Appendix E: Biological Opinion for the Rhyolite Ridge Lithium-Boron Mine Project

United States Department of the Interior

Pacific Southwest Region
FISH AND WILDLIFE SERVICE
Reno Fish and Wildlife Office
1340 Financial Boulevard, Suite 234
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In Reply Refer to:
2024-0062693-S7-001

September 4, 2024
Sent Electronically

Memorandum

To: Field Manager, Tonopah Field Office, Bureau of Land Management

From: Field Supervisor, Reno Fish and Wildlife Office, U.S. Fish & Wildlife Service

KRISTEN JULE Digitally signed by KRISTEN JULE
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Subject: Biological Opinion for the Rhyolite Ridge Lithium-Boron Mine Project

This biological opinion is in response to the Bureau of Land Management's (BLM) request, received via electronic mail on April 1, 2024, for initiation of formal consultation with the U.S. Fish and Wildlife Service (Service) pursuant to section 7 of the Endangered Species Act of 1973 (Act), as amended (16 U.S.C. 1531 *et seq.*). At issue is BLM's proposed approval of the plan of operations for the Rhyolite Ridge Lithium-Boron Mine Project (project) in Esmeralda County, Nevada. The BLM determined that the proposed project may affect, and is likely to adversely affect, the federally endangered *Eriogonum tiehmii* (Tiehm's buckwheat) and its designated critical habitat. BLM's proposed approval is conducted pursuant to the Federal Land Policy and Management Act of 1976, the Surface Management Regulations in 43 Code of Federal Regulations (CFR) 3809, as amended, and surface occupancy requirements under 43 CFR 3715.

This biological opinion is based on information provided in the Rhyolite Ridge Lithium-Boron Project Biological Assessment (Stantec Consulting Services, Inc. (Stantec) 2024) and correspondence, notes, and information compiled during our consultation with the BLM on the subject project. The information and other references cited in this biological opinion constitute the best scientific and commercial data available on the status and biology of the species and critical habitat considered.

CONSULTATION HISTORY

Ioneer Rhyolite Ridge LLC (Ioneer; project proponent) submitted a Plan of Operations (Plan) for the proposed project to the BLM in May 2020. In the following years, Ioneer made multiple revisions to the Plan, and BLM most recently accepted the Plan in August 2022. A revised summary of the preferred alternative was submitted to BLM by Ioneer in 2023. Ioneer's changes to the Plan between 2020 and 2023 have resulted in decreased impacts to *Eriogonum tiehmii* and its designated critical habitat (Figure 1).

Ioneer has been engaged with the BLM and the Service regarding the protection of *Eriogonum tiehmii* and measures to ensure the long-term viability of the species since the Plan was first proposed in 2020. As a result of these discussions, Ioneer moved project features and scaled back the extent of proposed impacts to *E. tiehmii* to approximately 191 acres under the proposed project (Stantec 2024). In addition, Ioneer incorporated measures to conserve *E. tiehmii* into the design of the current Plan, as described in the Buckwheat Protection Plan (WestLand 2024a). The Buckwheat Protection Plan is considered part of the proposed project. In addition, all activities have been designed to avoid any surface disturbance within occupied habitat for *E. tiehmii.*

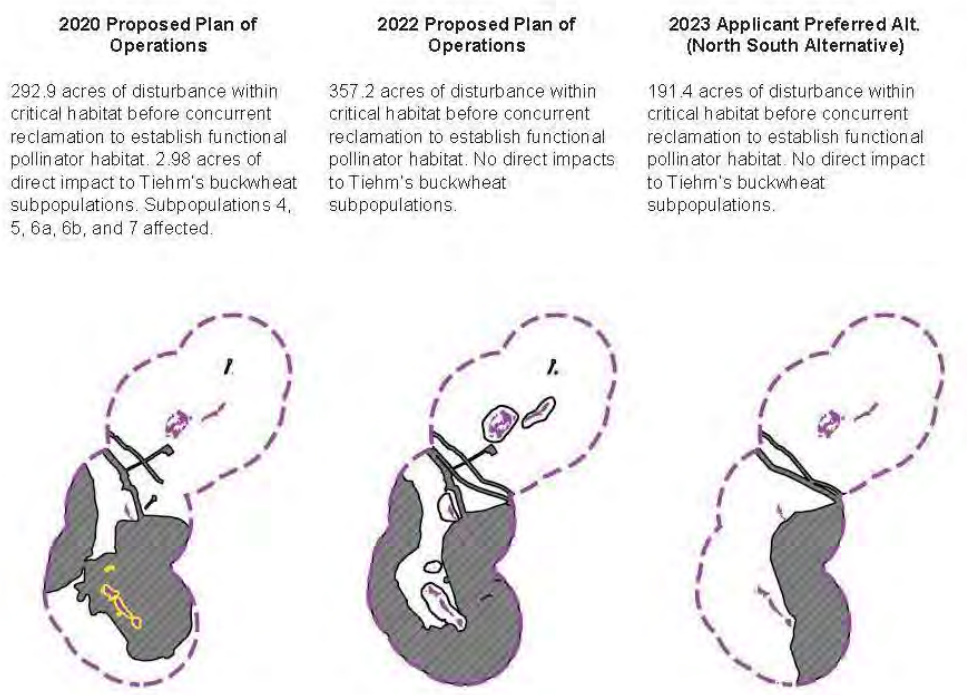

Figure 1: Ioneer's project redesigns to conserve Eriogonum tiehmii and its critical habitat. Critical habitat is outlined by a hatched purple line, and the occupied E. tiehmii habitats are depicted as purple polygons. Grey polygons display the extent of impacts from the proposed project within critical habitat. The left-most figure was the Plan as proposed in 2020. The middle figure depicts the Plan as proposed in 2022. The right-most figure shows the project as currently proposed and considered in the biological opinion (WestLand 2024a).

Beginning in January 2023, staff from the Service, BLM, and Ioneer have met several times to discuss the proposed project and address specific issues. The Service received BLM's draft biological assessment for the proposed project on January 18, 2024. The Service received the BLM's request for initiation of section 7 formal consultation on the proposed project on April 1, 2024. The draft environmental impact statement was published on April 15, 2024 (88 Federal Register (FR) 2883). The Service received the final biological assessment on July 18, 2024 (Stantec 2024). The Service provided a draft copy of the biological opinion to the BLM for review on July 19, 2024. The BLM submitted comments on the draft biological opinion to the Service on August 2, 2024.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

At issue is BLM's proposed approval of the plan of operations for the construction, operation, and closure of a new lithium-boron mine (proposed project). If approved by BLM, the footprint of the proposed project will encompass approximately 7,166 acres, which consists of an Operational Project Area (OPA), and an Access Road and Infrastructure Corridor. The total proposed surface disturbance from the OPA will be 2,266 acres (see Figure 22), including approximately 191 acres of disturbance within designated critical habitat for *Eriogonum tiehmii*.

The mine will operate 24 hours per day, 365 days per year for approximately 23 years. The 23-year mine life encompasses the construction, mining, processing, and reclamation and closure phases. This does not include the years required for the pollinator habitat reclamation monitoring and reporting period, which is anticipated to occur from years 20 to 35. Therefore, the life of the action refers to the entire 35-year period, inclusive of pollinator habitat monitoring, reporting, and management activities.

The following paragraphs briefly describe the various elements of the proposed project that BLM is considering for approval, as described in the biological assessment (Stantec 2024) and the Buckwheat Protection Plan (WestLand 2024a) (see Figure 2 and Figure 3). Refer to those documents for additional project details. The Buckwheat Protection Plan is considered part of the proposed project and is incorporated into the biological assessment in its entirety as Appendix B (Stantec 2024). Where applicable, the following paragraphs describe the location of project elements in relation to designated critical habitat for *E. tiehmii* to provide spatial context. The Environmental Baseline and Effects Analysis sections of this biological opinion provides more details about the location of the project elements in relation to *E. tiehmii* and its critical habitat.

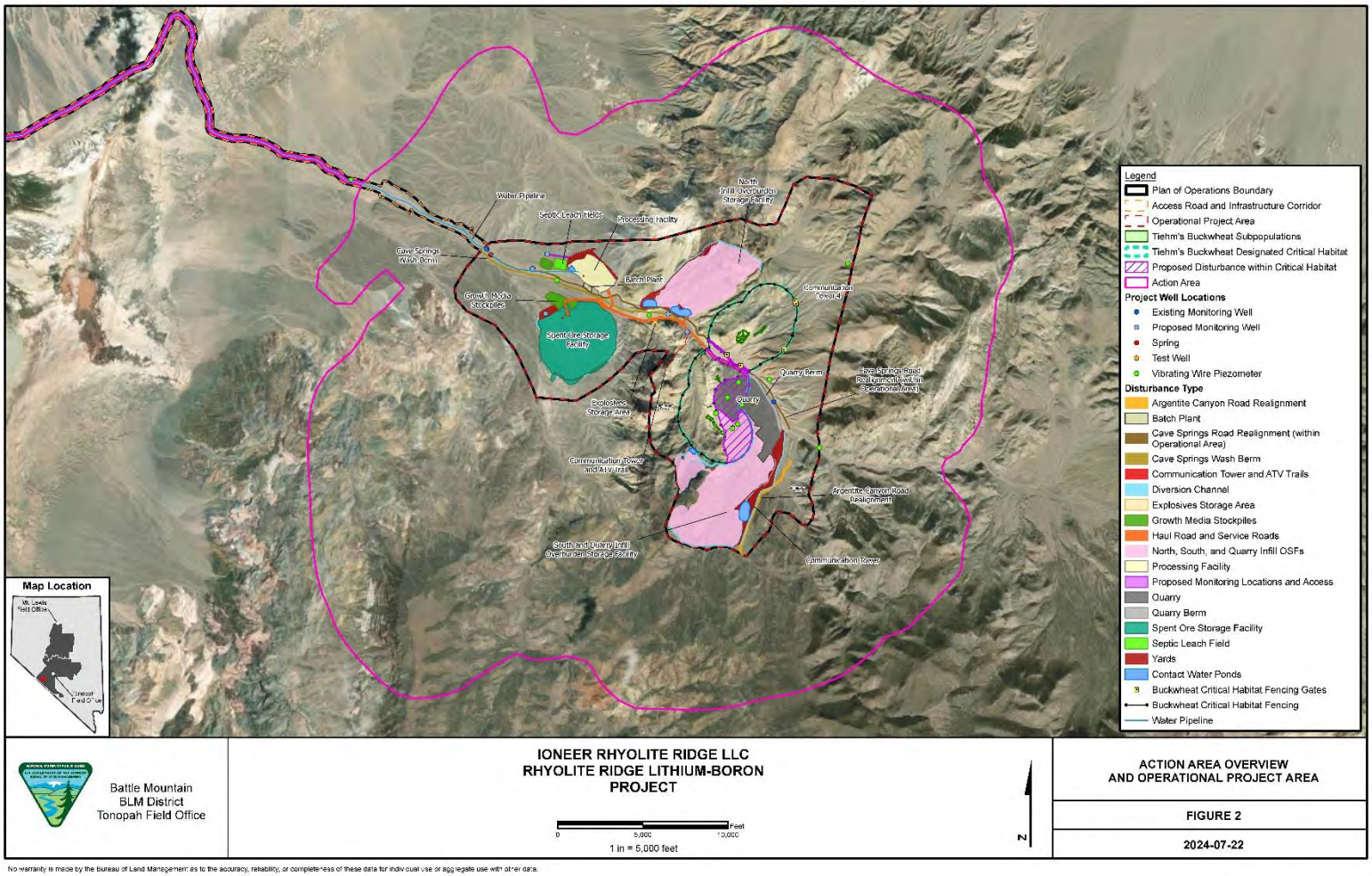

Figure 2: Proposed mine elements (Stantec 2024)

Exploration

If approved by the BLM, Ioneer will conduct exploration and resource definition activities concurrent with mining operations. Exploration activities may consist of reverse circulation and core drilling from constructed drill sites with single or double sumps, constructed roads, overland travel routes, bulk sampling, geotechnical auger holes, and geological test pits. Exploration activities will disturb 35 acres of habitat in areas proposed for disturbance by the eventual quarry or other project elements or will occur outside of designated critical habitat.

Mining Operations

If approved by BLM, Ioneer will excavate overburden rock and ore from a surface quarry. Haul trucks will transport ore to the processing plant, overburden rock and lithium-rich clays to two external overburden storage facilities (OSFs) or to the internal Quarry Infill OSF, and the residuum from the processing plant to the Spent Ore Storage Facility (SOSF). Ore will be crushed and placed into a vat leach system where sulfuric acid will be used to leach the lithium and boron. An evaporation/crystallization process will be used to produce lithium and boron products, which will be shipped off-site. Spent ore from the vat leach and evaporation/ crystallization processes will be dewatered at the processing plant area, then trucked to the SOSF.

Transportation for the import of equipment and supplies and export of processed materials will occur from State Route (SR) 264 along the existing road in the Access Road and Infrastructure Corridor to the OPA. Water used for the processing plant and dust control will be sourced from on-site groundwater wells within the OPA and from existing agricultural wells and a new pump station located on private land in the Fish Lake Valley and within the Access Road and Infrastructure Corridor Area. Water from this well will be pumped via a pipeline adjacent to SR 264 and the access road to the processing plant.

Site preparation will be conducted in accordance with the grading plan and design for each component and will include clearing, grubbing, and salvaging of growth media (approximately 6 inches of the alluvium from initial grubbing/grading activities at facilities such as the OSFs) for concurrent or future use in reclamation (*e.g.*, habitat restoration). See the *Growth Media Stockpiles* section for additional details. Ioneer will realign segments of a county road that bisects the OPA, Cave Springs Road, to accommodate a haul road prior to the start of construction. Ioneer will also install appropriate downgradient stormwater and sediment control features at the onset of construction and throughout the construction process in accordance with a Stormwater Management Plan.

The processing plant will be approximately 1.2 miles away from *Eriogonum tiehmii* critical habitat. Approximately 87 acres of the South and Quarry Infill OSF and 86 acres of the quarry will occur within *E. tiehmii* critical habitat. The North OSF will be constructed 382 feet outside *E. tiehmii* critical habitat. The SOSF will be constructed approximately 1-mile away from *E. tiehmii* critical habitat. The processing plant will be approximately 1.2 miles away from *E. tiehmii* critical habitat.

