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Subject: Revised SpaceX BCO
Date: Wednesday, November 1, 2023 11:54:50 AM
Attachments: [FAA SpaceX Starship Super Heavy Program REinitiation 1 draft modg4_CC \(508\).docx](#)

Amy,

Attached is our revised version of the BCO for your review and comment. Our plan is to send it to Chuck and our solicitor tomorrow by noon. Also, could you give us another word, more plain English, for off-nominal we can substitute in the sentence about the FireX system.

Mary



United States Department of the Interior



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In Reply Refer To:
02ETCC00-2012-F-0186-R001
2023-008741

November 1, 2023

Ms. Stacy Zee
Office of Commercial Space Transportation
Federal Aviation Administration
800 Independence Ave, SW
Washington, DC 20591

Subject: Reinitiation #1 of Interagency Consultation for the SpaceX Starship/Super Heavy Launch Vehicle Program at the SpaceX Boca Launch Site, Cameron County, Texas

Dear Ms. Zee:

The U.S. Fish and Wildlife Service (Service) received the Federal Aviation Administration's (FAA) request to reinitiate formal section 7 consultation and conference for consultation number 02ETCC00-2012-F-0186-R001. The Service received FAA's request on October 5, 2023, with an Addendum to the October 2021 Biological Assessment (BA Addendum #1; dated October 2023). The Service acknowledged the request to reinitiate by letter on October 19, 2023, and revised October 30, 2023. The BA Addendum #1 evaluates the effects of operating a deluge and detonation suppression system at the SpaceX Vertical Launch Area (VLA). The Addendum also provides updated information about the environmental baseline within the action area after a test launch and subsequent mishap of the Starship/Super Heavy launch vehicle on April 20, 2023. Further, SpaceX has also agreed to implement certain additional conservation measures in connection with its launch program at Boca Chica. Reinitiation of consultation is in accordance with 50 CFR 402.16(a), as the new activities will result in effects not previously considered in the Service's May 2022 Biological and Conference Opinion (BCO) and the listing of a new species, the cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*) as threatened and the proposed as endangered tricolored bat (*Perimyotis subflavus*).

We note that all conservation measures, Reasonable and Prudent measures from the original BCO and its Incidental Take Statements remain valid and applicable to all proposed changes and

considerations of new information discussed herein. For purposes of this reinitiation, we reference our original BCO and the BA Addendum #1 if appropriate. We revisit the Effects of the Action in the contexts of the changes proposed in the BA addendum #1 and any newly considered information. The Action Area defined in the BCO approximates the extent of the sonic boom impacts, extends approximately 14 miles around the VLA and remains applicable to this Addendum.

For this reinitiation, the Service provided FAA an official species list for consideration as an automated letter generated on October 2, 2023, by our Information Planning and Consultation (IPaC) database. The Service supplemented the IPaC letter via personal communications with the FAA and SpaceX. In total, the Service recommended review of 15 listed species, 2 proposed or candidate species, 1 designated critical habitat area, and 3 proposed critical habitat areas. The Service, FAA, and SpaceX discussed the content of draft and final versions of BA Addendum #1 on September 8, September 22, September 29, October 5, October 18, and October 25, 2023. The FAA declined to consider the monarch butterfly (*Danaus plexippus*), the candidate species under consideration for future listing; candidate species are not subject to section 7. However, it is addressed in the May 22, 2022, BCO under Conservation Recommendations. The FAA determined in the BA Addendum #1 that operation of the deluge and detonation suppression system would have no effect on the following listed and proposed to be listed species and/or critical habitat: eastern black rail (*Laterallus jamaicensis* ssp. *jamaicensis*), West Indian manatee (*Trichechus manatus*), green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), Mexican fawnsfoot (*Truncilla cognata*) and proposed critical habitat, salina mucket (*Potamilus metnecktayi*) and proposed critical habitat, South Texas ambrosia (*Ambrosia cheiranthifolia*), Texas ayenia (*Ayenia limitaris*), star cactus (*Astrophytum asterias*), and Walker's manioc (*Manihot walkerae*). Determinations were based on lack of habitat or presence in the immediate area of the deluge and detonation suppression system when in operation. The Service does not provide concurrences for agency determinations of no effect.

The FAA determined that the deluge and detonation suppression system may affect but is not likely to adversely affect the following: northern aplomado falcon (*Falco femoralis septentrionalis*), cactus ferruginous pygmy-owl, and tricolored bat. The FAA and the Service have considered the tricolored bat through a voluntary conference process since the Starship/Super Heavy launch program is not likely to jeopardize the continued existence of the bat. Due to lack of habitat or presence in the immediate vicinity of the deluge and detonation system, the Service considers the effects to be insignificant and discountable and does not anticipate impacts will rise to the level of "take". Therefore, the Service concurs with the FAA's analysis and determinations in the BA Addendum #1 of not likely to adversely affect for these species. Reinitiation of consultation or conference on these three species is concluded informally with this written concurrence of the not likely to adversely affect determinations.

Therefore, this reinitiation analyzes only the species and critical habitats that are likely to be adversely affected by the operation of the deluge and detonation suppression system. The

analysis herein considers whether these additional adverse effects are likely to jeopardize the continued existence of the following species or result in the destruction or adverse modification of the following critical habitat areas: piping plover (*Charadrius melodus*) and designated critical habitat, red knot (*Calidris canutus rufa*) and revised proposed critical habitat, Gulf Coast jaguarundi (*Puma yagouaroundi cacomitli*), and ocelot (*Leopardus* (= *Felis*) *pardalis*). The evaluation of proposed red knot critical habitat is through a formal, but voluntary, conference process.

