at point *i* (L_i) to a reference level is provided in Equation (4):

$$L_i = L_R + 20 \times \log_{10}\left(\frac{Dist_R}{Dist_i}\right), dB \quad (4)$$

where L_R is the measured reference level, $Dist_R$ is the distance between the reference level measurement location and the sound source, and $Dist_i$ is the distance between the sound source and Point *i*. $Dist_R$ and $Dist_i$ must be in the same units of distance. Moving sources will be addressed Section 3.4.3.

Sound transmits equally in all directions.

Sound transmits equally in all directions relative to the noise source (e.g., the L_{Amax} 10 meters off the nose of the aircraft is the same as 10 meters below the aircraft, 10 meters to the side of the aircraft and 10 meters to the rear of the aircraft).

3.4.2 Launch

Two sets of measurements are provided for launch. One measurement location was positioned on sideline (lateral) of the aircraft's flightpath, and one was positioned under the flight path (flyover). Of the two, the sideline values appear more appropriate than the flyover because a) the distance associated with the former is more clearly defined, and b) the former will propagate a more conservative estimate throughout the rest of the analysis. The launch noise sources are assumed to be a

stationary point source, occurring once for each aircraft departure. Sound exposure level for a given point i (SEL_i) located a specific distance ($Dist_i$) in feet from this particular launcher will be based on spherical spreading of a point source and calculated with Equation (5), where 75.5 dB was the measured SEL of a launch 50 feet from the launcher as indicated in Table 1. It is assumed that the launcher apparatus dominates the sideline noise with minimal contribution from the UA and therefore the equation is set up for a stationary source.

$$SEL_i = 75.5 + 20 \times \log_{10}\left(\frac{50}{Dist_i}\right), dB \quad (5)$$

3.4.3 Aircraft Flight

The applicant's aircraft is fixed wing and therefore must continue to move to be airborne. Flight of the aircraft in still air is anticipated to be in the range of 40 to 60 knots.[9] Sound exposure level for a given point i (SEL_i) with the aircraft flying directly overhead at altitude (Alt_i) in feet and a speed (Vi) 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 3.4.3 are only applicable for an aircraft that is moving relative to a stationary receptor.

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 (6).

$$\Delta J_1 = 12.5 \times log_{10}\left(\frac{H_A}{H_T}\right), dB \quad (6)$$

Where ΔJ_1 is the quantity in decibels that must be algebraically added to the measured SEL 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 the height of the vehicle during the measurement (or 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 (7).

$$\Delta J_3 = 10 \times log_{10}\left(\frac{V_{RA}}{V_R}\right), dB \quad (7)$$

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

To estimate the sound exposure level of the UA flying en route the measured sound exposure level made during delivery will be used. As shown in Table 1, the SEL is 68.1 dB measured when the vehicle was 56 feet high traveling at approximately 45 knots; therefore, adapting that measurement to the en

[9] Various documents provide various speed ranges. This range represents the lower and upper bounds mentioned.
[10] 14 CFR Part 36 Noise Standards: Aircraft Type And Airworthiness Certification

route condition when the UA is flying at an Altitude of Alt_i feet AGL and V_i knots can be made using Equation (8) to arrive at an estimate SEL_i dB for that phase of the flight.

$$SEL_i = 68.1 + 12.5 \times \log_{10}\left(\frac{56}{Alt_i}\right) + 10 \times \log_{10}\left(\frac{45}{V_i}\right), dB \quad (8)$$

3.4.4 Recovery

The applicant's aircraft is recovered by catching a wire positioned approximately 36 feet AGL, and then the aircraft rapidly decelerates and decreases in altitude until it comes to rest on a designated surface. The recovery sources are assumed to be a stationary point source, occurring once for each aircraft arrival. Similar to the en route noise, to estimate the sound exposure level at a given point i (SEL_i) located at a specific distance ($Dist_i$) in feet from the recovery device will be based on spherical spreading of a point source. Equation (9) calculates the recovery SEL_i as a function of distance from the recovery device where 72.8 dB was measured 59.9 feet from the recovery mechanism.

$$SEL_i = 72.8 + 20 \times \log_{10}\left(\frac{59.9}{Dist_i}\right), dB \quad (9)$$

3.5 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 (10).