Between approximately 400 to 500 people will work at the site during construction; 350 peoplewill be employed for the mining and processing phases, in staggered shifts (Stantec 2024). During the construction phase, Ioneer estimates that daily traffic will vary from 186 to 248 vehicle passes on the access road. Daily traffic will vary from 230 to 288 vehicle passes during operations (Stantec 2024).

Quarry Development

The quarry will be constructed and operated in phases. Excavation of the quarry will commence concurrently with the beginning of site construction activities and will be developed using open cast quarrying methods that utilize heavy equipment (*e.g.,* backhoe excavators, loaders, dozers, and haul trucks) to remove overburden to the OSFs. Explosives will be used to achieve sufficient fragmentation to allow removal of the certain overburden units as well as the ore zone. No blasting will occur within the alluvium and lithium-rich clay units, which means that minimal blasting will be required during the initial quarry development near the ground surface. Following blasting, backhoe excavators will be used to extract the ore and overburden. Development of the quarry, including mining and backfilling, will be completed within approximately 18 years after initiation.

A diversion structure will be installed around the southern end of the quarry to prevent surface water from entering. In addition, a 60-foot-wide quarry berm within a 200-foot-wide disturbance area will be constructed between the quarry and Cave Springs Wash. Cave Springs Wash is a natural feature where surface water collects during precipitation events. For the portion within critical habitat, the haul road will be co-located with Cave Springs Wash. A berm will be constructed along Cave Springs Wash with overburden and be approximately 10 feet high. The maximum quarry depth is anticipated to be approximately 960 feet.

A 6-foot-high berm with slopes at an angle-of-repose and a fence will be constructed around the quarry perimeter, except within *Eriogonum tiehmii* critical habitat, which will be fenced during initial quarry excavation along the quarry rim. At reclamation, the size of the berm may be larger to enhance safety and accommodate the storage of excavated alluvium and the fence will be removed. After closure, the berm around the non-backfilled portion of the quarry will remain.

Quarry Geotechnical Design and Stability

Geo-Logic Associates conducted slope stability studies in 2022 and 2023 to address concerns about quarry slope stability in zones of the quarry near *Eriogonum tiehmii* subpopulations (Geo-Logic Associates 2022; Geo-Logic Associates 2023). Consistent with the 2022 and 2023 studies, development of the quarry will be conducted to optimize the extraction of ore while maintaining geotechnical stability using a factor of safety of 1.2 or greater. This will be achieved in the vicinity of *E. tiehmii* subpopulations by using 10-foot benches (instead of the 30-foot benches proposed in other areas of the quarry) and installing ground anchors. Ioneer will implement a multi-tiered monitoring system to determine if and when potential failure of quarry faces might occur. The monitoring program will include daily visual inspections of quarry faces, mapping, and monitoring. The monitoring program will have two goals: to ensure the safety of the mining

operation and to guard against failure of the quarry slopes proximal to the *E. tiehmii* subpopulations.

If unstable zones are discovered, Ioneer will implement procedures and protocols that could include suspension of mining activities at the site of failure, stopping mining activities altogether to resolve the problem, and implementation of mitigation protocols to stabilize the quarry faces.

In the post-mining efforts to ensure stability of quarry faces and the overall slope of the final quarry, Ioneer will install buttresses along the western quarry wall.

Quarry Dewatering

During mine operations, surface water (*i.e.*, rainfall and snowmelt) and local groundwater entering the quarry will be intercepted by in-pit sumps, drains, and/or dewatering wells. Pipelines will convey the water to sumps around the perimeter of the quarry for storage. The water will be used for dust suppression within the quarry or on other roads, or for other project-related activities. During reclamation and after mining, dewatering will cease, and a quarry lake will form. Dewatering operations may require use of powerlines or generators, which will be constructed or occur in areas already proposed for disturbance within designated critical habitat.

Growth Media Stockpiles

During quarry development, the top 6 inches of topsoil and associated vegetation will be salvaged and retained as a growth media resource for subsequent reclamation efforts. Growth media stockpiles will be constructed at the SOSF and west of the processing plant. Surfaces of the stockpiles will be contoured with slopes at 3:1 (horizontal: vertical) to reduce erosion, and growth media stockpiles will be seeded with an interim seed mix to stabilize material, reduce wind and water erosion, and minimize the establishment of non-native, invasive plant species. Growth media stockpiles will not be constructed within *Eriogonum tiehmii* critical habitat.

Overburden and Backfill Management

If approved by BLM, the OSFs will be constructed within the valley to the south of the quarry (South OSF), the valley to the north of the quarry and the Cave Springs Wash (North OSF), and in the southern and western portions of the quarry (Quarry Infill OSF). Portions of the Quarry Infill OSF would be constructed within the *Eriogonum tiehmii* critical habitat boundary. The North and South OSF would be constructed outside of *E. tiehmii* critical habitat.

The South and North OSFs will be cleared and grubbed of vegetation prior to use and approximately 6 inches of alluvium will be retained for reclamation growth media and stored in stockpiles. The OSFs will be built using a progressive approach that combines construction with operation involving sequential site preparation, underdrain construction, placement, and concurrent reclamation. The overburden will be hauled via truck and dumped from the adjacent quarry. Each layer or “lift” of overburden will be 20 feet high. Ioneer will separate the lifts with benches that are wide enough to maintain side slopes on the lifts of 3:1 (horizontal: vertical). Slopes will be graded to drain to the reclamation benches. Alluvial overburden will be placed

along the outer slopes of the OSF concurrently during ongoing mining operations as part of the closure process.

The final placement of overburden will be in the Quarry Infill OSF, which will begin in the southernmost part of the quarry and proceed upward and north as the quarry expands to the north. The Quarry Infill OSF will reach a height of approximately 300 feet above the adjacent ground to the south.

Geochemical studies indicate that metals may leach from some of the overburden rock that originates in the quarry. Leaching potential for several metals, including arsenic, aluminum, antimony, iron, and manganese, is consistent with existing, naturally elevated concentrations of these elements in groundwater and surface water. In response, runoff from the OSFs will be directed to the lined OSF contact water ponds. Monitoring wells will be placed downgradient of the OSFs to assess groundwater quality throughout the 23-year mine life and provide responsive indicators and allow for management options in coordination with BLM and the Service to be implemented should any deviation in water quality be identified. Monitoring wells will not be constructed within *Eriogonum tiehmii* critical habitat.

During reclamation, the OSF slopes will be regraded to blend with the surrounding topography and covered with a minimum of 30 inches of alluvial cover (including approximately 6 inches of growth media) and revegetated.

Infrastructure

If approved by BLM, Ioneer will construct the following facilities to support the proposed project.

Access Road and Infrastructure Corridor

The Access Road and Infrastructure Corridor consists of approximately 13 miles of roadway between SR 264 and the western edge of the OPA, as well as approximately 6 miles along SR 264 to the Fish Lake Valley. The Access Road and Infrastructure Corridor will be approximately 2.7 miles from *Eriogonum tiehmii* designated critical habitat.

Haul Roads and Service Roads

Most of the traffic entering and exiting the OPA will be passenger vehicles, semi-trucks providing material and supplies, and vehicles (including buses) transporting employees. The initial traffic will include equipment for early works mobilization and site grading, as well as construction equipment and materials for construction of the batch plant.

Two primary types of roads will be constructed within the OPA: service roads and haul roads. Service roads will move equipment and supplies between the various project components and will provide for light-vehicle traffic. These service roads will not exceed 8% grade and be approximately 20 feet (nominal) wide plus shoulders, sufficient to safely pass equipment and supplies.

Haul roads will allow the haul trucks to transport ore, overburden, and spent ore between the quarry, processing plant, OSFs, and SOSF, with enough space incorporated into the design to allow for safe passage of two 150-ton haul trucks as well as sufficient room for safety berms and surface water runoff control systems. These roads will be constructed as close to natural grade as possible (maximum grade of 10%) with balanced cut/fill widening, as necessary. Haul roads will be maintained on a routine basis to ensure safe, efficient haulage operations and to minimize fugitive dust and diesel emissions. Ioneer relocated the haul road, as proposed in previous Plan of Operations (see *Consultation History*), from adjacent to *Eriogonum tiehmii* subpopulations to the east side of the quarry, away from the subpopulations south of Cave Springs Road. With this relocation, the majority of the haul road that is not within the quarry footprint will now be located outside of critical habitat except as necessary to exit the quarry and get to the processing plant and the North OSF.

The Cave Springs Wash berm is co-located with the haul road along Cave Springs Road and is described in more detail under the *Quarry Development* section above. Approximately 2,755 feet and 10 acres of the haul road and Cave Springs Wash berm will occur within *Eriogonum tiehmii* critical habitat.

All roads will be constructed using in-situ material. Inert overburden rock may be used as supplemental material, as necessary, either during construction or as part of subsequent maintenance activities.

All service and haul roads will be maintained according to Mine Safety and Health Administration standards and will accommodate drainage and sediment controls. Dust will be controlled with water trucks and/or a BLM- and Service-approved chemical binding agent.

Cave Springs Road Realignment

Cave Springs Road is an existing road on public land that bisects the OPA. This road will require a localized realignment within the OPA to accommodate planned haul roads. Approximately 3,008 feet and 6.5 acres of the Cave Springs Road realignment will occur within *Eriogonum tiehmii* critical habitat.

Power Supply and Distribution

Diesel-powered generators will supply power for the project during construction. Following construction, Ioneer will generate its own power with a steam turbine generator at the processing plant. The steam turbine generator, and associated facilities, will be constructed at the processing facility, outside of *Eriogonum tiehmii* critical habitat. Activities associated with dewatering may include powerlines or generators. The powerlines or generators needed for dewatering operations will be constructed or occur in areas already proposed for disturbance.

Ancillary Facilities

Ioneer will construct the following ancillary facilities to support implementation of the proposed project. Additional details about each of these facilities can be found in the biological assessment (Stantec 2024).

Processing Plant

This facility, where minerals will be processed to separate the lithium and boron from the mine ore, will be approximately 1.2 miles away from *Eriogonum tiehmii* critical habitat.

Spent Ore Storage Facility

The SOSF, where waste material from mining operations will be stored, will be approximately 1.0 mile away from *Eriogonum tiehmii* critical habitat.

Explosives Storage Area

Explosives will be used in certain areas to break up the overburden and the ore zone to allow adequate removal. The explosives storage area will be approximately 3,021 feet from *Eriogonum tiehmii* critical habitat.

Septic Leach Fields

Septic leach fields or a sewage package plant will be constructed west of the processing facility, which is over 1-mile away from *Eriogonum tiehmii* critical habitat.

Communication Towers

Ioneer will construct five communication towers powered by solar panels with battery backup. Communication Towers 1 and 2 will be constructed at the processing facility and SOSF, respectively. Communication Towers 3, 4, and 5 will be constructed 1,311 feet, 80 feet, and 2,759 feet outside of *Eriogonum tiehmii* critical habitat, respectively. An existing off-highway vehicle (OHV) road will be used to access Communication Tower 4. The existing road is currently within *E. tiehmii* critical habitat.

Monitoring Wells

Ioneer will construct monitoring wells adjacent to and downslope of project features within the OPA. Access to Monitoring Well 1 will require travel through *Eriogonum tiehmii* critical habitat on Cave Springs Road.

Water Supply Facilities

Water wells, pump station, and pipelines will primarily be constructed within the Access and Infrastructure Corridor outside of the OPA, approximately 2.7 miles from *Eriogonum tiehmii*

critical habitat, or at the processing plant, which is approximately 1.2 miles away. Nine vibrating wire piezometers and/or test wells will be constructed within the quarry or the South and Quarry Infill OSF footprint.

Stormwater Diversion Channel

Stormwater diversion channels will occur around the quarry and South and Quarry Infill OSF. Surface water diversion channels will border the OSFs to capture surface runoff from the surrounding natural topography. Non-contact water will be diverted around the OSF and directed toward the natural drainages. Runoff from the facility will be directed to and collected at a lined contact water pond (OSF contact water ponds) to preclude the potential of metals leaching from the facility. Temporary sediment control structures will be installed as part of the incremental development of the OSFs and will be sized appropriately for the 100-year, 24-hour storm event. Storm diversion channels will occur outside of *Eriogonum tiehmii* critical habitat.

Yards

Yards will be located at the SOSF, processing plant, North OSF, and adjacent to the quarry and South and Quarry Infill OSF. These yards will be approximately 1.5 miles, 1.2 miles, and 1,559 feet from *Eriogonum tiehmii* critical habitat, respectively.

Batch Plant

The batch plant will be located south of the processing plant, approximately 1.4 miles from *Eriogonum tiehmii* critical habitat, and will not be retained after construction.

Waste Management

If approved by BLM, employee training plans will address appropriate disposal practices, to include education on which wastes may be placed in a landfill, as well as management of regulated substances. Nonhazardous solid wastes will be disposed off-site in a licensed facility. Waste that may be regulated under the Resource Conservation and Recovery Act will be managed accordingly.

Spills and releases of hydrocarbons, non-hazardous, and hazardous materials will be contained, mitigated, stored, and properly transported off-site in accordance with applicable guidelines. Spill containment and clean-up equipment will be maintained at strategic locations throughout the OPA, including oil absorbent rolls, oil absorbent pads, oil absorbent booms, oil absorbent pillows, spill kits, and empty drums.

No storage of hazardous material or waste disposal will occur within, or in proximity to *Eriogonum tiehmii* critical habitat. Potential petroleum release from equipment or vehicular travel may occur within *E. tiehmii* critical habitat.