In addition, the FAA's BA Addendum #1 considered whether the activities addressed by the original BA and BCO may affect the proposed endangered tricolored bat and the threatened cactus ferruginous pygmy-owl. Neither of these species were previously addressed by the BCO. The FAA determined in BA Addendum #1 that the Starship/Super Heavy launch program, as described in the original BA, may affect, but is not likely to adversely affect the owl and is not likely to jeopardize the bat. The Service concurs with this determination and concludes consultation or conference informally with this written concurrence.

The Service previously evaluated the revised proposed boundary of red knot critical habitat in the BCO, despite not publishing the proposed revision until after issuance of the BCO. Therefore, this reinitiation does not consider the effects of the launch program on the proposed revised critical habitat boundary.

Original effects determinations for the launch program and effects determinations for operation of the deluge system are outlined in Table 3 in the Conclusion section of the BA Addendum #1. All other species' determinations and concurrences are found in Appendix A of the May 12, 2022, BCO and remain valid.

In summary, this addendum to the BCO (Reinitiation #1) analyzes:

- Whether the operation of the deluge and detonation system is likely to jeopardize the continued existence of the piping plover, red knot, Gulf Coast jaguarundi, and ocelot; and, if not, whether additional incidental take is reasonably certain to occur; and
- Whether the operation of the deluge and detonation system would likely result in the destruction or adverse modification of designated critical habitat for the piping plover or revised proposed critical habitat for the red knot.

ADDENDUM TO THE BIOLOGICAL AND CONFERENCE OPINION

Background

On April 20, 2023, SpaceX launched Starship Orbital Test Flight 1 under FAA's Commercial Space Transportation License VOL 23-129 from the Boca Chica VLA. The launch resulted in an unexpected mishap/anomaly causing the pad deck under the launch mount to be damaged and scattered concrete debris, dust, and fondag (refractory concrete used for thermal protection) to be expelled into the air and deposited in the vicinity of the launch pad in an approximately 1,000-

acre area. A small (approximately 4 percent) amount of debris was deposited outside of the area previously analyzed in the 2022 PEA in an area of approximately 20 acres (Figure 3 of the BA Addendum #1) but within the debris and heat field radiating 0.6 miles (Figure 2. BA Addendum #1) analyzed and in the BCO. The incident and resulting impacts are described further in the updated Environmental Baseline. As a corrective action SpaceX comprehensively redesigned the pad deck infrastructure, constructed a deluge and detonation system, and reinforced the launch pad with a steel plate to prevent a similar mishap from reoccurring.

A separate system, FireX, will be used in the event of a fire on the launch pad. Depending on the size of the fire it is anticipated to use approximately 20,000 gallons of water. Most of the water would either be vaporized or collected in the retention areas on the VLA. This would be an unexpected, off-nominal event and is not analyzed in the BA or in this Addendum. It has been addressed in an updated Fire Plan. The original plans can be found in the Appendix E of the 2022 BCO. They are living documents and can be updated or modified at any time in coordination with FAA, SpaceX and the Service.

Proposed Deluge and Detonation System Components and Operations

The FAA's BA Addendum #1, Deluge System Components and Operation, incorporated by reference herein consistent with section 7 implementing regulations (50 CFR 402.14(h)(3)(i)), describes the components of the deluge and detonation suppression system. Briefly, these components are:

- A perforated steel plate installed under the launch tower through which a large volume of water will be released to cool the rocket engine exhaust, absorb sound and heat energy, and maintain the physical integrity of the launch pad (the deluge system).
- Spray nozzles mounted on the launch mount ring to prevent detonations of free methane mixing in air and autoigniting during launch operations (the detonation suppression system).
- Water storage tanks with a capacity of 358,000 gallons (combined capacity for deluge) or 3,000 gallons (for detonation suppression) to be filled with potable water trucked in from Brownsville, Texas, or from clean water generated as a by-product of industrial processes at other SpaceX facilities or from rainwater collected and filtered at the VLA.
- Press tank pressurized with nitrogen gas at 3,000 pounds per square inch connected to the water storage tanks to expel the water when the deluge system is activated.
- A piping network and pumping system to distribute water under pressure through the deluge system.
- Control system sensors, actuators, valves, and control units to monitor water levels, pressures, and system status and allow operators to activate or deactivate the deluge system and receive alarms or notifications regarding system performance or anomalies.
- A water containment berms and gutters, a retention basin below the launch pad, and surface retention ponds; the total capacity of the water retention structures is presently

276,000 gallons and SpaceX may construct additional ponds to increase that capacity by up to 30,000 gallons; the water retention elements of the deluge system would also be used to collect and manage stormwater within the VLA; water that does not meet Texas Commission on Environmental Quality (TCEQ) standards (Appendix A of BA) will be removed from the containment structures and hauled to an industrial wastewater treatment facility outside the VLA.

SpaceX has constructed a deluge and detonation suppression system at Launch Mount A and expects to construct a similar system at Launch Mount B in the future. The specific configuration of the systems at each launch mount may differ slightly to accommodate site specific conditions but will be functionally equivalent. SpaceX would only operate one system at a time. Construction activities within the VLA are already addressed in the Proposed Action, Construction, Effects of the Action and various Plans in the 2022 BCO. Therefore, construction of the deluge system components is not addressed in this reinitiation.