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

The above equation applies to an SEL value representing one noise source such as an UA launch or an UA recovery. 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 (11).

$$DNL_i = 10 \times log_{10}\left(10^{\left(\frac{DNL_{iA}}{10}\right)} + 10^{\left(\frac{DNL_{iB}}{10}\right)} + \cdots + 10^{\left(\frac{DNL_{iZ}}{10}\right)}\right), (dB) \quad (11)$$

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

3.5.1 DNL for Launch Operations

The launch and climb process includes accelerating the UA to initial airspeed via a launcher and then having the UA climb at an angle of eight or more degrees. Additional details regarding the nominal launch profile are discussed in Section 2.1.2.1.

Launch operations will be represented by two sound levels provided by Zipline materials. First, the launch will be treated as a stationary source, creating a single noise event for each aircraft departure using the relationships in Section 3.4.2. Second, the aircraft itself will be treated as it moves along its flight path until the en route portion, assumed to be when it reaches an altitude of 250 ft AGL, using the relationships in Section 3.4.3.

The materials provided by Zipline indicate that for any single departure, the UA will be launched on one of two flight paths, depending on the winds. Since the launcher will be aligned in one of two directions, the initial flight paths, including the turns to the initial heading, are expected to be consistent from flight to flight.

3.5.2 DNL for En Route

En route includes the UA flying to and from the nest to delivery sites as discussed in Section 2.1.2.2. 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 3.4.3 and Equation (8). Operations will be based on representative numbers defined in relevant materials and generally assume that a receiver under the flight path will be overflown by the UA while it is traveling both outbound and inbound for a single delivery.

In instances where the UA may enter a holding pattern, DNL may be calculated consistent with the methodology used for en route flight. However, during holding, the UA may overfly a single location multiple times outbound or inbound while making a delivery, and the number of operations experienced during holding may exceed the number of delivery operations. In these instances, operations under the flight path over a receiver may vary based on information regarding the frequency of holding operations defined in relevant materials and may include additional overflights of the UA beyond typical inbound and outbound delivery operations.

3.5.3 DNL for Delivery Sites

Delivery includes delivery of a package by the UA to a delivery site as discussed in Section 2.1.2.3. As the specific delivery sites and flight path to and from a specific delivery site is likely not known at the time of the noise analysis, the sound exposure will be represented by the noise level associated with the vehicle during delivery and applied throughout a radius surrounding the delivery site where the UA could be at the lowest altitude and slowest speed. The information shown in Figure 3 and Section 2.1.2.3 indicates this area could be on the order of 1 to 1.5 statute miles.

A representative receiver will be placed under the flight path at the delivery site, and the SELs and DNL will be calculated as a function of altitude and speed as detailed in Section 3.4.3. Results will be presented in a tabular format for varying numbers of deliveries.

3.5.4 DNL for Recovery Operations

Recovery operations will be represented by two sound levels provided by Zipline. First, aircraft will fly a flight path from en route conditions (Section 2.1.2.2) and descend to the recovery apparatus at an assumed 36 ft AGL (Section 2.1.2.4). Second, the actual recovery event will be treated as a stationary source, creating a single noise event for each aircraft recovered using the relationships in Section 3.4.4.

3.5.5 DNL for Nest Activities

The launch and recovery operations discussed in Sections 3.5.1 and 3.5.4 are anticipated to occur at the same location. Therefore, the results for both will be calculated for a single set of receptors. Operations will be assumed to be “head-to-head” in which case the launch and the recovery flight paths will be the same.

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4 Noise Exposure Estimate Results

This section presents the estimated noise exposure for Zipline'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 nest. One delivery includes the outbound launch and inbound recovery and is representative of two operations. The DNL Equivalent deliveries, $N_{DNL,i}$ as described in Section 3.1, is presented below as Equation (12)

$$Deliveries_{DNL,i} = Deliveries_{Day} + 10 \times Deliveries_{Night} \quad (12)$$

$Deliveries_{Day}$ are between 7 AM and 10 PM and $Deliveries_{Night}$ are 10 PM and 7 AM. [11] If a portion of a delivery occurs in the nighttime hours (either launch or recovery) 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 two flight phases (for example, completing climb and starting en route), then the louder of the two results should be used.