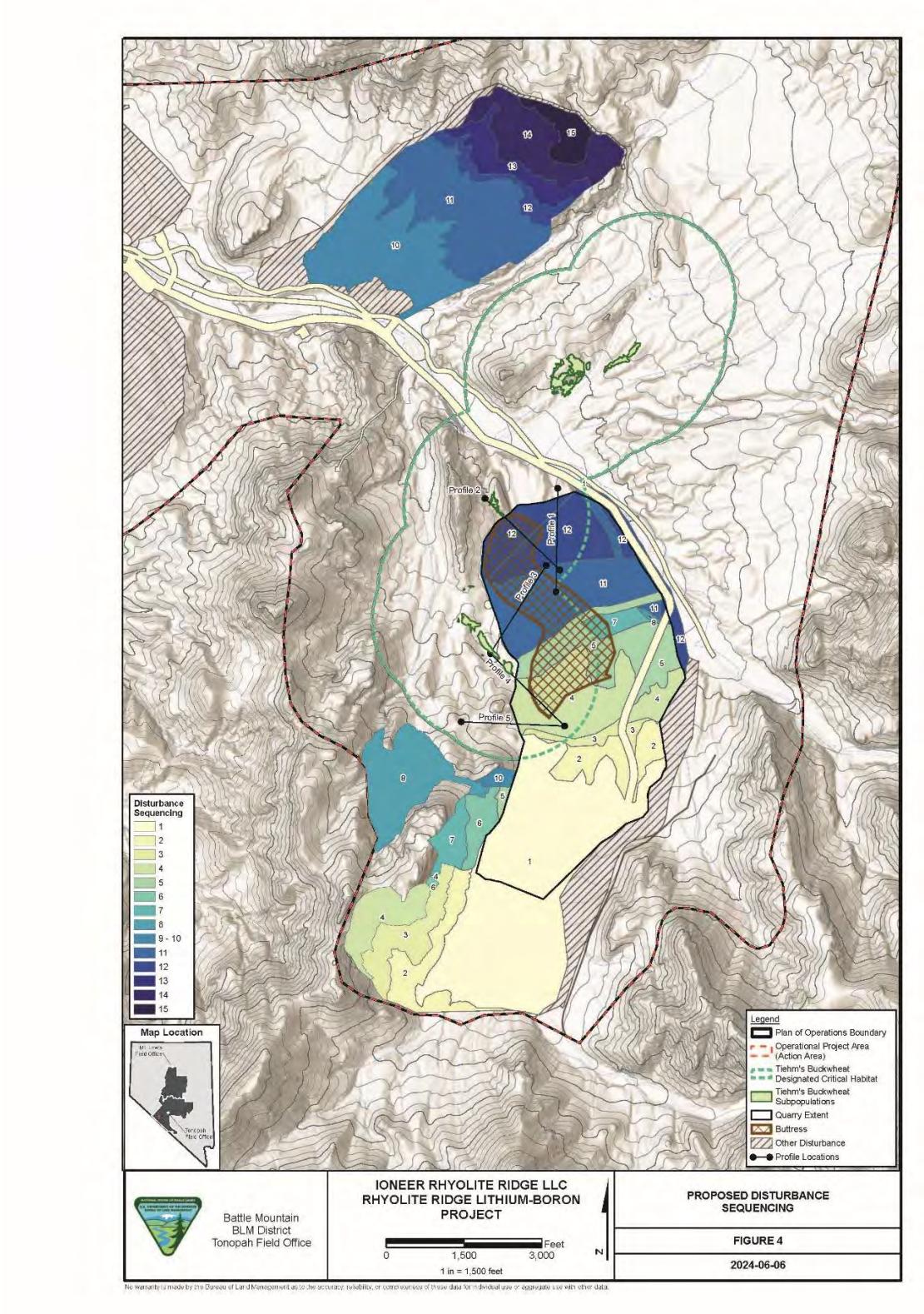

Figure 3: Project disturbance sequencing (Stantec 2024)

Reclamation

If approved by the BLM, the proposed project will result in the cumulative disturbance of 191.4 acres of *Eriogonium tiehmii* critical habitat (see Table 1). Ioneer will implement the reclamation and closure phase of the project between years 18 and 35, and will reclaim 146 acres of *E. tiehmii* critical habitat. Different reclamation standards will occur within and outside of *Eriogonum tiehmii* critical habitat. This section of the biological opinion will describe reclamation outside of critical habitat; the reclamation proposed within critical habitat is described in the Conservation Measures section, under Applicant-Proposed Conservation Measure 6.

The OSFs outside of *Eriogonum tiehmii* critical habitat will be reclaimed concurrently with active use, with reclamation benches constructed every 100 vertical feet and overall reclaimed side slopes of 3:1 (horizontal: vertical). All areas of disturbance associated with the haul roads and unneeded service roads outside of *E. tiehmii* critical habitat will be reclaimed at closure by ripping the surface to loosen the compacted soil. Once ripped, they will be regraded to blend with local topography to limit erosion and promote natural drainage. A 16-foot-wide all-terrain-vehicle road will remain where the haul road used to be for monitoring access. Slope stability monitoring will include visual inspections.

The reclamation areas outside of *Eriogonum tiehmii* critical habitat will be covered with native materials that can generate unimpacted runoff or store water during the colder times of the year and remove it through evaporation and evapotranspiration during the warmer months. Growth media for the South and Quarry Infill OSF will be sourced directly from the quarry material. Prior to placement of the growth media, the subsurface will be roughened by ripping, and then the growth media will be placed and spread using a minimal number of passes to limit compaction. Upstream drainages will be diverted away from reclaimed facilities to prevent potential erosion, where practicable. Seedbed preparation will be conducted, as needed, following growth media placement. Ioneer anticipates that soil amendments will not be needed due to adequate availability of retained native growth media (alluvium). Mulching will occur on areas where growth media has been applied to provide erosion control, promote soil moisture retention, and provide supplemental organic material. Broadcast seeding will primarily be used, with hydroseeding as a secondary method.

The reclamation seeding and seed mix outside of designated critical habitat is described in detail in the biological assessment (Stantec 2024). All seed will be certified, properly labeled, and will meet the requirements of the Federal Seed Act and the seed and noxious weed laws of Nevada.

Table 1: Project development and reclamation activities for quarry, overburden stockpiles, and ancillary facilities within critical habitat. Pollinator habitat reclamation represents the acres of reclamation to be accomplished using the methods outlined in this document for critical habitat. Highwall bench reclamation acres represent the acreage of quarry highwall benches where the benches will be ripped and seeded, but no further reclamation will occur due to safety concerns. Cumulative acres reclaimed is the running total of reclamation through the life of the Action within critical habitat. Reclaimed in current year represents the total acres reclaimed in any given year within critical habitat. The quarry lake, Cave Springs Road realignment, and OHV road used for monitoring access will remain as unreclaimed features, which amount to a total of 45 acres (Stantec 2024)

Year of Implementation	Cumulative Acres Disturbed	Reclamation of Pollinator Habitat	Reclamation of Highwall Bench	Cumulative Acres Reclaimed	Reclaimed in Current Year
1	21.1			0.0	0.0
2	21.4	3.2		3.2	3.2
3	23.6			3.2	0.0
4	66.9			3.2	0.0
5	87.9			3.2	0.0
6	87.9			3.2	0.0
7	88.2			3.2	0.0
8	88.2			3.2	0.0
9	88.2			3.2	0.0
10	88.2			3.2	0.0
11	133.8			3.2	0.0
12	191.4			3.2	0.0
13	191.4			3.2	0.0
14	191.4		6.8	10.0	6.8
15	191.4		7.1	17.1	7.1
16	191.4			17.1	0.0
17	191.4			17.1	0.0
18	191.4		16.5	33.6	16.5
19	191.4	103.0	9.6	146.2	112.6
TOTAL	191 (rounded to nearest whole acre)	106	40	146	Not applicable

Conservation Measures

If approved by BLM, Ioneer will implement various conservation measures to avoid and minimize project-related adverse effects to *Eriogonum tiehmii* and its critical habitat, as described in detail in the biological assessment and Buckwheat Protection Plan (Stantec 2024; WestLand 2024a). The Buckwheat Protection Plan is considered part of the proposed project and is incorporated into the biological assessment in its entirety as Appendix B (Stantec 2024). The Service provides a summary of the conservation measures below. The conservation measures are identified as either environmental protection measures (EPM) or applicant-proposed conservation measures (APCM) in the biological assessment. Implementation of the project as described in BLM's biological assessment, which includes the Buckwheat Protection Plan, the

APCMs, and the EPMs, are components of the proposed action; the analysis contained in this biological opinion is based upon the implementation of these conservation measures.

Ioneer's conservation measures include numerous monitoring commitments (see Appendix A). The goal of all monitoring associated with the species and its critical habitat is to assist Ioneer in detecting changes in site conditions that may be caused by various aspects of the proposed project and to implement measures to further minimize adverse effects to *Eriogonum tiehmii* and its critical habitat.

APCM-1. Avoidance of Tiehm's Buckwheat and Designated Critical Habitat.

Ioneer redesigned substantial parts of its Plan of Operations since its original plan was submitted in 2020 to avoid direct impacts to *Eriogonum tiehmii* subpopulations and minimize impacts to critical habitat.

APCM-2. Geotechnical Design of the Quarry Walls to Provide Appropriate Margins of Safety.

Ioneer will incorporate geotechnical design of the quarry wall for stability during operations. The design factor of safety criteria for quarry wall stability during operations is 1.20 or greater, and where necessary ground anchors will be installed to achieve this factor of safety. Geotechnical design will be incorporated into the closure of the quarry, including construction of buttresses where ground anchors were required, to provide long-term stability of the walls to minimize the risk of quarry wall collapse adjacent to *Eriogonum tiehmii* subpopulations and within its critical habitat. The modeled slope stability in the vicinity of the *E. tiehmii* subpopulations in the closed quarry will range from 1.81 to 2.71 (Geo-Logic Associates 2023; WestLand 2024a).

APCM-3. Geotechnical Monitoring

Ioneer will implement multiple geotechnical monitoring systems to ensure the stability of the quarry walls to avoid adverse effects to *Eriogonum tiehmii* and its critical habitat that occur outside of the quarry. This will be accomplished by visual inspections and radar systems, providing continuous monitoring of the site during the mining operations. If indicated through monitoring that additional management actions, such as deployment of additional ground anchors, additional layback of the quarry wall, or buttress construction, these will be implemented to ensure quarry wall stability.

APCM-4. Establish Fencing and Signage to Protect Tiehm's Buckwheat and Critical Habitat

Ioneer will place fencing and or signage, as appropriate, along the limits of proposed disturbance within *Eriogonum tiehmii* critical habitat, as well as around, but outside of critical habitat to prevent unauthorized access or disturbance outside of proposed areas. Fencing outside of the limits of proposed disturbance will be constructed one foot away from *E. tiehmii* critical habitat.

Fencing will be four-strand wildlife-friendly design with the top and bottom strands using barbless wire. Gates will be constructed at key areas to control access to *Eriogonum tiehmii* critical habitat. The fence locations will be located and staked prior to construction by a land surveyor licensed in Nevada. During survey of the fence alignment and fence construction, a biological monitor will be present.

APCM-5. Restrict Public Access to the County Road

Ioneer will restrict public access to all roads in and through *Eriogonum tiehmii* critical habitat to prevent unauthorized access or disturbance outside of designated areas. Ioneer will use pilot vehicles to manage interactions between the public and mine traffic on the county road. This will minimize potential adverse effects to *E. tiehmii* and its critical habitat from unauthorized access.

APCM-6. Pollinator Habitat Reclamation Within Critical Habitat

Ioneer will enhance reclamation efforts inside of *Eriogonum tiehmii* critical habitat to help conserve pollinators and minimize the project-related adverse effects of habitat loss for pollinator species. The overall goal of the reclamation is to support the restoration of ecosystem processes and functions. Reclamation efforts inside of critical habitat will be enhanced to accelerate the establishment of habitat suitable for the various life history stages of the diverse pollinator guild that supports *E. tiehmii* (Functional Habitat). Ioneer will experiment, refine, and optimize various restoration methods during early phase reclamation efforts. Beginning in year 4 of quarry operations, experimental test plots for habitat restoration will be implemented on areas outside of *E. tiehmii* critical habitat to better inform pollinator habitat reclamation within critical habitat when it begins.

Reclaimed sites will be assessed both qualitatively and quantitatively. A qualified ecologist will qualitatively evaluate the conditions of the sites quarterly to identify any areas that will require additional work such as supplemental seeding or other stabilization efforts. Annual quantitative assessments of reclaimed sites will be conducted to determine progress towards the interim functional habitat and final reclamation success objectives and to inform management activities, as appropriate. The protocols and procedures to evaluate enhanced reclamation methods to achieve the reclamation objectives outlined in this plan will be developed in collaboration with the Service and BLM prior to year 2 of the project and will include interim and final success criteria. Annual reports detailing the monitoring efforts will be submitted to the BLM and the Service.

APCM-7. Control of Nonnative, Invasive, and Noxious Species

Ioneer will implement a non-native, noxious, and invasive weed species control program within the operations footprint to minimize project-related adverse effects from non-native species. The noxious weed program will occur through the life of the project, until final reclamation success criteria have been achieved and the bond has been released. The noxious weed monitoring and control plan will be developed prior to implementation of project construction in coordination with the BLM and the Service. Ioneer will utilize herbicides and hand-pulling methods within

and outside of critical habitat. Ioneer will implement multiple measures to reduce the risk of exposing *Erigonium tiehmii* to herbicides, such as utilizing a 50-foot-wide buffer from subpopulations for herbicide application and measures to reduce herbicide drift. Weed control within the 50-foot-wide buffer will be accomplished using hand pulling or other approved hand-operated mechanical methods. All herbicide applicators will be state certified, receive site-specific training, and either be qualified as or accompanied by a biological monitor. Herbicide application will meet all product label requirements. Ioneer will require herbicide applicators to be knowledgeable of plant identification to ensure that assigned staff have a working knowledge in the identification of nonnative, invasive, or noxious weed species as well as native plant species. Annual reports detailing the monitoring and treatment efforts will be submitted to the BLM and the Service.

APCM-8. Light Management to Minimize Adverse Impacts to Pollinators

Dark sky lighting best management practices will be used throughout the operations area to minimize the adverse effects of lighting on *Eriogonum tiehmii* and its critical habitat through light-related disturbance to pollinators. Key elements of light management to minimize impacts to pollinators will include the use of state-of-the-art light sources that can be switched on and off easily and dim well. Ioneer will conduct an annual audit of lighting fixtures and will deploy light monitoring equipment proximate to *E. tiehmii* subpopulations. Light monitoring equipment will be co-located at noise monitoring sites (APCM-17) to capture the intensity of lighting and frequency of light being detected (see Figure 4).

Light monitoring, along with other biotic and abiotic monitoring data (*e.g.*, noise, local weather conditions, and dust deposition), will be used to explore and identify, to the extent practicable, changes in site condition within critical habitat and year-over-year shifts (if any) in potential pollinator/insect visitor diversity and abundance and *Eriogonum tiehmii* demographics. If monitoring data shows negative trends, Ioneer will implement measures to minimize effects caused by lighting. Annual reports synthesizing the monitoring data will be submitted to the BLM and the Service.