As described in BA Addendum #1, SpaceX would operate the deluge system during static fire engine tests and vehicle launches (engine ignition events). Each launch is associated with an estimated two static fire engine tests. During operation, water begins to spray through the perforations in the steel plate under the launch pad 5 seconds before ignition and continues through the duration of the test or until the launch activity is complete or the volume in the water tanks is fully discharged. Consistent with conservative assumptions made in BA Addendum #1, it is assumed that up to 358,000 gallons (the maximum volume of the deluge water tanks) would be applied during each ignition event, released at a rate of 100,000 to 260,000 gallons per minute. In addition, the detonation suppression system would discharge another 3,000 gallons of water immediately before engine ignition. The assumed maximum amount of water discharged during each event is 361,000 gallons.

Water discharged through the system would disperse from the launch pad as a combination of overland sheet flow, push out (i.e., pushed through the air by rocket thrust), or vapor (i.e., a cloud of steam or aerosolized mist or fog). The water in the vapor cloud would either condense as rain or dew or remain evaporated and become part of the overall moisture content of the air. The distribution of condensation vs. evaporation would be highly variable with weather conditions. Table 1 summarizes the expected fate of deluge system water.

Table 1. Discharged deluge system water.

Mode of Discharge	Estimated Maximum Discharge Area	Notes
Overland Sheet Flow	Within 300 feet of the developed edge of the VLA	Most overland sheet flow would be contained within the developed VLA by the water containment structures. Overland sheet flow that evades or overwhelms the containment structures would likely travel no further

		than approximately 300 feet and remain within the undeveloped part of the VLA site.
Push Out	Within 300 feet of the developed edge of the VLA	The volume of push out water would vary with conditions during each ignition event. But, given the thrust forces involved, the push out distance is expected to be generally within 300 feet of the developed VLA.
Vapor Cloud	0.6-mile radius from VLA (co-incident with the extent of the heat plume)	The vapor cloud would disperse as condensation or evaporation within 5 minutes of the ignition event.

SpaceX estimates that approximately 71,000 gallons of water per event (roughly 20 percent) of the total discharge per event) will be dispersed outside of the developed VLA as a combination of overland sheet flow, push out, or condensation from the vapor cloud. The remaining water (approximately 290,000 gallons or roughly 80 percent of the total discharge per event) would either be captured by containment structures on the developed VLA or fully evaporated and dispersed in the air as increased ambient humidity.

Tests of the deluge and detonation suppression system support the impact distances estimated in Table 1. The tests demonstrated that most overland flow or push out water traveled no further than 300 feet of the developed boundary of the VLA. However, SpaceX had not yet constructed the containment berms at the edge of the developed VLA. These berms are expected to prevent most of the overland flow observed during the tests. Some overland flow also exited the developed VLA via a stormwater drain that directed some water into an adjacent waterbody. SpaceX has also subsequently modified this stormwater drain to prevent this type of release. Visual monitoring of the vapor cloud created during the tests showed the cloud extended approximately 0.2 mile from the launch pad, demonstrating that the estimated vapor cloud extent is likely conservative.

The stainless steel components of the launch pad and mount, including the perforated stainless steel plate of the deluge system, are a combination of approximately 74 percent iron, 18 percent chromium, and 8 percent nickel (FAA 2023). These metals will be mechanically eroded by intense heat and pressure of rocket engines firing; an effect called ablation. SpaceX estimates that each Starship/Super Heavy vehicle launch would ablate (erode) up to 190 pounds of stainless steel, equating to 140.6 pounds of iron, 34.2 pounds of chromium, and 15.2 pounds of nickel. SpaceX expects that most of the ablated metals would be dispersed no further than the developed VLA (i.e., captured in the overland sheet flow and retained on site). However, some of those metals, including an oxidized form of chromium known as hexavalent chromium, may disperse beyond the developed VLA in the push out water or vapor cloud. Hexavalent chromium is a toxic material regulated by the Environmental Protection Agency with drinking water standards of 100 parts per billion and also by the Occupational Safety and Health Administration with an action level of 5.0 micrograms/cubic meter of air (EPA 2023).

The BCO evaluated the effects of up to 20 static fire engine tests and up to 10 launches per year. Under this scenario, the deluge system may be operated up to 30 times per year. The impact area for the consequences of deluge and detonation system operation is assumed to be a maximum of 0.6-mile from the VLA. This distance is the furthest extent that the vapor cloud and subsequent condensation is expected to travel and is the same impact area as the heat plume evaluated in the BCO.

Proposed Additional Conservation Measures

During informal coordination following FAA's reinitiation request, SpaceX committed to implementing the following additional conservation measures as part of the Starship/Super Heavy launch program related to operation of the deluge and detonation suppression system:

1. SpaceX will use drone imagery to monitor the visible extent of water in overland sheet flow discharges and vapor plume from the developed VLA during deluge and detonation system operation. SpaceX will summarize and report findings in each post-launch monitoring report and in the annual vegetation monitoring report.
2. SpaceX will schedule deliveries of water for the deluge and detonation suppression system to the VLA during daytime hours to the extent practicable.
3. SpaceX will test water generated by its production and manufacturing facilities in Boca Chica to assure it is of comparable quality to potable water trucked in from Brownsville before adding it to the water tanks at the VLA.
4. SpaceX will sample the soil, water and air adjacent to the launch pad for components of stainless steel including but not limited to total chromium, iron, and nickel.