4.1 Noise Exposure for Operations at the Nest

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

Table 2 presents for a given number of daily average DNL Equivalent deliveries (including the launch, climb, descent, and recovery as detailed in Section 2.1.2), the estimated extent of DNL 45 dB, 50 dB, 55 dB, 60 dB, and 65 dB under the flight paths for a given orientation of the launcher relative to the nest extents as described in Section 3.2. Table 3 presents for a given number of deliveries (including the launch, climb, descent, and recovery), the estimated extent of DNL 45 dB, DNL 45 dB, 50 dB, 55 dB, 60 dB, and 65 dB to the sideline of the nest for a given orientation of the launcher and nest extents. The analyses presented in Table 2 and Table 3 were rounded up conservatively to the nearest 25 ft intervals. The actual noise levels, should they be calculated with greater precision or measured, are anticipated to be within the estimated extents depicted.[12]

The subsections that follow discuss how to interpret the data contained in Table 2 and Table 3 for application to estimating nest noise exposure for two circumstances.

[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 25 foot intervals from 25 to 1,925 ft. The interval of 25 feet was selected based on professional judgement considering the anticipated use of these tables for estimating noise at locations outside of the nest.

Table 2. Estimated Extent of Noise Exposure from the Nest per Number of Deliveries - Under Flight Paths

Number of DNL Equivalent Deliveries Served by Nest		Estimated Extents, feet, for				
Average Daily	Annual	DNL 45 dB	DNL 50 dB	DNL 55 dB	DNL 60 dB	DNL 65 dB
<= 1	<= 365	25	25	25	25	25
<= 5	<= 1,825	25	25	25	25	25
<= 10	<= 3,650	50	25	25	25	25
<= 15	<= 5,475	50	25	25	25	25
<= 20	<= 7,300	75	25	25	25	25
<= 40	<= 14,600	100	50	25	25	25
<= 60	<= 21,900	150	50	25	25	25
<= 80	<= 29,200	200	75	50	25	25
<= 100	<= 36,500	225	75	50	25	25
<= 120	<= 43,800	275	100	50	25	25
<= 140	<= 51,100	325	100	50	25	25
<= 160	<= 58,400	375	125	50	25	25
<= 180	<= 65,700	400	150	50	25	25
<= 200	<= 73,000	450	150	75	25	25
<= 220	<= 80,300	500	175	75	25	25
<= 240	<= 87,600	525	175	75	50	25
<= 260	<= 94,900	575	200	75	50	25
<= 280	<= 102,200	725	200	75	50	25
<= 300	<= 109,500	750	225	75	50	25
<= 340	<= 124,100	800	250	100	50	25
<= 360	<= 131,400	825	275	100	50	25
<= 380	<= 138,700	850	275	100	50	25
<= 400	<= 146,000	925	300	100	50	25
<= 420	<= 153,300	975	325	100	50	25
<= 440	<= 160,600	1000	325	100	50	25
<= 460	<= 167,900	1075	350	125	50	25
<= 480	<= 175,200	1150	350	125	50	25
<= 500	<= 182,500	1200	350	125	50	25

Notes:
a) One delivery includes the outbound launch and inbound recovery and is representative of two operations.
b) If a value for deliveries is not specifically defined in 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.

Table 3. Estimated Extent of Noise Exposure from the Nest per Number of Deliveries - Sideline

Number of DNL Equivalent Deliveries Served by Nest		Estimated Extents, feet, for				
Average Daily	Annual	DNL 45 dB	DNL 50 dB	DNL 55 dB	DNL 60 dB	DNL 65 dB
<= 1	<= 365	25	25	25	25	25
<= 5	<= 1,825	25	25	25	25	25
<= 10	<= 3,650	50	25	25	25	25
<= 15	<= 5,475	50	25	25	25	25
<= 20	<= 7,300	50	25	25	25	25
<= 40	<= 14,600	75	50	25	25	25
<= 60	<= 21,900	75	50	25	25	25
<= 80	<= 29,200	100	50	25	25	25
<= 100	<= 36,500	100	50	50	25	25
<= 120	<= 43,800	100	75	50	25	25
<= 140	<= 51,100	125	75	50	25	25
<= 160	<= 58,400	125	75	50	25	25
<= 180	<= 65,700	150	75	50	25	25
<= 200	<= 73,000	150	75	50	25	25
<= 220	<= 80,300	150	75	50	25	25
<= 240	<= 87,600	150	100	50	25	25
<= 260	<= 94,900	175	100	50	25	25
<= 280	<= 102,200	175	100	50	25	25
<= 300	<= 109,500	175	100	50	50	25
<= 340	<= 124,100	200	100	50	50	25
<= 360	<= 131,400	200	100	75	50	25
<= 380	<= 138,700	200	125	75	50	25
<= 400	<= 146,000	225	125	75	50	25
<= 420	<= 153,300	225	125	75	50	25
<= 440	<= 160,600	225	125	75	50	25
<= 460	<= 167,900	225	125	75	50	25
<= 480	<= 175,200	225	125	75	50	25
<= 500	<= 182,500	250	125	75	50	25

Notes:
a) One delivery includes the outbound launch and inbound recovery and is representative of two operations.
b) If a value for deliveries is not specifically defined in 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.