APCM-9. Dust Control and Monitoring of Fugitive Dust Emissions within Tiehm's Buckwheat Subpopulations

Fugitive dust will be controlled on roadways and other areas to minimize adverse effects to *Eriogonum tiehmii* and its critical habitat (*e.g.*, pollinators). Along the haul road, proximate to *E. tiehmii* subpopulations and critical habitat, control efforts will be implemented with water applications and approved dust suppressants. Ioneer will collect baseline data on dust and deploy dust monitoring stations near *E. tiehmii* populations (see Figure 4). Dust deposition from each of the monitoring sites will be collected and reported monthly along with information about project implementation (*e.g.*, haul road traffic). If the trailing 12-month average dust deposition level at any monitoring site exceeds the standard of 4 grams per square meter (g/m^2) per day, Ioneer will take measures to minimize dust generation. If these measures do not result in a material reduction in dust deposition attributable to mining activities, Ioneer will evaluate specific placement of dust control fencing or establishment of reduced speed limits (*i.e.*, less than the 35

miles per hour) along the haul road proximate to *E. tiehmii* subpopulations to reduce dust deposition.

Ioneer will fund research using *Eriogonum tiehmii* plants it has growing in its greenhouse (as authorized under their recovery permit under the Act) and, if authorized by BLM and the Service, will fund in-situ studies at the site. Dust monitoring data, along with other biotic and abiotic monitoring data (*e.g.*, noise, light, local weather conditions) will be used to explore and identify, to the extent practicable, changes in site condition within critical habitat and year-over-year shifts (if any) in potential pollinator/insect visitor diversity and abundance and *E. tiehmii* demographics. Annual reports synthesizing the monitoring data will be submitted to the BLM and the Service.

APCM-10. Remove Fencing and Debris from the Three Transplant Experimental Sites Located within Tiehm's Buckwheat Critical Habitat

Ioneer will restore areas formerly used for research activities related to *Eriogonum tiehmii* on BLM land. Fencing and debris from these sites will be removed and disposed of, and the sites will be regraded (as needed) and seeded with species approved by BLM and the Service.

APCM-11. Minimize the Effects of Blasting to Tiehm's Buckwheat Subpopulations and Critical Habitat

Ioneer will implement measures to minimize the adverse effects of energy transmission from blasting to *Eriogonum tiehmii* populations and critical habitat. To protect *E. tiehmii* from flyrock (rock that is ejected from the blast site) and minimize dust generated by blasting, Ioneer will physically arrest flyrock by muffling/covering the blasting area with heavy rubber mats/wire rope mats and/or other suitable covering materials when blasting within 100 meters of any *E. tiehmii* subpopulation.

APCM-12. Demographic and Recruitment Monitoring

Ioneer will collect quantitative data along previously established transects on an annual basis to estimate the number of plants in each subpopulation and track changes in population density, flower production, and size structure. Ioneer will continue *Eriogonum tiehmii* seed collection efforts in accordance with the currently accepted standards determined by the Center for Plant Conservation. Ioneer will continue long-term monitoring of seed viability in support of the demographic monitoring outlined in this APCM. Specific procedures and protocols outlining the data collection, reduction, and long-term data management and reporting for this APCM will be developed in cooperation with the Service and BLM.

Demographic and recruitment monitoring, along with abiotic monitoring data (*e.g.*, noise, light, local weather conditions, and dust deposition) will be used to explore and identify, to the extent practicable, changes in site condition within critical habitat and year-over-year shifts (if any) in potential pollinator/insect visitor diversity and abundance and *Eriogonum tiehmii* demographics. Annual reports synthesizing the monitoring data will be submitted to the BLM and the Service.

APCM-13. Develop a Specific Environmental Awareness Program for Project Employees, Contractors, and Guests Specific to Eriogonum tiehmii

Ioneer will develop an environmental training program that provides a brief description of the natural history and status of *Eriogonum tiehmii* and its critical habitat, discuss the conservation program, and outline restrictions related to unauthorized access to critical habitat. Ioneer will ensure that all personnel receive this training before beginning work on site; Ioneer will update the training program and provide refresher training as appropriate or as directed by the BLM.

APCM-14. Control Stormwater from Project Activities Located in or with the Potential to Discharge to Critical Habitat

Ioneer will develop and implement a stormwater plan that will capture runoff from project facilities outside of critical habitat and keep the water from running onto undisturbed portions of critical habitat. Erosion and sediment control will be accomplished through application of best management practices to limit erosion and reduce sediment from precipitation or snowmelt runoff. Following construction, areas of cut and fill proximate to or within critical habitat will be seeded using a seed mix developed in conjunction with the BLM and the Service.

APCM-15. Critical Habitat and Subpopulation Monitoring

Ioneer will monitor fencing surrounding critical habitat on a quarterly basis and document the general condition of critical habitat, including *Eriogonum tiehmii* subpopulations. Monitoring reports will be submitted within 20 days of each inspection and will specifically note the amount and extent of habitat disturbance within critical habitat to document compliance with the authorized action or if the action is affecting *E. tiehmii* or critical habitat in a way or to an extent that was not previously considered.

APCM-16. Monitor Insect Visitors and Pollinator Diversity and Abundance

Ioneer will monitor insect visitation and pollinators during peak flowering of *Eriogonum tiehmii* each year using cameras and pan traps and will provide an annual pollinator monitoring report, to the BLM and the Service, documenting the relative abundance and diversity of insects collected at each independent sample site.

Insect and pollinator monitoring data, along with abiotic monitoring data (*e.g.*, noise, light, local weather conditions, and dust deposition; see Figure 4), will be used to explore and identify, to the extent practicable, changes in site condition within critical habitat and year-over-year shifts (if any) in potential pollinator/insect visitor diversity and abundance and *E. tiehmii* demographics.

APCM-17. Monitor Noise Proximate to Tiehm's Buckwheat Subpopulations

Ioneer will implement noise monitoring activities proximate to *Eriogonum tiehmii* subpopulations during peak flowering of *E. tiehmii* each year. Noise monitoring data, along with other biotic and abiotic monitoring data (*e.g.*, light, local weather conditions, and dust

deposition) will be used to explore and identify, to the extent practicable, changes in site conditions within critical habitat and year-over-year shifts (if any) in potential pollinator/insect visitor diversity and abundance and *Eriogonum tiehmii* demographics. Annual reports synthesizing the monitoring data will be submitted to the BLM and the Service.

APCM-18. Develop an Ex-Situ Conservation Program in Cooperation with the Service and BLM.

Ioneer will establish a conservation program for *Eriogonum tiehmii* to aid in understanding best practices for conservation of the species. The goal of the conservation program is to identify seed collection, seed storage, and propagation requirements and methods to establish *E. tiehmii* grown in an ex-situ greenhouse setting in potentially suitable reclaimed and undisturbed sites. The program will build on Ioneer's ongoing seed collection work and propagation research being conducted in the greenhouse constructed on private lands and built for this purpose. Ioneer will conduct seeding and transplant experiments within the OPA as approved by BLM and the Service, and in accordance with Service policy (Controlled Propagation of Species listed under the Endangered Species Act; 65 FR 56916).

EPM-1: No Water and Dust Suppressant Use Near Tiehm's Buckwheat Subpopulations and Designated Critical Habitat

Ioneer will not water or use dust suppressants within *Eriogonum tiehmii* critical habitat beyond the approximately 191 acres of proposed disturbance within critical habitat without prior coordination with the BLM.

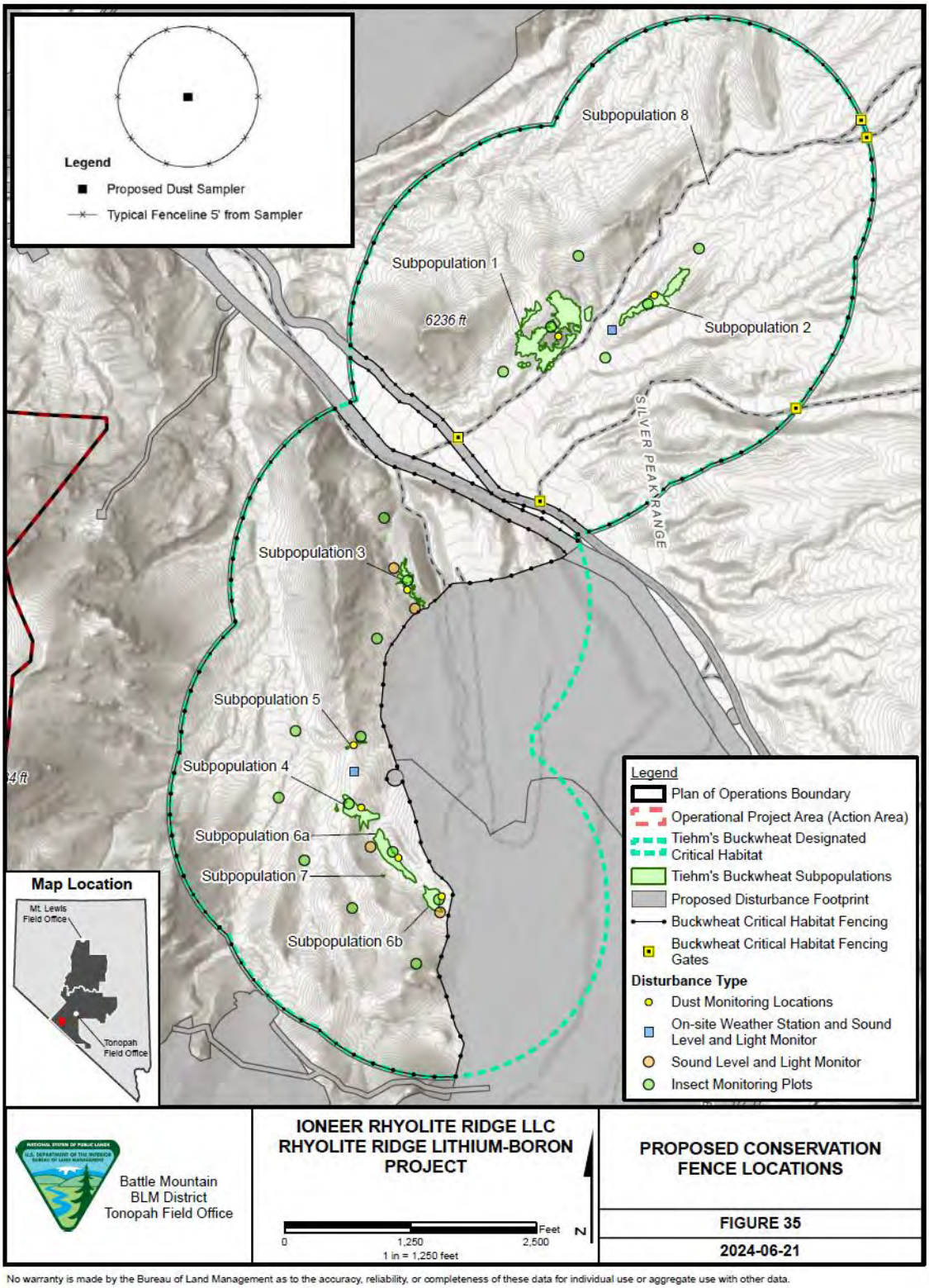

Figure 4: Locations of dust, noise, light, weather, and insect monitoring stations (Stantec 2024)

ANALYTICAL FRAMEWORK FOR THE SECTION 7(A)(2) DETERMINATIONS

Jeopardy Determination

Section 7(a)(2) of the Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. “Jeopardize the continued existence of” means “to engage in an action that reasonably will be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species” (50 CFR 402.02).

The jeopardy analysis in this biological opinion relies on four components: (1) the status of the species, which describes the range-wide condition of the species, the factors responsible for that condition, and its survival and recovery needs; (2) the environmental baseline, which refers to the condition of the listed species in the action area, without the consequences to the listed species caused by the proposed action; (3) the effects of the action, which are all consequences to listed species caused by the proposed action that are reasonably certain to occur; and (4) the cumulative effects, which evaluate the effects on the species of future State or private activities in the action area that are reasonably certain to occur.

For the section 7(a)(2) determination regarding jeopardizing the continued existence of the species, the Service begins by evaluating the effects of the proposed Federal action and the cumulative effects. The Service then examines those effects against the current status of the species to determine if implementation of the proposed action is likely to reduce appreciably the likelihood of both the survival and recovery of the species in the wild.

Destruction or Adverse Modification Determination

Section 7(a)(2) of the Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to destroy or to adversely modify designated critical habitat. “Destruction or adverse modification” of critical habitat means “a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species” (50 CFR 402.02).

In accordance with policy and regulation, the destruction or adverse modification analysis in this biological opinion relies on four components: (1) the status of critical habitat, which describes the condition of all designated critical habitat in terms of its physical and biological features, the factors responsible for that condition, and the intended recovery function of the critical habitat overall; (2) the environmental baseline, which refers to the condition of critical habitat in the action area, without the consequences to critical habitat caused by the proposed action; (3) the effects of the action, which are all consequences to critical habitat caused by the proposed action that are reasonably certain to occur; and (4) cumulative effects, which evaluate the effects on critical habitat of future State and private activities in the action area that are reasonably certain to occur .

For purposes of the adverse modification determination, the effects of the proposed Federal action on the designated critical habitat are evaluated in the context of the condition of all designated critical habitat, taking into account any cumulative effects, to determine if the consequences of the proposed action are likely to appreciably reduce the value of critical habitat as a whole for the conservation of the species.

STATUS OF THE SPECIES AND ITS CRITICAL HABITAT

Status of the Species

The Service listed *Eriogonum tiehmii* as endangered on December 16, 2022 (87 FR 77368).

Eriogonum tiehmii is a low growing perennial herb in the buckwheat family (Polygonaceae) that is found across a 10-acre area, ranging in elevation from 5,906-6,234 feet in elevation in the Silver Peak Range, Esmeralda County, Nevada.

A thorough review of the taxonomy, life history, and ecology of *Eriogonum tiehmii* is presented in the species status assessment report (SSA; Service 2022), proposed listing rule (86 FR 55775) and final listing rule (87 FR 77368). A summary of the species needs, reproduction, numbers, distribution, and recovery goals of the species, as more thoroughly described and cited in the SSA and listing documents, is provided below.

Eriogonum tiehmii is the dominant native herb in the sparsely vegetated community in which it occurs resulting in an open plant community with low plant cover and stature. Where *E. tiehmii* grows, the vegetation varies from exclusively *E. tiehmii* plants to sparse associations with a few other low growing herbs and grass species. The species occurs on dry, upland sites, subject only to occasional saturation by rain and snow and is not found in association with free surface or subsurface waters.