Updated Environmental Baseline

Conditions in the Action Area

SpaceX implements a monitoring program for certain avian species and vegetation conditions near the VLA following protocols reviewed and approved by the Service. The most recent annual avian monitoring report provided to the Service addresses findings from avian monitoring conducted between July 2022 and June 2023. The most recent vegetation monitoring report is dated June 2023 and addresses intensive vegetation monitoring performed in October 2022. The report also addresses the most recent extensive (remote sensing) vegetation monitoring using imagery from March 2022.

The various study areas for the monitoring program overlap partially or fully with the 0.6-mile impact area for the consequences of deluge and detonation system operation. Monthly avian monitoring occurs along 4 established survey routes that sample areas within 3 miles of the VLA. Pre- and post-launch avian monitoring occurs along the portions of these survey routes that occur within 1 mile of the VLA. The intensive vegetation monitoring occurs within approximately 0.25 mile of the VLA, and the extensive vegetation monitoring assesses a study area of 3 miles around the VLA.

Monthly avian monitoring between July 2022 and June 2023 detected a total of 1,016 piping plover observations and 273 red knot observations under survey protocols (i.e., excluding incidental observations). Data analysis did not detect significant evidence for trends, increasing or decreasing, in the abundance of piping plovers or red knots. These observations are consistent with prior annual monitoring reports prepared by University of Texas Rio Grande Valley that did not find evidence of trends in the number of observations of these species over time. SpaceX performed the first test launch of the Starship/Super Heavy launch vehicle on April 20, 2023. Pre- and post-launch avian monitoring around this event reported 67 pre-launch and 22 post-launch piping plover observations and 0 pre-launch and 74 post-launch red knot observations. April is a month in which piping plover occurrence at Boca Chica is typically decreasing, as birds leave these wintering grounds and migrate north for the breeding season. Red knot occurrence in Boca Chica is typically spotty and highly variable across months.

Routine vegetation monitoring reported in the 2022 annual report found that between 2021 and 2022, total vegetation cover within different habitat types was highly variable. In 2022, vegetation plots were surveyed within the 8.66 acres of piping plover habitat that were originally anticipated to be impacted by water vapor ground clouds and an additional 23.51 acres that may be subject to change, and the Service did not issue take for and was only to be monitored. Sampling areas encompassed low-lying, unvegetated or barren mudflats, a transition zone comprised of halophytic vegetation and short hind dunes, and creep plots. “Creep” plots are placed at the edge of a vegetation zone transition between mudflats and halophytic salt flats to track encroachment or “creep” of plants into mudflats (Hicks and Gabler 2023). Some of the plot markers had been lost due to beach cleanup, in 2018, heavy machinery used in the area to clean up rocket debris in 2021 after the SN10 prototype exploded, and some were overtaken by a southward expansion of the launch pad in 2020-2021. A total of 121 plots were surveyed in 2022, 41(33.1 percent) in the take zone, and 80(66.9 percent) in the monitoring zone. Overall, 58 plots (47.9 percent) were categorized as bare/mudflat, 14(11.5 percent) as dune, 42(34.7 percent) as transition, and 7(5.8 percent) as creep. Vegetation cover decreased in mudflats (57 percent) and transition plots (20 percent) there was little change in dune plots (26.2-26.4 percent) and vegetation cover increased in creep plots (20 percent). This represents the lowest plant cover observed in mudflats and transition plots since 2018, but also represents additional evidence of a gradual (with variability) 5-year increase in plant cover in creep plots which could be significant over time. It is a reversal of the temporary decrease seen in 2021 and reinforces a larger multi-year trend towards increasing plant cover at the mudflat margins. The vegetation monitoring plan concluded much of the variation observed over the past 7 years has been within the range of natural variability, but some may be statistically attributable to land use change at the Boca Chica launch pad. Some of the largest changes observed to date have been in the most recent sampling period and during the most active time period to date by far for launch pad construction and operations. The evidence suggests:

1. Proximity to the launch site has influenced total plant cover and overall cover of some dominant plant species; however, investigators could not say with absolute certainty

whether these changes were due to SpaceX activities, other drivers, or unquantified variation in environmental conditions.

2. Some changes are clearly the result of increased activity in the area, such as 20-fold increase in vehicle tracks in 2021, but groups other than SpaceX, primarily Border Patrol and the public also use vehicles and ATVs in the area.
3. Plant community composition differed significantly between the monitoring and take proximity zones. The effects on the monitoring zone was much more visible in the dune and transition habitats, and plant communities in the vegetated areas in the vicinity of the launch pad have changed in significant ways since 2016.
4. Further monitoring is merited to identify whether observed impacts are temporary or will persist and whether these impacts are better explained by natural confounding factors or are genuine impacts of the launch pad construction and/or operation. It would also provide information critical to the success of potential future mitigation efforts. (Hicks and Gabler 2023, Appendix D)

There has not been an increase in vegetation in the mudflats, but there has been an increase in the creep plots that has to be further monitored to determine whether these changes indicate a decrease in habitat for the piping plovers or red knots. Prescribed vegetation monitoring following the April 20, 2023, conducted by the consulting firm Raba Kistner within the 0.6-mile radius area surrounding the VLA test launch detected only minimal damage to vegetation attributed to sand and debris deposits. Larger vegetation damage occurred approximately 260 feet southwest and southeast of the LVA. Damage to the northern and western portions consisted of sand deposits and launch pad debris with no other changes identified. The southeastern portion of the study area contained minor sand deposits and debris, with no loss of vegetation identified (Raba Kistner 2023).