4.1.1 Nest Flight Paths Are Known to Be on a Single Axis

If the initial launch/climb flight paths and recovery paths are known and are parallel (i.e., on a single axis, with one heading and its 180-degree counterpart), analogous to an airport with a single runway, then the noise extents from nest operations can be represented as a rectangular area.

The length of the rectangle is represented by the distance/noise levels presented in Table 2 added to the nest extent sides that the flight paths cross. The "under flight path" levels and distances from Table 2 would be added to both sides of the nest extents and create the long sides of the rectangle along the flight path. The width of the rectangle is represented by the distance/noise levels presented in Table 3 added to the lateral sides of the nest extents, which represent those sides parallel to the flight path.

Figure 9 presents guidance on constructing a rectangle representing the extent of various noise exposure levels and orient the nest extents relative to the flight paths based on the data presented in Table 2 and Table 3.

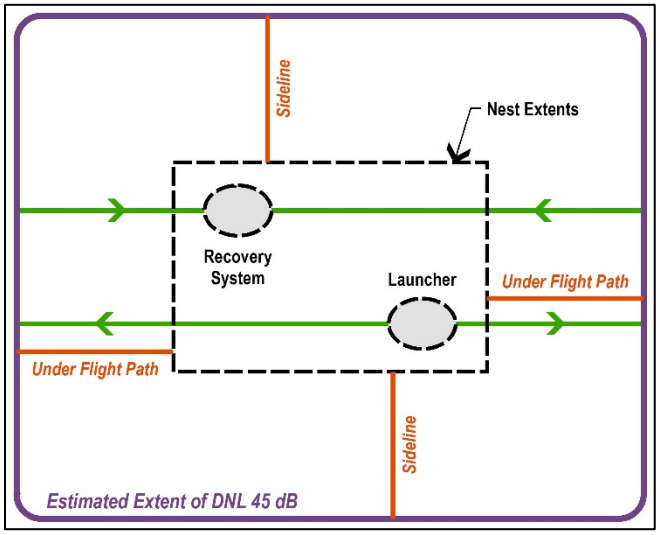

Figure 9. Demonstration of Determining Extent of DNL 45 dB at Nest with Flight Paths at 180 Degrees
Source: HMMH

4.1.2 Nest Flight Paths are Not Known or Varied

For situations in which the flight paths are not known or are expected to be more complicated than presented in Section 4.1.1, a conservative rectangular area can be constructed to represent the anticipated extent of noise exposure. Such situations may be include a) the orientation of the launch and recovery infrastructure are not known, b) launch and recovery will not occur in opposite directions/single axis, or c) flight paths from the nest have not been determined. The polygon is developed by applying the distance "Under Flight Path" provided in Table 2 to all sides of the nest extents. Figure 10 presents guidance on how to apply the "Under Flight Path" provided in Table 2 relative to a rectangular nest extent.

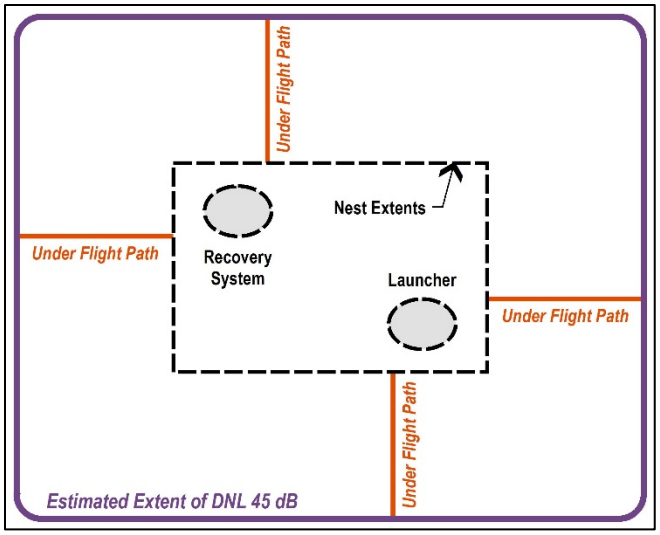

Figure 10. Demonstration of Determining Extent of DNL 45 dB at a Nest for Flight Paths are Not Known or Varied
Source: HMMH

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 nest and the delivery site and inbound flight path back to the nest (See Section 2.1.2 and Figure 3). Therefore, each location under the en route path would be overflown twice for each delivery served by the respective overhead en route path.