Like most terrestrial plants, *Eriogonum tiehmii* requires soil for physical support and as a source of nutrients and water. *E. tiehmii* occurs on soil with a high percentage (70–95 percent) of surface fragments. The soil pH is greater than 7.6 (*i.e.,* alkaline) in all soil horizons. *E. tiehmii* is distributed on these soils along an outcrop of lithium clay and boron in exposed former lake beds.

High rates of endemism (*i.e.,* when a species naturally occurs in just one place) are characteristic of plants growing on unusual soils (Mason 1964; Rajakaruna 2004; Hulshof and Spasojevic 2020). Taking all soil components into consideration, current research suggests that there is a range of soil conditions in which *Eriogonum tiehmii* thrives that is different from adjacent, unoccupied soils. *E. tiehmii* meets the definition of a soil specialist or edaphic endemic (*i.e.,* a species naturally occurs in just one place due to soil characteristics) because it occurs primarily or exclusively on challenging soils that differ from the surrounding soil matrix and grows better on soils with these conditions (Mason 1964; Gankin and Major 1964; Rajakaruna and Bohm 1999; Rajakaruna 2004; Palacio *et al.* 2007; Escudero *et al.* 2014).

Soil specialists or edaphic endemics are under different selection regimes compared with non-specialists because they are generally subjected to stressful physical and chemical properties such as increased metal concentrations, lower water availability, lower nutrient availability, higher light levels, and/or poor soil structure (Palacio *et al.* 2007; Boisson *et al.* 2017; Hulshof and Spasojevic 2020). Like many other soil specialists or edaphic endemics, colonization of unoccupied, but suitable habitat by *Eriogonum tiehmii* may be limited by dispersal (Palacio *et al.* 2007; Hulshof and Spasojevic 2020; McClinton *et al.* 2020).

In this section, we will synthesize the status of the species, which describes the range-wide condition of the species, the factors responsible for that condition, and its survival and recovery needs by reviewing the numbers, distribution, and reproduction of *Eriogonum tiehmii* (see *Analytical Framework for Section 7(a)(2)*).

Numbers

Permanent belt transects were established in 2019 to estimate the number of individuals in subpopulations 1, 2, 3, 4, and 6, and these locations have been sampled along the transects annually since. Population estimates using belt transects are not complete counts of every individual in a subpopulation; rather, plants are counted along fixed locations within subpopulations, and mathematical models are used to estimate the total number of plants throughout the subpopulation based on the density counted along the transect. Belt transects are used by scientists to estimate population numbers when counting every individual (*i.e.*, a population census) on an annual basis is unfeasible. In various years, population estimates are compared to complete counts to ensure the estimates are providing accurate results. Populations 5, 7, and 8 are counted in their entirety every year; a belt transect estimate is not needed because there are relatively few individuals to count in these subpopulations. Table 2 shows population estimates using the belt transect method (WestLand 2024b), unless otherwise noted.

WestLand conducted belt transect surveys in 2019 and estimated 43,921 *Eriogonum tiehmii* plants (WestLand 2024b). The following year, in 2020, the estimated number of *E. tiehmii* decreased to 38,241 plants. It's unclear if there was a true decrease in the population or if it was an artifact of the survey methods. For example, the permanent belt transects and models used to calculate population estimates were relatively new, and it can take time for surveyors to become consistent with implementing methods and protocols. All surveyors do not detect plants with the same reliability and various methods of surveying have not yet accounted for this variation.

In 2021, following an herbivory event that killed or damaged many *Eriogonum tiehmii* plants (see *Herbivory* section below), the population was surveyed using both the belt transect and population census methods. WestLand conducted belt transect surveys and estimated a total population size of 22,399 plants. Fraga (2021a) conducted a population census (*i.e.*, complete count of all individuals), and documented 15,757 plants. Based on the number of plants counted during the 2021 population census, and the difficulties previously described with belt transect survey method, the 2019 population was likely over-estimated (Service 2022). The population has been estimated to be between 28,000 and 29,000 individuals between 2022 and 2024 (WestLand 2024b).

With this limited amount of data and the varying methods and surveyors used to collect the data, the available information on the number of *Eriogonum tiehmii* individuals does not allow us to ascertain long-term population trends. However, we know there are tens of thousands of *E. tiehmii* across the range of the species (See Table 3).

Distribution

Eriogonum tiehmii was first discovered in 1983. As of 1994, *E. tiehmii* was only known from its type locality. Field surveys located five new locations (subpopulations 2 through 6) on approximately 9 acres, all within 1 mile of the type locality (Morefield 1995). From surveys conducted in 2019, the estimated area occupied by the species increased by approximately 14 percent; however, it is unclear if this indicates a true increase in the amount of area occupied by *E. tiehmii* because observers and mapping tools used have not been consistent among years. In 2019, surveys of potential habitat led to the discovery of two additional locations (subpopulations 7 and 8).

Eriogonum tiehmii is known from 8 subpopulations that cover approximately 10 acres (see Figure 5). The distance between the furthest subpopulations is approximately 1.5 miles. Because of its restriction to a specific type of substrate and the extensive surveys that have been conducted to find the species in recent years, we consider it unlikely that a substantial number of additional subpopulations exist. The extremely limited distribution of *E. tiehmii* renders it vulnerable to negative stochastic events.

Table 2: Summary of Eriogonum tiehmii subpopulation size per year in acres (Service 2022).

Subpopulation	Occupied habitat (acres) in 2008/2010	Occupied habitat (acres) in 2019
1	4.71	4.81
2	1.17	1.56
3	0.62	0.63
4	0.58	1.04
5	0.03	0.04
6	1.64	1.88
7	N/A	0.004
8	N/A	(1 plant)
Total	**8.75**	**9.97**

Table 3: Estimated number of Eriogonum tiehmii plants using belt transects (unless otherwise noted) and footnote notations provided by WestLand 2024b.

Subpopulation	2019	2020[2]	2021	2022[3]	2023[5]	2024[5]
1	9,240	10,146	5,592	7,710	9,047	8,625
2	4,541	6,724	3,600	4,584	4,520	4,564
3	1,860	1,734	867	4,191[4]	1,471	1,665
4	8,159	3,059	1,116	2,253	1,427	2,211
5[1]	199	No Data	9	15	31	22
6a	11,824	11,001	7,831	6,933	7,003	8,357
6b	8,047	5,575	3,367	2,868	4,533	3,590
7[1]	50	No Data	15	20	13	12
8[1]	1	2	2	2	4	2
Total	**43,921**	**38,241**	**22,399**	**28,626**	**28,049**	**29,048**

1. Due to the subpopulations' small size, complete counts of these subpopulations were conducted in all years. In 2020, surveys were not conducted for Subpopulations 5 and 7.
2. Transect surveys conducted partially by University of Nevada, Reno, personnel. Estimates vary from 2019, possibly due in part to detection probability differences among observers.
3. Higher estimates in 2022 as compared to 2021 could in part be due to plants in 2021 that appeared dead but recovered in 2022.
4. Surveyors detected a substantial number of seedlings along one transect in Subpopulation 3, thus resulting in a substantially higher estimate than in other years.
5. Preliminary results.

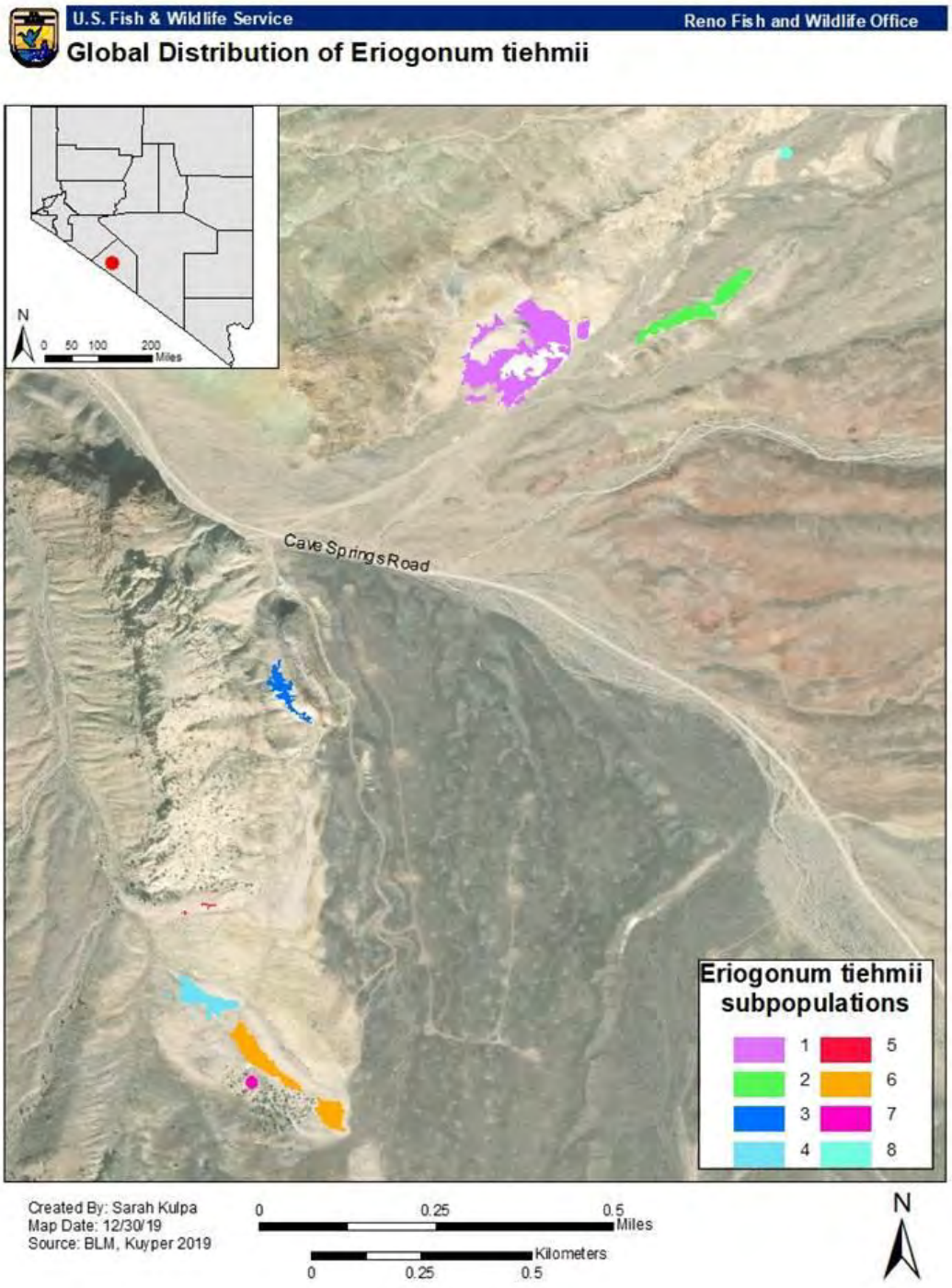

Figure 5: Range-wide distribution of Eriogonum tiehmii (Service 2022)

Reproduction

Timing for flowering and seed production may vary due to year-to-year fluctuations in temperature and precipitation patterns. New leaves are produced in late winter and early spring, flowering occurs from late May to mid-June, and seeds ripen in late-June through mid-July.

Although there is no information on *Eriogonum tiehmii*'s specific water needs during its various life cycle events, it appears to be primarily dependent on occasional precipitation for its moisture supply (Morefield 1995). Low precipitation could entirely prevent reproductive activity in some years, although under low precipitation conditions in 2020, *E. tiehmii* individuals were able to still produce seed (McClinton *et al.* 2020).

The primary seed dispersal agents of *Eriogonum tiehmii* are probably gravity, wind, and water. Upon maturation of the fruit, seeds are likely to fall to the ground in the immediate vicinity of the parent plant, becoming lodged in the soil surface. The number of seeds produced by individual *E. tiehmii* plants is variable.

We have no information on the longevity and viability of *Eriogonum tiehmii* seed in the soil seed bank (natural storage of seeds within the soil of ecosystems) or what environmental cues are needed to trigger germination. However, many arid plants possess seed dormancy enabling them to delay germination until receiving necessary environmental cues.

Eriogonum, in general, are sexual reproducers and insects are the most common pollinators (Gucker and Shaw 2019). Studies have shown that *Eriogonum* flowers can be pollinated by everything from bee flies and spiders to specialist pollinators, while some *Eriogonum* species are capable of self-pollination. During studies conducted in 2020, abundance and diversity of arthropods observed in *E. tiehmii* subpopulations was found to be especially high for a plant community dominated by a single native herb species. Primary insect visitors to *E. tiehmii* flowers include bees, wasps, beetles, and flies (McClinton *et al.* 2020). Results from a study conducted in the wild indicate that *E. tiehmii* plants may be able to produce some seed when pollinators are excluded (through wind pollination or selfing), but open pollination significantly increased seed production. For genetic exchange of *E. tiehmii* to occur, insect visitors and pollinators must be able to move freely between subpopulations.

As further described in the SSA, it has been well documented that not all floral visitors are pollinators and not all pollinators are equally effective in their pollination services (Senapathi *et al.* 2015; Garratt *et al.* 2016; Wang *et al.* 2017). Visit frequency and per-visit pollen deposition are useful metrics to compare relative contributions of insect visitors to plant species (Ne'eman *et al.* 2010), but may not be well suited to understand pollinator performance and pollination success to an individual plant or within the broader scale of plant-pollinator community (Willcox *et al.* 2017). Studies that correlate insect visitor frequency with pollinator effectiveness or performance (the ability of a floral visitor to remove and deposit pollen) have not been conducted for *E. tiehmii*.

Successful transfer of pollen among *Eriogonum tiehmii* subpopulations may be inhibited if subpopulations are separated by distances greater than pollinators can travel and/or a pollinator's nesting or foraging habitat and behavior is negatively impacted. Flight distances are generally correlated with body size in bees; larger bees can fly farther than smaller bees. Some evidence suggests that larger bees do not need their habitat to remain contiguous, but it is more important that the protected habitat is large enough to maintain floral diversity (BLM 2012). While researchers have reported long foraging distance for solitary bees, most individuals remain close to their nest, thus foraging distance tends to be 1,640 feet or less (BLM 2012; Danforth *et al.* 2019; Antoine and Forrest 2021). Nest building is common in some solitary wasps, such as Sphecidae and Pompilidae, which were observed at *E. tiehmii* subpopulations. The distances between hunting sites and nests are unknown for wasps, but many wasps probably hunt close to their nest (within 66 feet) (O'Neill 2019). Most butterflies, flies, and beetles find egg laying and feeding sites as they move across the landscape. The most common bee and wasp pollinators have a fixed location for their nest, and thus their nesting success is dependent on the availability of resources within their flight range (Xerces 2009). Also, alternative pollen and nectar sources (other plant species within the surrounding vegetation) are needed to support pollinators during times when *E. tiehmii* is not flowering.