The April 20, 2023, test launch distributed debris from damage to the launch pad (mostly composed of concrete and dust) across approximately 1,000 acres. Concrete debris was detected outside of the debris impact area evaluated in the BCO, affecting approximately 20 additional acres. This additional debris impact area was south of the VLA and inside of the 0.6-mile heat plume impact area. In response, SpaceX modified the launch pad deck infrastructure, including the addition of the deluge system, to avoid recurrence of this unexpected damage. SpaceX began retrieving the concrete debris following close of the 2023 avian breeding season, with clean-up activities contingent on weather and tidal conditions.

The April 20, 2023, test launch also burned approximately 3.5 acres of upland vegetation (Hicks and Contreras 2022) within piping plover critical habitat and red knot proposed critical habitat. However, upland vegetation is not a key component of habitat for piping plovers or red knots. On wintering grounds, these species use areas with no or sparse vegetation.

Analysis of water samples from the two tests of the deluge and detonation suppression system detected trace amounts of arsenic, barium, fluoride, and nitrate in amounts comparable to the quantities found in the potable water used to fill the tanks. Elevated amounts of chromium, zinc,

aluminum, iron, and total suspended solids were also detected, with levels after the first test much higher than after the second test. The results suggest that the elevated metals and total suspended solids in that case are the result of residual filings or other manufacturing-related debris and/or rust inside tanks and pipes.

Piping Plover and Designated Critical Habitat

The listing status of the piping plover and the piping plover critical habitat designation remain unchanged from the date of the BCO. The Service has not performed a new status review (i.e., Species Status Assessment, 5-year Status Review, or updated Recovery Plan) of the piping plover since the date of the BCO. As described above, avian monitoring conducted by SpaceX following protocols approved by the Service demonstrate that piping plovers continue to use the action area and continue to be detected along all four survey routes, including the portions of these routes nearest to the VLA. Piping plovers were detected during pre- and post-launch monitoring. While the number of piping plover detections post-launch was less than during pre-launch monitoring, the species begins peak spring migration in mid-April and is generally scarce on Texas wintering grounds by mid-May. The avian monitoring data are consistent with this seasonal pattern.

Vegetation monitoring near the VLA has not detected any significant increase in vegetation within piping plover habitat that would indicate habitat loss.

Red Knot and Revised Proposed Critical Habitat

The listing status of the red knot remains unchanged from the date of the BCO. The Service has not performed a new status review of the red knot since the date of the BCO. While the Service revised its proposed designation of red knot critical habitat in April 2023, the BCO already evaluated effects to proposed red knot critical habitat using the revised boundary.

Avian monitoring by SpaceX following protocols approved by the Service demonstrate that red knots continue to occasionally use the areas within 3 miles and 1 mile of the VLA. Red knots were detected during post-launch monitoring following the April 20, 2023, test launch.

Vegetation monitoring near the VLA has not detected any significant increase in vegetation within proposed red knot critical habitat that would indicate habitat loss.

Gulf Coast Jaguarundi

The listing status of the Gulf Coast jaguarundi remains unchanged and the Service has not performed a new status review of the subspecies since the date of the BCO. The Service is unaware of any reports of the Gulf Coast jaguarundi in the action area since the date of the BCO.

Ocelot

The listing status of the ocelot remains unchanged, and the Service has not performed a new status review of the species since the date of the BCO. Our 2018 5-year Status Review estimates the current Texas population of ocelots as numbering approximately 80 individuals in two separate populations (Service 2018). One population resides primarily on two ranches, the Yturria Ranch and El Sauz Ranch, in Kenedy, Kleberg, and Willacy counties; the other

population primarily resides on the Laguna Atascosa National Wildlife Refuge in Cameron County. The refuge population may occasionally use the northern edge of the action area (Service 2018). A petition was made to list the ocelot as a distinct population of the Texas population of ocelots but found not warranted in February 2021 (87 FR 7082; February 8, 2022). Currently there are ongoing efforts to reintroduce the ocelot into historically documented habitat (Pers. com., L. DelaGarza, Service Ocelot Coordinator), however the Service is unaware of any new reports of ocelots in the action area since the date of the BCO.

Effects of the Action

Physical Consequences of Operating the Deluge and Detonation Suppression System

The BA Addendum #1 describes the likely physical consequences of operating the deluge and detonation suppression system. These likely physical consequences include:

1. Discharging approximately 71,000 gallons of potable, chlorinated water as a combination of overland sheet flow, push out, and vapor cloud condensation outside of the developed VLA with each engine ignition event.
2. Increasing the duration and magnitude of visual disturbances by spraying a large volume of water from the launch pad up to 5 seconds prior to engine ignition.
3. Discharging up to 190 pounds of metals from the mechanical erosion of steel components of the launch pad infrastructure.
4. Cooling and reducing the extent of the heat plume.
5. Absorbing and reducing the amount and extent of noise and vibrations.
6. Reducing the likelihood of damage to launch pad infrastructure and related debris scatter beyond the VLA.
7. Reducing ignition risk and minimizing the extent of fires in adjacent vegetation; and
8. Increasing truck traffic on State Highway 4 by up to 73 trips per engine ignition event to fill or refill the water tanks.