In addition, there is expected to be at least one location near a nest in which all flight paths will intersect. For Zipline's operations, all departures and arrivals would always be funneled through the same point prior to continuing to the delivery site or to the recovery. This is where the maximum expected concentration of operations should occur at en route altitudes between 250ft - 400ft AGL. [13]

Table 4 presents 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.

[13] Zipline October 20, 2021

Table 4. Estimated DNL Directly Under En Route Flight Paths at Various Altitudes and Ground Speeds

Number of DNL Equivalent Deliveries Served by Route		Day-Night Average Sound Level (DNL), dB					
		Altitude 130 ft AGL		Altitude 250 ft AGL		Altitude 400 ft AGL	
Average Daily	Annual	40 kts	60 kts	40 kts	60 kts	40 kts	60 kts
<= 1	<= 365	17.7	15.9	14.1	12.4	11.6	9.8
<= 5	<= 1,825	24.7	22.9	21.1	19.4	18.6	16.8
<= 10	<= 3,650	27.7	25.9	24.1	22.4	21.6	19.8
<= 15	<= 5,475	29.4	27.7	25.9	24.1	23.3	21.6
<= 20	<= 7,300	30.7	28.9	27.1	25.4	24.6	22.8
<= 40	<= 14,600	33.7	31.9	30.2	28.4	27.6	25.8
<= 60	<= 21,900	35.5	33.7	31.9	30.2	29.4	27.6
<= 80	<= 29,200	36.7	35.0	33.2	31.4	30.6	28.9
<= 100	<= 36,500	37.7	35.9	34.1	32.4	31.6	29.8
<= 120	<= 43,800	38.5	36.7	34.9	33.2	32.4	30.6
<= 140	<= 51,100	39.1	37.4	35.6	33.8	33.0	31.3
<= 160	<= 58,400	39.7	38.0	36.2	34.4	33.6	31.9
<= 180	<= 65,700	40.2	38.5	36.7	34.9	34.1	32.4
<= 200	<= 73,000	40.7	38.9	37.1	35.4	34.6	32.8
<= 220	<= 80,300	41.1	39.3	37.6	35.8	35.0	33.2
<= 240	<= 87,600	41.5	39.7	37.9	36.2	35.4	33.6
<= 260	<= 94,900	41.8	40.1	38.3	36.5	35.7	34.0
<= 280	<= 102,200	42.2	40.4	38.6	36.8	36.1	34.3
<= 300	<= 109,500	42.5	40.7	38.9	37.1	36.4	34.6
<= 340	<= 124,100	43.0	41.2	39.4	37.7	36.9	35.1
<= 360	<= 131,400	43.2	41.5	39.7	37.9	37.1	35.4
<= 380	<= 138,700	43.5	41.7	39.9	38.2	37.4	35.6
<= 400	<= 146,000	43.7	41.9	40.2	38.4	37.6	35.8
<= 420	<= 153,300	43.9	42.2	40.4	38.6	37.8	36.1
<= 440	<= 160,600	44.1	42.4	40.6	38.8	38.0	36.3
<= 460	<= 167,900	44.3	42.6	40.8	39.0	38.2	36.4
<= 480	<= 175,200	44.5	42.7	40.9	39.2	38.4	36.6
<= 500	<= 182,500	44.7	42.9	41.1	39.4	38.6	36.8

Notes:

a) One delivery includes an outbound operation and inbound operation along the same flight path, thus two overflights.
b) If a value for deliveries is not specifically defined in in this table, use the next highest value. For example, if there are 50 average daily deliveries, use the entry for 60 average daily deliveries.
c) If a value for altitude or speed is not specifically defined in in this table, use the next lowest value. For example, if the UA is anticipated to operate at an altitude of 190 ft AGL at 45 kts, use the entry for 130 ft AGL and 40 kts.