In summary, successful reproduction of *Eriogonum tiehmii* depends on appropriate weather conditions and the availability of pollinators. Weather conditions can vary greatly over time in this area. We do not have demographic data on lifespan, survival, time to first reproduction, or the number of plants present every year prior to 2019 to determine trends in reproductive success. We also do not understand if differences in effectiveness exist among the pollinator species. However, the wide variety of insect species that can pollinate *E. tiehmii* provides stability; *E. tiehmii* likely does not depend on a single pollinator species and variation in the abundance of any single species of pollinator is unlikely to affect reproduction of *E. tiehmii*.

Threats

The current range of *Eriogonum tiehmii* is subject to anthropogenic threats such as mineral development, road development and OHV activity, livestock grazing, nonnative and invasive plant species, and climate change, as well as natural threats such as herbivory and potential effects associated with small population size (Service 2022).

Mineral Exploration

Mineral exploration, including the drilling of boreholes and the excavation of exploration trenches, began in the area where *Eriogonum tiehmii* occurs in 1962. Some of the earlier exploration trenches (*i.e.,* prior to 2016) were within the *E. tiehmii* subpopulation boundaries and most of the subpopulations have been affected by mineral exploration to some degree. If approved by BLM, the proposed project will continue the history of mineral exploration onsite. The proposed project was identified as a threat to the species in the Species Status Assessment, but at that time, fewer details were known about the proposed project and various design elements have since changed (Service 2022). This biological opinion is the first large-scale

mining project in the action area that an action agency has engaged with the Service through Interagency Consultation (16 U.S.C. 1531 *et seq).*

Roads and OHVs

Roads within the area where *Eriogonum tiehmii* occurs include the county-maintained Cave Springs Road, unnamed wash roads, and past mine exploration roads. Cave Springs Road bisects *E. tiehmii* critical habitat with subpopulations 1, 2, and 8 north of the road and subpopulations 3, 4, 5, 6, and 7 south of the road. Subpopulations 1, 2, 5, and 8 are also directly adjacent to secondary dirt roads. OHVs travelling off these roads have affected *E. tiehmii* subpopulations as documented in multiple studies, likely killing individuals and disturbing habitat, including in subpopulation 1 in 2007, 2019, 2020, and 2021, and in subpopulations 4, 5, and 6 in 2021 (Service 2022). In addition, OHV's may expose *E. tiehmii* individuals or other plants which host its pollinators to excessive levels of dust. Dust deposition has been shown to have a variety of physiological effects on plants, such as declines in photosynthetic and transpiration rates, which may result in reduced plant growth and survival. In addition, plant species may experience reduced reproduction from dust deposition.

To restrict access of OHVs into subpopulations of *Eriogonum tiehmii*, the BLM constructed two pipe rail fences in December 2021. One fence, approximately 1,500 feet long, was constructed along the unnamed wash road southeast of subpopulation 1. A second fence was installed at the entrance of the intersection of Cave Springs Road and an exploration road, preventing OHV access to subpopulations 3, 4, 5, 6, and 7.

Livestock Grazing

The area where *Eriogonum tiehmii* occurs is within the BLM's Silver Peak livestock grazing allotment. Evidence of livestock use within subpopulations has been observed in the past, for example trampling has been observed within subpopulation 1. In 2022, the current permittee voluntarily agreed to not graze livestock in the vicinity of the subpopulations. As a result, current effects from grazing to *E. tiehmii* subpopulations have been reduced relative to past conditions (Stantec 2024).

Nonnative and Invasive Plant Species

Nonnative, invasive plant species could negatively affect *Eriogonum tiehmii* through competition, displacement, and degradation of the quality and composition of its habitat. Beginning in 2019, surveys have documented the presence of *Halogeton glomeratus* (salt lover) and it has since become the most abundant nonnative, invasive species within and adjacent to all *E. tiehmii* subpopulations (Center for Biological Diversity 2019; Ioneer 2020; Fraga 2021b; WestLand 2021). Although *H. glomeratus* is not an extremely competitive plant and does not become dominant in undisturbed areas or areas with competing vegetation, salt desert shrublands (the plant community in which *E. tiehmii* occurs) are particularly susceptible to invasion of *H. glomeratus* if ground disturbing activities that reduce desirable vegetation and increase bare soil occur in these communities (DiTomaso *et al.* 2013; Padgett *et al.* 2018, Fraga 2024).

Additional nonnative, invasive species found within *Eriogonum tiehmii* subpopulations include *Salsola tragus* (prickly Russian thistle) and *Amaranthus albus* (tumbleweed). *S. tragus* was documented co-occurring with *Halogeton glomeratus* in disturbed areas (*i.e.*, near exploration wells and along the access road).

Climate change

Any direct, long-term impact from climate change to *Eriogonum tiehmii* is yet to be determined. The timing of phenological events, such as flowering, are often related to environmental variables such as temperature. Large scale patterns of changing plant distributions, flowering times, and novel community assemblages in response to rising temperatures and changing rainfall patterns are apparent in many vegetation biomes. However, we do not know if or how climate change may alter the phenology of *E. tiehmii* or cause changes in plant distribution, community assemblage, and pollinator behavior.

Eriogonum tiehmii is adapted to dry, upland sites, subject only to occasional saturation by rain and snow. Increasing temperature can affect precipitation patterns. The fraction of winter precipitation (November through March) that falls as snow versus rain is declining in the western United States (Palmquist *et al.* 2016). Shifts from snow to rain when temperatures are cold enough to limit water losses from plant transpiration, and soils that are not frozen may have minimal impact on deep soil water storage. If rainfall replaces snow and temperatures are increased enough to thaw soils to stimulate plant growth and physiological activity earlier in the year, this will result in less deep soil water recharge (*i.e.,* less soil water infiltration and more evaporation) and potential changes in plant community composition (Huxman *et al.* 2005).

Statewide and regional trends in temperature, precipitation, snowpack, and other indicators of regional climatology can be used as a proxy to discuss current climate trends. Nevada has seen an increase in average temperatures of approximately 2 degrees Fahrenheit (°F) over the last century, with heat waves increasing throughout the southwestern United States (U.S. Environmental Protection Agency 2016). General precipitation trends in the Great Basin have been observed to be both increasing and decreasing among various locations, seasons, and time periods of analysis. Likewise, statewide precipitation is highly variable and has showed no overall trend in annual average precipitation during the last century (Runkle *et al.* 2022).

As described in the SSA, total precipitation was above average from 2015 to 2019 (Service 2022). As noted in the *Herbivory* section below, higher temperatures and drought conditions may have contributed to herbivore effects to *Eriogonum tiehmii* in 2020, but a causal link has not been clearly established. Stantec reviewed data from the Western Regional Climate Center and found that the thirty-year average annual mean maximum temperature, annual mean temperature, and annual mean minimum temperature were similar from 1961 to 1991 and 1981 to 2010 with less than one percent negative change across all three parameters (Stantec 2024; Morton 2024). Thirty-year average annual mean precipitation showed a 13.6 percent negative change from 1961 to 1991 and 1981 to 2010 (Stantec 2024; Morton 2024). We do not know how or if climate change may alter precipitation patterns within the local microclimates where *E. tiehmii* occurs,

and how it may relate to long-term demographics for the species. We do not have long-term census data to compare to precipitation data.

Fire is a naturally occurring phenomenon that impacts the distribution and structure of vegetation. However, due to increasing temperatures and reductions in precipitation, the severity and frequency of wildfires is likely to increase. While the Great Basin, where the species occurs, is extremely prone to fires, with 14 million acres burning in the last 20 years, there are no reported accounts of fire within *Eriogonum tiehmii* habitat or in the surrounding Rhyolite Ridge area. We currently do not have any data to suggest what level of effect wildfire could have on *E. tiehmii*; however, it could result in habitat loss, habitat fragmentation, and/or the removal of *E. tiehmii* individuals.

Herbivory

In September 2020, researchers and members of the public observed wide-scale damage to *Eriogonum tiehmii* individuals in all subpopulations, which had not been observed in previous years. Researchers estimated that 37 percent of all plants were killed and an additional 24 percent were damaged by the 2020 herbivory event (Thill and Kuyper 2020, Morefield 2020). Two small Nevada native mammal species were observed on site or by sign (*i.e.*, burrows and mounds) and were identified as possibly responsible for the vegetation damage (Morefield 2020; West 2020). Field observations were corroborated by environmental DNA (eDNA, *i.e.*, trace DNA found in soil, water, food items, or other substrates with which an organism has interacted) analyses on damaged *E. tiehmii* roots, undamaged control samples of *E. tiehmii* roots, soil tailings adjacent to damaged plants, control soil from undamaged plants, and rodent scat found near damaged plants (Grant 2020). The rodent DNA found associated with damaged plants most likely originated from the locally abundant white-tailed antelope ground squirrel (*Ammospermophilus leucurus*; Grant 2020). This reduction in *E. tiehmii* numbers, known as an herbivory event, was evident in *E. tiehmii* population surveys (Table 2).

It is currently unclear what lead to this herbivory event, if similar events have occurred in the past, and what the likelihood is of another event occurring in the future. Above average precipitation from 2015 to 2019 may have led to a substantial increase in rodent numbers. Below average precipitation in 2020 may have led to a decrease in the abundance of annual plants that could have caused a shift in herbivory and the increased damage to *Eriogonum tiehmii*. To date, the ecological connection between precipitation and the herbivory event is largely speculative. Herbivory on *E. tiehmii* has not been documented in any other year that scientists have surveyed for the species.

Small Population

Generally, the extinction probability of a population increases as population size decreases, with small populations having a greater risk of extirpation and extinction. The risks to small plant populations, like *Eriogonum tiehmii*, include losses in reproductive individuals, declines in seed production and viability, loss of pollinators, loss of genetic diversity, and Allee effects (Eisto *et al.* 2000; Berec *et al.* 2007; Willis 2017).

Recovery

The Service completed a recovery outline for *Eriogonum tiehmii* on March 23, 2023 (Service 2023). The recovery outline found that *E. tiehmii* has a high degree of threat and has a low recovery potential, primarily due to a potential conflict with mining interests at the population location. The recovery outline was written before additional details and design elements were known about the proposed mine. Threats to the species described in the recovery outline were habitat loss and degradation from mineral exploration and development, road development and OHV use, livestock grazing, and nonnative, invasive plant species; herbivory; and climate change. The Service found that with sufficient funding and commitment to implementing conservation measures, monitoring, and incorporating monitoring results into adaptive management, the species could be recovered. We will consider these aspects of recovery in the later sections of this biological opinion, including how the implementation of the proposed project, inclusive of conservation measures and monitoring, factor into the recovery of the species.

Important aspects of recovery for *Eriogonum tiehmii* include the following:

- stable or increasing, self-sustaining subpopulations with the physical and biological features needed to support the species that include open, sparsely vegetated areas, suitable soils and hydrology, and year-round and connected habitat for pollinators;
- maintenance of subpopulations to provide sufficient representation, resiliency, and redundancy to ensure a high probability of survival for the foreseeable future;
- collection of seeds for long-term ex situ storage and for testing propagation and transplantation methods;
- threats are sufficiently understood and abated; and
- demographic monitoring to provide the information necessary to ensure that these objectives are fulfilled.

The recovery outline described the following recovery objectives:

- Objective 1: Work with partners to protect the existing population (comprised of eight subpopulations) and critical habitat.
- Objective 2: Continue to fill knowledge gaps on species and population needs, habitat needs, and threats.
- Objective 3: Develop a research program to identify methods to direct seed, transplant, and/or translocate *Eriogonum tiehmii*.
- Objective 4: Implement long-term ex situ conservation measures.

Status of Designated Critical Habitat

The Service designated approximately 910 acres as critical habitat for *Eriogonum tiehmii* on December 16, 2022 (87 FR 77368). The entire unit, Rhyolite Ridge Unit, is on Federal lands managed by the BLM in the Silver Peak Range. Cave Springs Road, a rural, unpaved county

road, bisects the unit. The Service excluded roads and other man-made structures existing as of the effective date of the final rule from the designation of critical habitat.

The unit is currently occupied and contains the single population comprised of eight subpopulations of *Eriogonum tiehmii* and all the habitat that is occupied by the species across its range. This unit includes the physical footprint of where the plants currently occur and their surroundings to 1,640 feet in every direction from the periphery of each subpopulation. This area of surrounding habitat contains the PBFs necessary to support the conservation needs of *Eriogonum tiehmii*.

In designating critical habitat, we found that a 1,640-foot area around subpopulations was sufficient to support the maximum foraging distance of primary insect visitors that are presumed to be the pollinators of *Eriogonum tiehmii*. For genetic exchange of *E. tiehmii* to occur, insect visitors and pollinators must be able to move freely between subpopulations.

Physical and Biological Features

Based on our current knowledge of the habitat characteristics required to sustain the species' life-history processes, we determined that the following PBFs are essential to the conservation of *Eriogonum tiehmii*:

1. Plant community. A plant community that supports all life stages of *Eriogonum tiehmii* includes:
    a. Open to sparsely vegetated areas with low native plant cover and stature.
    b. An intact, native vegetation assemblage that can include, but is not limited to, *Atriplex confertifolia* (shadscale saltbush), *Artemisia nova* (black sagebrush), *Ephedra nevadensis* (Nevada mormon tea), *Hilaria jamesii* (James' galleta), and *Sporobolus airoides* (alkali sacaton) to maintain plant to plant interactions and ecosystem resiliency and provide the habitats needed by *E. tiehmii* insect visitors and pollinators.
    c. A diversity of native plants whose blooming times overlap to provide insect visitors and pollinator species with flowers for foraging throughout the seasons and to provide nesting and egg-laying sites; appropriate nest materials; and sheltered, undisturbed habitat for hibernation and overwintering of pollinator species and insect visitors.
2. Pollinators and insect visitors. Sufficient pollinators and insect visitors, particularly bees, wasps, beetles, and flies, are present for the species' successful reproduction and seed production.
3. Hydrology. Hydrology that is suitable for *Eriogonum tiehmii* consists of dry, open, relatively barren, upland sites subject to occasional precipitation from rain and/or snow for seed germination.
4. Suitable soils. Soils that are suitable for *Eriogonum tiehmii* consist of:
    a. Soils with a high percentage (70 to 95 percent) of surface fragments that are classified as clayey, smectitic, calcareous, mesic Lithic Torriorthents; clayey-

skeletal, smectitic, mesic Typic Calcicargids; and clayey, smectitic, mesic Lithic Haplargids.

b. Soils that have a thin (0 to 5.5 inches) A horizon, B horizons that are present as Bt (containing illuvial layer of lattice clays) or Bw (weathered), C horizons that are not always present, and soil depths to bedrock that range from 3.5 to 20 inches.
c. Soils characterized by a variety of textures, and include gravelly clay loam, sand, clay, very gravelly silty clay, and gravelly loam.
d. Soils with pH greater than 7.6 (*i.e.*, alkaline) in all soil horizons.
e. Soils that commonly have on average boron and bicarbonates present at higher levels, and potassium, zinc, sulfur, and magnesium present at lower levels.