SpaceX may operate the deluge and detonation suppression system up to 30 times per year. Therefore, a year's worth of operations would:

- Discharge up to 2,130,000 gallons of fresh, clean water outside the developed VLA to a maximum distance of 0.6-mile.
- Discharge up to 5,700 pounds of metals from mechanical erosion of the steel components of the launch pad infrastructure to a maximum distance of 0.6-mile; and
- Increase truck traffic on State Highway 4 within the action area by 2,190 trips (an increase of less than 1 percent of the estimated daily traffic load of trucks otherwise supporting the Starship/Super Heavy launch program).

As described in the BA Addendum #1, each of these estimated quantities and extents are highly conservative and likely overestimate the actual quantity and extent of the impact.

The BA Addendum #1 also describes possible, but relatively unlikely or speculative, physical consequences of operation, including:

- Vegetation growth promoted by increased freshwater deposition that increases the density and/or extent of vegetation into the naturally unvegetated or sparsely vegetated mudflats; and
- Metal contamination of soil, air, and/or water that causes long-term negative effects to ecological communities.

Vegetation growth promoted by increased freshwater is unlikely or speculative at this time because the amount of freshwater likely deposited outside the developed VLA is equivalent to a light rain. If 71,000 gallons were to be distributed evenly across the 0.6-mile maximum impact radius, the applied depth would be approximately 0.003 inch of water. If applied evenly across a more likely 0.3-mile impact radius, the depth would be 0.014 inch of water. If applied evenly across a 300-foot impact radius (much of which would be within the undeveloped VLA boundary), the depth would be 0.4 inch of water. The mean monthly rainfall totals for the City of Brownsville between 2000 and 2022 range from 6.02 inches to 0.92 inches; are at least twice and mostly many times greater than the amount of water likely to be deposited across the impact areas—at any of the contemplated impact distances.

Metal contamination from the mechanical erosion of steel distributed outside of the developed VLA is poorly studied and the best available comparable information suggests negative effects on ecological communities near the VLA is unlikely (FAA 2023). The amount of metals likely to be eroded from the launch pad infrastructure is very small compared to the amount of metals released and dispersed by the exhaust of the National Aeronautics and Space Administration's Space Shuttle vehicle (FAA 2023). The Starship/Super Heavy program would erode approximately 190 pounds of metals, while the Space Shuttle exhaust plume generates and distributes approximately 61,835 pounds of aluminum-based metals (FAA 2023). Although the metals may be different, Space Shuttle program monitoring has detected no adverse ecological changes in nearby or far-afield areas from its metals (FAA 2023).

Piping Plovers and Red Knots

The increased duration and magnitude of visual disturbances associated with spraying water from the launch pad for several seconds prior to engine ignition is likely to cause piping plovers and red knots in the immediate vicinity to flush and move away from the VLA. This flushing response is likely to adversely affect the behavior of individual birds as they are startled and compelled to cease their prior activity (foraging, resting, grooming, evading potential predators) and move away from the disturbance.

Ultimately, however, this flushing response may benefit these individuals if they move further away from the most intense parts of the heat plume and vapor cloud, which could cause death or physical injury. The applied water is also likely to reduce the intensity and extent of the heat plume and associated noise and vibrations from the engine ignition. To date, data from the avian

monitoring program performed by SpaceX, with methods approved by the Service, has not detected any significant changes in how either species uses habitat in the vicinity of the VLA. The addition of the deluge and detonation suppression system to the suite of launch-related activities is not expected to modify piping plover or red knot habitat beyond the levels previously evaluated in the BCO. The amount of freshwater dispersed outside of the VLA is small compared to the amount of natural rainfall in the area and is unlikely to cause a significant increase in vegetation that would encroach into (and cause a loss of) the mudflat or beach habitat used by these species.

The dispersal or accumulation of metals eroded from steel components of the launch pad infrastructure are presently speculative. There is no evidence at present that metals are being deposited outside of the developed VLA. SpaceX has agreed to monitor the presence of metals in air, water, and soil within the 0.6-mile vapor plume and overland overflow water impact areas and will report the findings to the Service.

Piping Plover and Red Knot Designated or Proposed Critical Habitats

Water leaving the developed VLA during operation of the deluge and detonation suppression system may cause a change in vegetation by promoting the growth of plants that would otherwise be inhibited by the saline conditions of the tidal, wind, sand, and mudflats that comprise piping plover and red knot habitat at Boca Chica. Vegetation growth could invade these flats and alter important habitat types that are otherwise devoid of vegetation. This could cause a potentially adverse effect to designated or proposed critical habitats for these species. However, evidence of increased vegetation cover in the unvegetated flats has not been detected by vegetation monitoring. This monitoring is ongoing, and findings will continue to be reported to the Service by SpaceX. Further, the spatial extent of vegetations changes, if any, would most likely be limited to the area closest to the developed VLA (i.e., generally within 300 feet). Much of this area is within the part of the VLA identified for future expansion and has already been evaluated as eventual habitat loss.