In some instances, the UA may overfly locations not consistent with the en route circumstances and associated results presented in Table 4. This may include maneuvers such as en route static or ad-hoc holding patterns. For these circumstances, Table 5 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 5. Estimated DNL Directly Under Overflights

Altitude and Speed of Overflight		DNL for 1 Overflight Between 7 AM and 10 PM (dB)	DNL equation for the number of DNL Equivalent Overflights
Altitude 60 ft AGL	40 kts	18.9	$10 \times \log_{10}(N_o) + 18.9$
	60 kts	17.1	$10 \times \log_{10}(N_o) + 17.1$
Altitude 130 ft AGL	40 kts	14.7	$10 \times \log_{10}(N_o) + 14.7$
	60 kts	12.9	$10 \times \log_{10}(N_o) + 12.9$
Altitude 250 ft AGL	40 kts	11.1	$10 \times \log_{10}(N_o) + 11.1$
	60 kts	9.4	$10 \times \log_{10}(N_o) + 9.4$
Altitude 400 ft AGL	40 kts	8.6	$10 \times \log_{10}(N_o) + 8.6$
	60 kts	6.8	$10 \times \log_{10}(N_o) + 6.8$

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) If a value for altitude or speed is not specifically defined in in this table, use the next lowest value. For example, if the UA is anticipated to operate at an altitude of 190 ft AGL at 45 kts, use the entry for 130 ft AGL and 40 kts.

4.3 Noise Exposure for Operations under Delivery

Table 6 presents DNL values over a range of potential daily average DNL Equivalent delivery counts at a delivery site. The DNL values present what is anticipated to be the loudest noise exposure level that could be associated with a UA during its delivery attempts during the course of an average 24-hour period. Also included in Table 6 is the equation for calculating the estimated DNL for a specific number of daily average DNL Equivalent delivery counts at a delivery site, defined as N_d, for instances where the number of deliveries may fall between the range of presented delivery count intervals.

It should be noted that the UA may fly in a circular and then an oval pattern near the delivery site as it approaches the drop zone, and may make multiple turns as it leaves the drop zone. Therefore, a multiple of the number of Deliveries/Flybys could be considered if the levels in Table 6 are applied beyond the immediate designed 40 foot by 40-foot drop zone. As discussed in 2.1.2 and presented in Figure 11, such patterns are generally within 1 and 1.5 statute miles of the designator delivery site.[14]

[14] A single delivery drop at 60 feet is anticipated to be of greater SEL and DNL than two pattern passes at 130 feet AGL ground speed and equivalent to six pattern passes at 250 feet AGL. This general comparison assumes delivery and pattern passes are at the same speed.