Threats to Critical Habitat

Critical habitat for *Eriogonum tiehmii* is subject to anthropogenic threats such as mineral development, road development and OHV activity, livestock grazing, nonnative and invasive plant species, and climate change (Service 2022).

Livestock Grazing

Eriogonum tiehmii critical habitat is within the BLM's Silver Peak livestock grazing allotment. Evidence of livestock use within subpopulations has been observed in the past. In 2022, the current permittee voluntarily agreed to not graze livestock in the vicinity of the subpopulations. As a result, effects from grazing to *E. tiehmii* critical habitat have been reduced relative to past conditions. Past grazing practices may have altered the PBFs of critical habitat; however, because we do not have information regarding their condition prior to the onset of livestock grazing, we cannot assess how it affected the plant community, pollinators and insect visitors, hydrology, and soils we have described as PBFs.

Mineral Exploration

As stated previously, mineral exploration activities within critical habitat began in 1962. Drilling of boreholes and excavation of exploration trenches likely degraded the PBFs of critical habitat. Mineral exploration, including the proposed project, was identified in the final critical habitat rule as an activity that may require special management considerations (87 FR 77368). This biological opinion is the first large-scale mining project in the action area that an action agency has engaged with the Service through Interagency Consultation (16 U.S.C. 1531 *et seq).*

Ioneer disturbed 11.8 acres of critical habitat in 2018 and 2019 as a part of their South Infill Exploration Project. Reclamation of disturbance within critical habitat is ongoing. The disturbed area was recontoured and seeded upon completion. An evaluation in 2022 indicated that 7.6 acres required additional reclamation; 4.8 acres needed additional reseeding and 2.8 acres required more substantial work. Work currently being undertaken to achieve reclamation goals within critical habitat includes construction of a gate adjacent to and south of Cave Springs Road, regrading and reshaping of disturbed areas where more substantial work was required, application of pre-emergent herbicide in the regraded/reshaped areas to limit germination of non-

native, invasive, and noxious weed species, and reseeding in those areas that needed reseeding (Stantec 2024).

Roads and OHVs

Roads within critical habitat include the county-maintained Cave Springs Road, unnamed wash roads, and past mine exploration roads. Use of these roads likely creates dust that may affect at least two of the PBFs of critical habitat, specifically the plant community and pollinators and insect visitors. We do not have site-specific information regarding this potential effect. In addition, off-road use by OHVs has resulted in effects to the PBFs of designated critical habitat, as documented in multiple studies (Service 2022).

To restrict access of OHVs into critical habitat, the BLM constructed two pipe rail fences in December 2021 (Service 2022). One fence, approximately 1,500 feet long, was constructed along the unnamed wash road southeast of the critical habitat that supports subpopulation 1. A second fence was installed at the intersection of Cave Springs Road and an exploration road, preventing OHV access to the critical habitat that supports subpopulations 3, 4, 5, 6, and 7. These fences help protect designated critical habitat from further degradation due to OHVs.

Climate Change

We described how climate change may alter local conditions for *Eriogonum tiehmii* previously in this biological opinion. Specific monitoring data related to the PBFs that address the plant community, pollinators and insect visitors, and hydrology are not available to assess the effects from any shifts in precipitation or temperature cycles or amounts relative to the conservation value of critical habitat for *Eriogonum tiehmii*. Climate change is unlikely to affect the fourth PBF, soils. Climate change may increase the likelihood and severity of wildfires. The plant community (PBF 1) within critical habitat is dominated by low-growing, desert plant species; therefore, severe wildfire may not be a primary threat to this area because of a relatively low fire fuel load. However, a severe wildfire could reduce available habitat for the plant community and potential pollinators (PBF 1 and 2). Changes in temperature and precipitation caused by climate change could affect the plant community, pollinators, and hydrology (PBF 1, 2, and 3).

Nonnative and Invasive Plant Species

Nonnative, invasive plant species are a threat to critical habitat for *Eriogonum tiehmii* because they can degrade the native plant community required for the conservation of *E. tiehmii* (PBF 1). As stated in the *Status of the Species* section above, surveys have documented the presence of *Halogeton glomeratus* and it has since become the most abundant nonnative, invasive species within critical habitat and adjacent to all *E. tiehmii* subpopulations (Center for Biological Diversity 2019; Ioneer 2020; Fraga 2021b; WestLand 2021). Although *H. glomeratus* is not an extremely competitive plant and does not become dominant in undisturbed areas or areas with competing vegetation, salt desert shrublands (the dominant plant community in critical habitat where *E. tiehmii* occurs) are particularly susceptible to invasion of *H. glomeratus* if ground

disturbing activities that reduce desirable vegetation and increase bare soil occur in these communities (DiTomaso *et al.* 2013; Padgett *et al.* 2018, Fraga 2024).

Additional nonnative, invasive species found within critical habitat include *Salsola tragus* (prickly Russian thistle) and *Amaranthus albus* (tumbleweed). *S. tragus* was documented co-occurring with *Halogeton glomeratus* in disturbed areas (*i.e.*, near exploration wells and along the access road).

ENVIRONMENTAL BASELINE

The regulations implementing the Act define the environmental baseline as "the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The impacts to listed species or designated critical habitat from Federal agency activities or existing Federal agency facilities that are not within the agency's discretion to modify are part of the environmental baseline" (50 CFR 402.02).

Because the action area encompasses all subpopulations of *Eriogonum tiehmii* and its designated critical habitat, the condition of *E. tiehmii* and its designated critical habitat in the action area have been fully described in the Status of the Species section above.

Action Area

The implementing regulations for section 7(a)(2) of the Act define "action" as "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas. Examples include but are not limited to: (a) actions intended to conserve listed species or their habitat; (b) the promulgation of regulations; (c) the granting of licenses, contracts, leases, easements, rights-of-way, permits, or grants-in-aid; or (d) actions directly or indirectly causing modifications to the land, water, or air" (50 CFR 402.02). For this biological opinion, the proposed action is the BLM's approval of the plan of operation for the Rhyolite Ridge Lithium-Boron Mine Project. If the BLM approves the plan of operations, Ioneer will construct, operate, and close the mine, as summarized in the Description of the Proposed Action section of this biological opinion, and described in detail in the BLM's biological assessment and WestLand's Buckwheat Protection Plan (Stantec 2024; WestLand 2024a).

Regulations implementing the Act describe the "action area" as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 402.02). Consequently, the action area for this consultation includes all areas where the BLM's proposed action, approval of the plan of operations of the project, will result in modifications to the land, air, or water. In this biological opinion, we define the action area as the

physical footprint of all project-related elements of the Rhyolite Ridge Lithium-Boron Mine Project, inclusive of the Access and Infrastructure Corridor, which may be exposed to project-caused modifications such as noise, lighting, particulate matter deposition, and altered surface runoff. We estimate that project-caused modifications of land, air, or water will occur up to the 10-foot drawdown contour (where groundwater will draw down 10 feet) around the OPA where land may experience subsidence; 50 feet from the centerline of SR 264 where dust, lighting, and noise may extend beyond current conditions due to increased traffic; and 100 feet from the centerline of Hot Ditch and Cave Springs roads where dust, lighting, and noise may extend beyond current conditions due to increased traffic. See Figure 6 for an illustration of the action area.

The action area, which covers 30,492 acres (Stantec 2024), is public land administered by the BLM and managed for multiple uses. Past and present activities in the action area that may be affecting the current condition of *Eriogonum tiehmii* and its critical habitat include livestock grazing, mineral exploration, the construction of roads, and OHV use. The past and present status of each of these activities in the action area is described above in the *Status of the Species and Status of Designated Critical Habitat* sections.

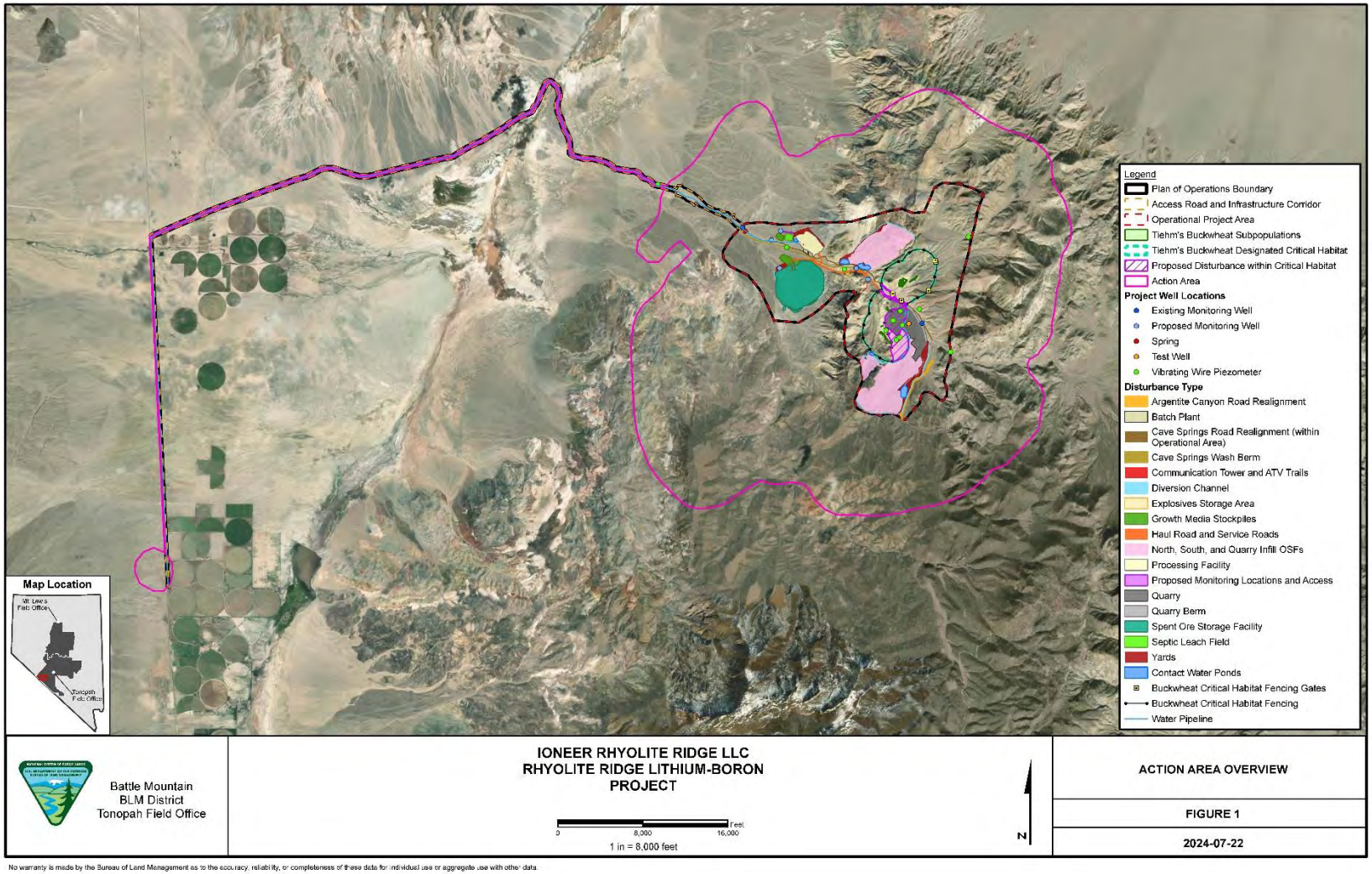

Figure 6: Action Area (Stantec 2024)

Status of the Species in the Action Area

All subpopulations of *Eriogonum tiehmii* are within the action area; see the Status of the Species section.

Status of Critical Habitat in the Action Area

All critical habitat of *Eriogonum tiehmii* is within the action area; see the Status of the Species section.

EFFECTS OF THE ACTION

Introduction

Regulations implementing the Act define the effects of the action as "all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action but that are not part of the action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action" (50 CFR 402.02).

In this section, we will review the stressors that will result from the proposed project that are relevant to the species and its critical habitat. We define stressors as changes to the land, air, or water that result from the proposed action. We will determine if the species or critical habitat will be exposed to those stressors. Where exposure to stressors occurs, we will consider how the species and its critical habitat will respond to the exposure. Given those responses, we will determine how the project may affect the numbers, distribution, reproduction and recovery of the species, and the physical and biological features of critical habitat.

Stressors from Project Activities

Exploration

Stressors from exploration include particulate matter deposition (*e.g.*, dust from excavation, driving on dirt surfaces, and tailpipe emissions), pollinator habitat removal, and effects to pollinators (from lighting, noise, and vibration). Exploration will be temporary and will occur within areas proposed for disturbance from other project elements.

Mining Operations

Stressors from mining operations include herbicides, spread of invasive plants, release of hazardous materials and runoff (*e.g.*, leached elements and petroleum), greenhouse gas emissions, quarry slope wall failure, fencing, particulate matter deposition (*e.g.*, dust from excavation and blasting, driving on dirt surfaces, and tailpipe emissions), pollinator habitat removal, changes in hydrology, and effects to pollinators (from lighting, noise, and vibration).

Overburden and Backfill Management

Stressors from overburden and backfill management include particulate matter deposition (*e.g.,* dust from clearing and grubbing, placing material, placing alluvium, driving on dirt surfaces, and tailpipe emissions), pollinator habitat removal, changes in hydrology, release of hazardous materials and runoff (*e.g.,* leached elements, and petroleum), spread of nonnative plants, and effects to pollinators (from lighting, noise, and vibration).

Infrastructure

Stressors from infrastructure include particulate matter deposition (*e.g.,* dust from driving on dirt surfaces and tailpipe emissions), pollinator habitat removal, changes in hydrology, spread of non-native plants, and effects to pollinators (from lighting, noise, and vibration).