The mechanical erosion of steel during engine ignition events and subsequent opportunity for metals to disperse with the water applied during operation of the deluge and detonation suppression system could also adversely affect designated and proposed critical habitats for the piping plover and red knot. Chromium, nickel, and iron could accumulate over time because they do not really degrade after each launch and metal concentrations in the deposition area could increase over time due to repeated launchings. This could cause disruptions to the food chain that supports migrating and wintering piping plovers and red knots. The likelihood and extent to which eroded metals escape the developed VLA, accumulate in critical habitat areas, and alter food chains are presently unknown. However, if these metals are primarily carried by water, then most effects would likely occur nearest to the VLA (i.e., generally within 300 feet) and within an area already evaluated as habitat loss. SpaceX has agreed to monitor the presence of metals in air, water, and soil within the 0.6-mile vapor plume impact area and will report the findings to the Service. If metals are detected benthic organism testing should be begin. The contaminants plan will be updated to include this type of testing.

Gulf Coast Jaguarundis and Ocelots

Gulf Coast jaguarundis and ocelots are not expected to occur within the 0.6-mile vapor plume impact area due to a lack of suitable habitat. However, suitable habitat with a moderate probability of use by ocelots occurs towards the western edge of the action area between the Rio Grande and State Highway 4. Increased truck traffic on State Highway 4 could increase the risk of vehicle strikes with these cats and the activity could functionally increase this existing barrier to dispersal. While these adverse effects are to some extent likely, the lack of recent detections of either species within the action area, particularly along State Highway 4, limiting truck deliveries to daylight hours to the maximum extent possible, and implementation of an employee transportation shuttle would reduce the potential that additional vehicle mortality or habitat avoidance is reasonably certain to occur.

Opinion Regarding Jeopardy or Destruction or Adverse Modification of Critical Habitat

The effects of operating the deluge and detonation suppression system are likely to have some adverse effects on:

- piping plovers and red knots by creating new visual disturbances that will likely flush individual birds that may be nearest to the VLA immediately prior to an engine ignition event; and
- Gulf Coast jaguarundis and ocelots by creating additional truck traffic along State Highway 4 that may increase the risk of vehicle mortality and inhibit use of potentially suitable habitat along the highway.

However, the expected adverse behavioral responses (i.e., flushing and avoidance) are also likely to have other beneficial effects that, on the whole, would not create an appreciable reduction of the likelihood of survival and recovery in wild for any of these species. No individuals of these species have been detected dead or injured as a likely consequence of SpaceX's Starship/Super Heavy launch program. The addition of the deluge and detonation suppression system is likely to further reduce the risk for wintering piping plover or red knot death, physical injury, or use of habitat for feeding or sheltering as it will not directly destroy or degrade habitat. Neither species breeds along the Texas coast. The additional water truck traffic is minor compared to existing traffic loads and does not create a new or substantially greater barrier to movement, such that neither the Gulf Coast jaguarundi nor ocelot is likely to face an appreciably reduced likelihood for survival and recovery in the wild.

The reduced intensity and extent of the heat plume, noise, and vibrations, without habitat loss from vegetation growth spurred by freshwater discharges into the saline mudflats being documented in vegetation surveys or metal contamination from the erosion of stainless steel not yet analyzed, it is not anticipated destruction or adverse modification of designated or proposed critical habitat for the piping plover or red knot will occur. These designated and proposed units of critical habitat are expected to continue to provide the conditions necessary to support the conservation of these species.

Conservation Recommendations

The Service recommends the following additional discretionary conservation recommendations in connection with the SpaceX/Super Heavy launch program:

1. SpaceX should coordinate with the Services' National Wildlife Refuge staff to help identify and implement opportunities to conserve loma habitat on and off the project site and preserve trees along the Rio Grande corridor.
2. SpaceX should partner with the Service on the implementation of camera monitoring to detect ocelot and their movements, in the action area.
3. SpaceX should consider partnering with the Service to conserve important habitats for the listed species adversely affected by the SpaceX/Super Heavy launch program.

Conservation recommendations are advisory and are not intended to carry any binding legal force.

AMENDED INCIDENTAL TAKE STATEMENT

Amount or Extent of Take

The likely adverse effects of operating the deluge and detonation suppression system are not expected, with reasonably certainty, to cause additional incidental take of the piping plover, red knot, Gulf Coast jaguarundi, or ocelot. The adverse effects of the action are moderated by coincident beneficial effects or are not reasonably certain to occur considering the information presently available. Therefore, no additional incidental take is authorized with this reinitiation, and the take limits previously established in the BCO and associated Incidental Take Statement remain applicable to the expanded set of proposed activities.

Reasonable and Prudent Measures

1. The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize incidental take of the previously authorized incidental take of the piping plover, red knot, Gulf Coast jaguarundi, and ocelot. These reasonable and prudent measures apply only to those activities discussed within the above Addendum to the BCO. All reasonable and prudent measures associated with the May 12, 2022, BCO, and the respective Incidental Take Statement remain valid. SpaceX will design and implement a contaminants monitoring plan with a focus on constituents of the steel used in launch pad infrastructure and trace constituents of the potable water applied (e.g., chlorine/chloride).
2. SpaceX and FAA will coordinate with the Service to review and update all plans in the May 12, 2022, BCO as needed.

3. FAA will make implementation of the voluntary conservation measures listed on page 7 and reasonable and prudent measures listed above a condition of its license for the Starship/Super Heavy launch program.