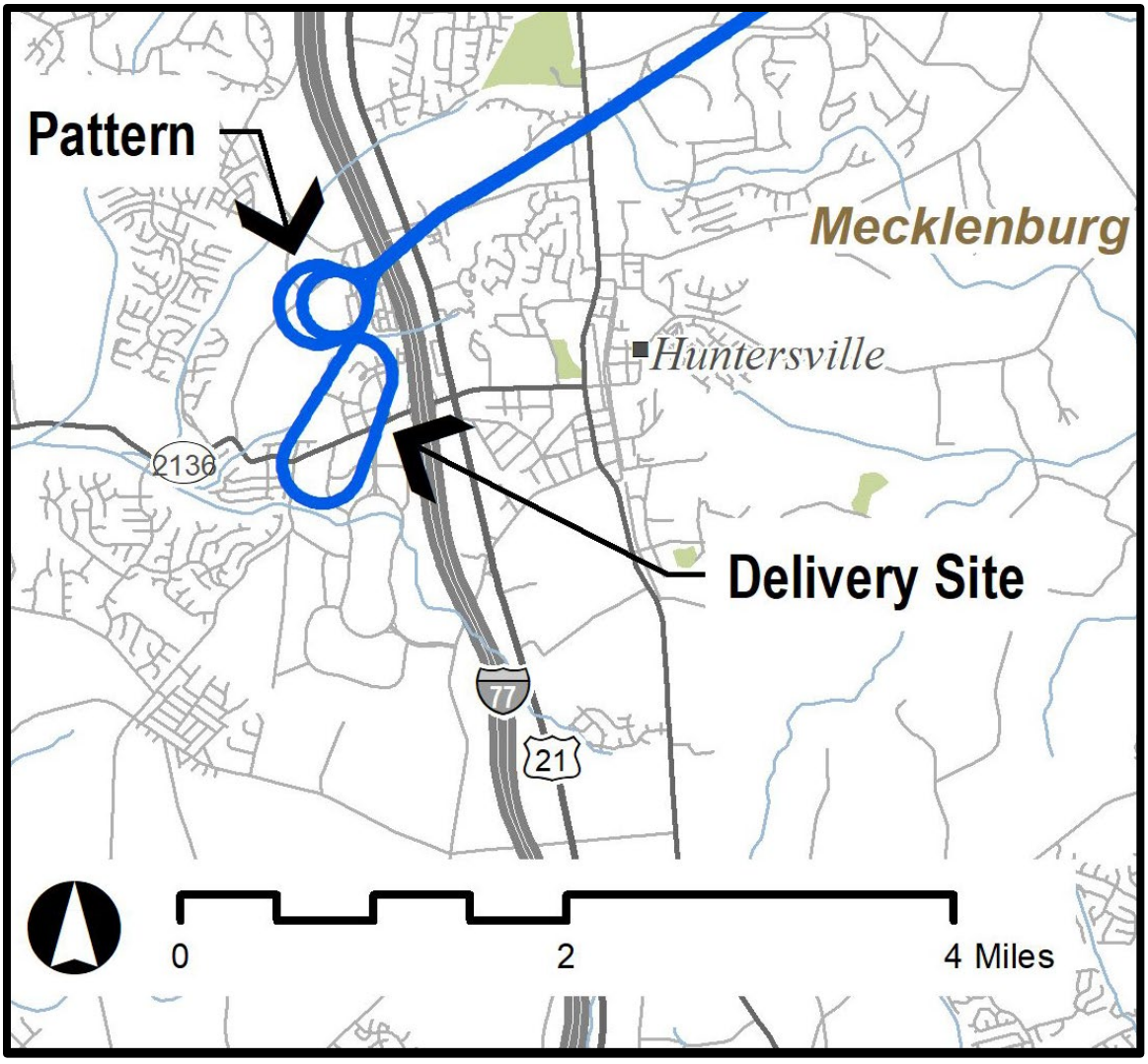

Figure 11. Annotated Example Delivery Flight Path around Delivery Site

Sources: Zipline, October 29, 2021; Annotations by HMMH

Table 6. Estimated Maximum DNL at Delivery Site

Number of DNL Equivalent Deliveries, Delivery Attempts, and Flybys		60 ft AGL 40 knot Ground Speed Estimated DNL (dB)
Average Daily	Annual	
<= 1	<= 365	18.9
<= 5	<= 1,825	25.9
<= 10	<= 3,650	28.9
<= 15	<= 5,475	30.6
<= 20	<= 7,300	31.9
<= 40	<= 14,600	34.9
<= 60	<= 21,900	36.7
<= 80	<= 29,200	37.9
<= 100	<= 36,500	38.9
<= 120	<= 43,800	39.7
<= 140	<= 51,100	40.3
<= 160	<= 58,400	40.9
<= 180	<= 65,700	41.4
<= 200	<= 73,000	41.9
<= 220	<= 80,300	42.3
<= 240	<= 87,600	42.7
<= 260	<= 94,900	43.0
<= 280	<= 102,200	43.3
<= 300	<= 109,500	43.6
<= 340	<= 124,100	44.2
<= 360	<= 131,400	44.4
<= 380	<= 138,700	44.7
<= 400	<= 146,000	44.9
<= 420	<= 153,300	45.1
<= 440	<= 160,600	45.3
<= 460	<= 167,900	45.5
<= 480	<= 175,200	45.7
<= 500	<= 182,500	45.9
N_d	$N_d \times 365$	$10 \times \log_{10}(N_d) + 18.9$

Notes:
a) One delivery includes the outbound launch and inbound recovery.
b) If a value is not specifically in in this table, use the next highest. For example, if there we are 50 daily operations, use the entry for 60 daily operations.

APPENDIX C

Non-Standard Noise Methodology Memos

Federal Aviation Administration

Memorandum

Date: September 27, 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 Zipline International Inc. Commercial Package Delivery Operations with the Sparrow UA in South Jordan/Salt Lake City, UT

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 Zipline International, Inc. (Zipline) operations using the Sparrow unmanned aircraft (UA) in South Jordan/Salt Lake City, UT 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 Zipline's proposed commercial package delivery operations using the Sparrow UA from a single central distribution center (a "nest") located in South Jordan, UT serving an operating area in South Jordan, Salt Lake City, and the surrounding area. Approval of a Federal Action providing Zipline's air carrier Operations Specifications (OpSpecs) is required before these operations can occur.

Zipline is proposing to perform package delivery operations from the nest connecting to a supporting route network within the proposed operating area to transport packages to delivery locations ("delivery sites"); such as medical centers, health facilities, private homes and commercial facilities, in seventeen surrounding communities.

The Sparrow UA is a fixed-wing design with a maximum takeoff weight listed as 49.3 pounds. General operating airspeeds of the UA are expected to be in the range of 45 to 60 knots. The UA is launched via catapult at the nest and then climbs to en route altitude, at which point it navigates along a defined path from the nest to the intended delivery site. The en route portion of the flight would generally be operated at an altitude of 250 feet Above Ground Level (AGL) and is always below an altitude of 400 feet AGL. Approaching the delivery site, the UA flies a pattern near the delivery point, descends to 60 feet AGL, drops a package via parachute at a pre-defined drop zone, climbs back to en route altitude, and then flies along a defined path for recovery at the nest via a cable driven recovery system.

Zipline projects operating a maximum of 20 delivery flight operations per day during daylight hours (8 AM to 6 PM) from the South Jordan nest as detailed in Table 1 under the scope of this proposed action.

Table 1. Maximum Anticipated Daily UA Delivery Operations per Community

Cedar Fort	1.17
Draper	1.17
Erda	1.17
Fairfield	1.17
Lehi	1.17
Orem	1.17
Pleasant Grove	1.17
Provo	1.17
Sandy	1.17
Saratoga Springs	1.17
Springville	1.17
South Jordan	1.17
Stansbury Park	1.17
Stockton	1.17
Tooele	1.17
West Jordan	1.17
West Valley City	1.17

Community	Maximum Daily Deliveries
**Note: Totals may not match due to rounding*	

Noise Analysis Methodology

AFS requests use of the noise analysis methodology described in HMMH Report No. 309990.003-4 for the "Noise Assessment for Zipline Proposed Package Delivery Operations with Sparrow Unmanned Aircraft" dated January 5, 2022.

Federal Aviation Administration

Memorandum

Date: September 30, 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)

Subject: Environmental Assessment (EA) Noise Methodology Approval Request for Zipline International, Inc. Commercial Package Delivery Operations with the Sparrow UA from South Jordan/Salt Lake City, UT

The Office of Environment and Energy, Noise Division (AEE-100), has reviewed the proposed non-standard noise modeling methodology to be used for Zipline International, Inc. (Zipline) operations using the Sparrow unmanned aircraft (UA) in South Jordan/Salt Lake City, Utah (UT). This request is in support of an Environmental Assessment (EA) for Zipline to provide package delivery services as a 14 CFR Part 135 operator in South Jordan/Salt Lake City, UT and communities in a surrounding operating area.

The Proposed Action is to use the Sparrow UA from a single central distribution center, referred to as a "nest", connecting to a supporting route network to deliver packages to potential delivery locations ("delivery sites") such as medical centers, health facilities, and private homes within the proposed operating area to seventeen surrounding communities. Typical operations of the UA will consist of departure from the nest via launch by catapult and a quick climb to an approximate en route altitude between 250-400 feet above ground level (AGL). The UA will then navigate along a defined path from the nest to the intended delivery site. Approaching the delivery site, the UA will fly a pattern near the delivery point, descend to 60 feet AGL, and drop a package via parachute within a pre-defined drop zone. Following delivery, the UA will climb back to en route altitude, fly along a defined path back to the nest, and then be recovered at the nest via a cable driven arrestor system.

Zipline projects operating a maximum of 20 delivery flight operations per day during daytime hours (8 AM to 6 PM) from the South Jordan/Salt Lake City nest under the scope of this proposed action. Zipline anticipates daily delivery operations will be distributed among the seventeen communities as presented in Table 1 of the proposed non-standard noise modeling methodology request, "Environmental Assessment (EA) Noise Methodology Approval Request for Zipline International Inc. Commercial Package Delivery Operations with the Sparrow UA in South Jordan/Salt Lake City, UT" dated September 27, 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. 309990.003-4 for the "Noise Assessment for Zipline Proposed Package Delivery Operations with Sparrow Unmanned Aircraft" dated January 5, 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.