Terms and Conditions

To be exempt from the prohibitions of section 9 of the ESA, the FAA and SpaceX must comply with the following terms and conditions that implement the reasonable and prudent measures described above and outlined in reporting/monitoring requirements. These terms and conditions are non-discretionary. The following terms and conditions implement reasonable and prudent measure 1:

1. SpaceX will coordinate with FAA and the Service in the design of monitoring and testing protocols and adaptive management strategies based on findings.
2. SpaceX will seek Service input and concurrence with the final contaminants monitoring plan within 3 months of the date of this letter.
3. SpaceX will include control sites, establish baseline conditions, and monitor for deposition and/or accumulation of potential contaminants.
4. SpaceX will test for changes in air, soil, water, and benthic environment within the 0.6-mile water overland sheet flow and vapor plume impact areas.
5. SpaceX must also collect soil samples from within the 0.6-mile water overland sheet flow and vapor plume impact areas for preliminary baseline monitoring prior to the next test launch.
6. SpaceX will identify 3 transects extending radially from the VLA to a distance of 0.6-mile and collect 5 soil samples, equally spaced, from each of the transects. Samples will be collected and stored in a manner appropriate for analysis.
7. Analysis of these soil samples may be deferred until the final contaminants monitoring plan is ready for implementation.

The following terms and conditions implement reasonable and prudent measure 2.

1. SpaceX will coordinate with the Service to update BCO plans as necessary and review effectiveness of each plan as needed or at least annually.
2. SpaceX will coordinate with the Service to modify the Avian and Vegetation Monitoring Plans to improve the quality of data being collected to track potential incidental take.

The following terms and conditions implement reasonable and prudent measure 3:

1. SpaceX shall comply with the reasonable and prudent measures described above and the required reporting and monitoring requirements below to ensure the amount of authorized incidental take is not exceeded and to further minimize the take.
2. Any failure by SpaceX to comply with these terms and conditions stated herein may result in loss of Section 9 take coverage, if not remedied within a reasonable period of time to the satisfaction of the Service. Any efforts to identify and coordinate any remediation efforts with the Service shall occur as soon as possible but shall not exceed a period of 48 hours.

Monitoring and Reporting Requirements

Upon locating a dead, injured, or sick listed species on refuge lands contact Refuge Law Enforcement, Iriz Elizondo-Navarro at (956) 784-7520 located at 3325 Green Jay Road Alamo, Texas 78516. If the species is found off refuge, contact Special Agent Alejandro Rodriguez at (956) 686-8591, 4500 N. 10th Street #400, McAllen, TX 78504, within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy sent to U.S. Fish and Wildlife Service, Texas Coastal Ecological Services Field Office, ATTN: Assistant Field Supervisor, 4444 Corona Drive, Suite 215, Corpus Christi, Texas 78411. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve the biological material in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured endangered specimens or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed. SpaceX shall inform the Service immediately upon knowing any conservation measures, reasonable and prudent measures and terms and conditions within the Addendum, and the May 12, 2022, BCO that are not implemented to the fullest extent at any time during project implementation and/or any actions taken to remedy any failure to fully implement all conservation measures and Reasonable and Prudent measures associated all facets of the formal section 7 consultation.

REINITIATION NOTICE

This concludes the reinitiation of formal consultation and conference for the FAA-licensed SpaceX Starship/Super Heavy launch program in Boca Chica, Cameron County, Texas (consultation number 02ETCC00-2012-F-0186-R00) addressing the operation of a deluge and detonation suppression system during engine ignition events. As provided in 50 CFR 402.16, reinitiation of consultation is required and shall be requested by the federal action agency where

discretionary federal involvement or control over the action is retained or is authorized by law and: (1) if the amount or extent of incidental taking specified in the incidental take statement is exceeded; (2) if new information reveals effects of the action that may affect listed species or designated critical habitat in a manner or an extent not previously considered; (3) if the identified action is subsequently modified in a manner that causes an effect to the listed species or designated critical habitat not considered in the biological opinion or written concurrence; or (4) if a new species is listed or designated critical habitat that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation. The May 12, 2022, BCO is currently effective. This addendum to the May 12, 2022, BCO becomes effective on issuance FAA license and pursuant to any necessary TCEQ or U.S. Army Corps of Engineers permit being issued.

The Service appreciates your consideration of threatened and endangered species and South Texas's wildlife resources. If you have any questions regarding this addendum to the 2022 BCO, please contact Mary Orms of my staff at 281-271-2162 or by electronic mail at Mary_Orms@fws.gov.

Sincerely,

Charles Ardizzone
Field Supervisor

Literature Cited

- Environmental Protection Agency (EPA). 2023. Chromium in Drinking Water. <https://www.epa.gov/sdwa/chromium-drinking-water>. Accessed 1 November 2023.
- Federal Aviation Administration (FAA). 2023. Addendum to the October 2021 Biological Assessment for the SpaceX Starship-Super Heavy Launch Vehicle Program at the SpaceX Boca Chica Launch Site in Cameron County, Texas addressing Operation of the Deluge.
- Hicks, D.W. and L.M. Contreras. 2022. Biological Assessment Starship Super Heavy Orbital Launch Wildfire. May 26, 2023.
- Hicks, D.W. and C.A. Gabler. 2023. Commercial launch site construction-phase vegetation monitoring survey prepared for Space Exploration Technologies (SpaceX). June 2023.
- Raba Kistner. 2023. SpaceX Boca Chica Launch Site-Pre and Post Launch Vegetation Monitoring Boca Chica, Cameron County, Texas. May 5, 2023.
- U.S. Fish and Wildlife Service (Service). 2018. 5-Year Review: Summary and Evaluation. Ocelot. U.S. Fish and Wildlife Service, Hilary Swarts, Laguna Atascosa National Wildlife Refuge, Los Fresnos, TX.