Waste Management

Stressors from waste management include habitat loss due to exposure to hazardous materials and runoff (*e.g.,* leached elements, and petroleum).

Stressors relevant to Eriogonum tiehmii

After review of the Status of the Species, the following stressors from project activities are relevant to *Eriogonum tiehmii*: herbicides; spread of nonnative, invasive plants; release of hazardous materials and runoff; greenhouse gas emissions; quarry slope wall failure; fencing; pollinator habitat removal; particulate matter deposition (*e.g.,* dust); changes in hydrology; and effects to pollinators (from lighting, noise, and vibration).

Stressors relevant to Eriogonum tiehmii critical habitat

After review of the Status of Critical Habitat, the following stressors from project activities are relevant to designated critical habitat for *Eriogonum tiehmii*: herbicides; spread of nonnative, invasive plants; release of hazardous materials and runoff; greenhouse gas emissions; quarry slope wall failure; fencing; pollinator habitat removal; particulate matter deposition (e.g., dust); changes in hydrology; and effects to pollinators (from lighting, noise, and vibration)

Effects on *Eriogonum tiehmii*

Ioneer has modified the proposed project from previous iterations to avoid direct damage to (*e.g.,* crushing) or removal of *Eriogonum tiehmii* plants. Consequently, we anticipate that the proposed action will not damage *E. tiehmii* plants during the life of the action (*i.e.,* 35 years). The following paragraphs discuss how *E. tiehmii* plants may be exposed to project-related stressors and, given that exposure, how the individuals will respond.

Although project facilities will not directly remove individual *Eriogonum tiehmii* plants, the proposed facilities will occur in close proximity to *E. tiehmii*. Table 4 lists the nearest distance between the subpopulations and several of the closest major project elements**.** Seven dust

monitoring locations will be in direct proximity to each subpopulation. These dust monitoring stations, which are described in APCM-9, are intended to assist in monitoring and minimizing project-related effects from dust to *E. tiehmii* and pollinators.

Table 4: Proximity of proposed mine facilities to Eriogonum tiehmii subpopulations (Stantec 2024).

Subpopulation	Distance from South and Quarry Infill OSF (feet)	Distance from Quarry (feet)	Distance from Haul Road (feet)	Distance from North OSF (feet)	Distance from Dust Monitoring Locations (feet)
1	4,025	1,849	1,502	2,022	37
2	4,536	2,381	2,558	2,587	14
3	1,520	15	138	3,758	12
4	329	558	2,171	5,825	12
5	331	208	1,611	5,327	45
6a	265	698	2,379	6,225	Adjacent to subpopulation
6b	165	744	2,858	6,882	Adjacent to subpopulation
7	492	1,046	2,823	6,680	No dust monitors occur at this subpopulation
8	6,087	3,998	4,118	2,263	No dust monitors occur at this subpopulation

Herbicides

Eriogonum tiehmii individuals may be affected by exposure to herbicides associated with controlling nonnative and invasive weeds (*i.e.*, APCM-7). However, Ioneer will implement multiple measures to reduce the risk of exposure, such as utilizing a 50-foot-wide buffer from *E. tiehmii* subpopulations for herbicide application and measures to reduce herbicide drift. Weed control within the 50-foot-wide buffer will be accomplished using hand pulling or other approved hand-operated mechanical methods. All herbicide applicators will be state certified,

receive site-specific training, and either be qualified as or accompanied by a biological monitor. Herbicide application will meet all product label requirements. Therefore, we do not expect *E. tiehmii* to be adversely affected by the application of herbicides.

Spread of Nonnative, Invasive Plants

Eriogonum tiehmii may be affected by exposure to nonnative, invasive plant species. As described in the *Status of the Species* section above, *E. tiehmii* occurs in a sparsely vegetated community with low plant cover and stature. Where *E. tiehmii* grows, the vegetation varies from exclusively *E. tiehmii* plants to sparse associations with a few other low growing herbs and grass species. Nonnative, invasive plant species could negatively affect *E. tiehmii* through competition (*i.e.*, loss of resources needed for survival, like sunlight and water), displacement (*i.e.*, loss of habitat), and degradation of the quality and composition of its habitat. Fraga (2024) claims nonnative, invasive plants "are likely to spread, especially along haul roads, due to the large amounts and high frequency of water application that is proposed to occur to reduce fugitive dust" and "this amount of water is significant and would increase the spread of invasive plant species across the Project area that might otherwise be limited to Cave Spring." However, Ioneer will implement a non-native, noxious, and invasive weed species control program through the life of the project, until final reclamation success criteria have been achieved and the bond has been released to minimize project-related adverse effects from non-native species (APCM-7). A noxious weed monitoring and control plan will be developed prior to implementation of project construction in coordination with the BLM and the Service. The plan will include measures for the use of herbicides, trained staff, and routine monitoring. With the implementation of APCM-7, we do not expect *E. tiehmii* to be adversely affected by the spread of nonnative invasive plants.

Hazardous Materials and Runoff

Exposure to hazardous materials, including petroleum from vehicles or equipment, runoff, and leached elements may result from the proposed project. We do not expect *Eriogonum tiehmii* plants will be exposed to hazardous materials from equipment because equipment containing hazardous materials will not be used within or above occupied habitat. We do not expect *E. tiehmii* to be exposed to runoff because Ioneer will implement stormwater control measures (APCM-14). We do not expect *E. tiehmii* to be exposed to leached elements because facilities that contain materials with the potential to leach hazardous metals (*e.g.*, OSF contact water ponds) are located far away from populations and are at lower elevations.

Release of hazardous materials may expose pollinators and their habitat to this stressor outside of habitat occupied by *Eriogonum tiehmii*. Individual pollinators and plants the pollinators rely on may die or have decreased reproductive success because of exposure to hazardous materials. A decrease in the abundance of pollinators could affect the reproduction of *E. tiehmii*. To minimize the potential adverse effects on pollinators outside of habitat occupied by *Eriogonum tiehmii*, soils contaminated with hazardous materials resulting from spills or leaks will be addressed immediately, with spill kits being located throughout the action area; and contaminated soils will be removed from the spill site, stored in appropriate secondary containment areas, and

transported to a licensed off-site disposal facility. We expect few pollinators and the plants they rely on will be exposed to hazardous materials. Given we do not expect *E. tiehmii* or its pollinators to be exposed to hazardous materials, including petroleum from vehicles and equipment, runoff, or leached elements, we do not expect *E. tiehmii* to be adversely affected by hazardous materials.

Greenhouse Gas Emissions

Operations associated with the proposed project will result in approximately 471,589 tons per year of direct greenhouse gas emissions and 24,429 tons per year of indirect GHG emissions in terms of carbon dioxide (CO_2; Stantec 2024). Indirect greenhouse emissions are related to transport and delivery of quarried materials. As stated previously, greenhouse gas emissions have been linked with accelerated global climate change. As a result, the proposed project may contribute to climate change to some extent.

Although the emissions likely to be emitted from the proposed project can be quantified, the Service cannot determine the extent to which *Eriogonum tiehmii* will be exposed to the emissions and how *E. tiehmii* will respond to that specific exposure. That is, we cannot quantify the level of impact the greenhouse gas emissions from this individual project will have on global climate change, how that impact will translate to climatic changes within the action area, and how the *E. tiehmii* will respond to the stressors from the proposed mine. Adverse effects to *E. tiehmii* caused by project-related emissions (*e.g.*, increased risk of severe wildfire, and changes to temperature and precipitation) are not reasonably certain to occur.

Quarry Wall Slope Failure

The west quarry wall will be lower in elevation and adjacent to *Eriogonum tiehmii* subpopulations. Slope failure may adversely affect *E. tiehmii,* its pollinators, and their habitats by habitat loss and direct mortality. Ioneer has incorporated design features into the quarry construction plan to minimize risks associated with slope failure, including the use of ground anchors (APCM-2). During the mine-life, these design features will result in an estimated factor of safety of 1.2 for the quarry wall adjacent to subpopulations. During and after mine closure, additional design features (*i.e*., buttresses) will increase the modeled slope stability in the vicinity of the *E. tiehmii* subpopulations in the closed quarry to a factor of safety of 1.81 to 2.71. The modeled slope stability included a review of the closed quarry with its associated lake. Geo-Logic Associates (2023) examined whether the lake would affect the critical slip surface of various locations around the quarry and found that there were no locations near *E. tiehmii* subpopulations, and only one location away from *E. tiehmii,* where water elevation interacted with the critical slip surface, decreasing the factor of safety in that distant, specific location from 1.9 to 1.72. Therefore, the risk of wall slope failure has been minimized, and adverse effects to *E. tiehmii* from wall slope failure are discountable (Geo-Logic Associates 2023, WestLand 2024a). Although Emerman (2024) regards the slope stability analysis as unreliable, largely based on Australian mining standards, an architect/civil engineer with the Service reviewed the Supplemental Geotechnical Report prepared by Geo-Logic Associates and found it to be acceptable (Johns 2023; Geo-Logic Associates 2023). Given the proposed design of the quarry

walls (APCM-2), and ongoing stability monitoring during operations (APCM-3), failure of the wall slope is not reasonably certain to occur. Consequently, *E. tiehmii* is not expected to be exposed to this stressor.

Fencing

Fencing construction may affect *Eriogonum tiehmii* through loss or disturbance of pollinator habitat, changes to the current hydrological conditions (*i.e.*, how water flows across the surface of the land) that support occupied habitat due to digging soil for fence post installation, increasing particulate matter deposition during fence construction, and spreading non-native vegetation. The proposed fencing is a conservation measure intended to prevent unauthorized access or disturbance to *E. tiehmii* subpopulations from the proposed project (APCM-4) and to deter mammals from being attracted to dust monitoring stations (APCM-9). Fencing will be four-strand wildlife-friendly design with the top and bottom strands barbless. Fence construction will not remove any individual *E. tiehmii* plants and fencing will not cast shade on *E. tiehmii* plants.

To minimize adverse effects from fence construction, vegetation and soil disturbance will be limited to the smallest amount necessary, construction personnel will only use areas outside *E. tiehmii* occupied habitat for work areas, and fenced areas will be monitored during quarterly critical habitat monitoring (APCM-15). With the implementation of quarterly monitoring, and because of the minimal level of disturbance required for fence construction and the temporary nature of this activity, effects to *E. tiehmii* subpopulations from loss or disturbance to pollinator habitat, particulate matter deposition, altered hydrology, and the spread of nonnative vegetation will be insignificant. We do not expect *E. tiehmii* to be adversely affected from installing and maintaining fencing.

Particulate Matter Deposition

Various elements of the proposed project will generate particulate matter emissions (*e.g.*, dust and aerial pollutants), including vehicular travel along the access roads, quarry operations (*e.g.*, blasting), construction operations (including construction of the South and Quarry Infill OSF, North OSF, Cave Springs Road realignment, and Cave Springs Wash berm), haul traffic on the haul road, access to monitoring wells and access to Communication Tower 3.

Dust

Dust deposition has been shown to have a variety of physiological effects on plants when they are exposed to the stressor (Stantec 2024). Common documented effects to plants include declines in photosynthetic and transpiration rates due to deposited dust decreasing the stomatal conductance of leaves, declines in photosynthetic rates due to a reduction in photosynthetically active radiation reaching the leaves, and increased leaf temperatures. These physiological effects may result in reduced plant growth and survival. In addition, plant species may experience reduced reproduction from dust deposition. Many of the documented effects have been shown to vary in magnitude depending on the plant species, soil types, and precipitation. In this section,

we will consider what levels of dust deposition will result in effects to *Eriogonum tiehmii* and if the proposed project will generate dust levels sufficient to result in those biological effects.

Determining the level of dust deposition at which effects to *Eriogonum tiehmii* are reasonably certain to occur is difficult without species-specific studies or studies that document a no-effect threshold in similar species. In addition, most studies document total dust deposition, which can make comparison to the dust deposition rates modeled for the proposed project difficult. Stantec (2024) reviewed the current literature regarding the biological effects of dust deposition on plants, including studies that measured dust deposition in various levels of grams per square meter (g/m^2) that resulted in photosynthetic effects, reduced shoot growth, and decreased fruit production. However, none of the plants mentioned in these studies were *Eriogonum* species from the southwest; different species likely respond to dust in different ways and to different degrees. Studies regarding the effects of dust on a species of milkvetch (*Astragalus* spp.) from the desert southwest have potential applicability to *E. tiehmii*. Using the results of that study, Stantec (2024) used a threshold of 4 g/m^2/day as the impact threshold for particulate matter deposition in the analysis for *E. tiehmii*; that is, based on this information, we will consider levels of dust deposition above 4 g/m^2/day to be where *E. tiehmii* may begin to experience adverse effects.

This represents the best scientific and commercial data available regarding the effects of dust deposition on *Eriogonum tiehmii* because it was a study of a perennial plant in a similar environment in the desert southwest. The available science is very limited, and there are no studies that directly address *E. tiehmii*. We have no information to suggest a different threshold than 4 g/m^2 per day is appropriate. Although Fraga (2024) states the studies using *Astragalus* spp. may not be comparable and impacts to *E. tiehmii* could be more significant, no alternative studies or dust deposition thresholds were provided. Therefore the 4 g/m^2 threshold continues to be the best available science related to *E. tiehmii*. However, if BLM approves the proposed project, Ioneer will fund research using *E. tiehmii* plants it has growing in its greenhouse under its federal recovery permit, and possibly in-situ within the OPA if approved by BLM and the Service (APCM-9). The research will provide data on the physiology and growth of *E. tiehmii* and will be used to refine thresholds for the implementation of the management strategy outlined here. That is, if the science shows that a different threshold is appropriate, management will be triggered at that new threshold. Finally, Ioneer will conduct demographic monitoring of the species (APCM-12) that will document changes in population trends, which combined with abiotic monitoring (*e.g.*, dust, noise and light monitoring), will guide management of the proposed project using the best scientific and commercial data available.

Dust deposition is likely to decrease in subpopulations 1, 2, and 8 from current conditions because the unpaved road between these subpopulations will be closed to public use. Construction of Communication Tower 4 will require the use of this road for approximately seven days with three round trips per day. Once in operation, Ioneer anticipates a single round trip per month for inspection and routine maintenance. On rare instances when the tower needs repair, additional trips will be required for maintenance. The speed limit for all vehicles using the road to Communication Tower 4 will be 10 miles per hour. This level of use will be less than

current recreational uses and at slower speeds (WestLand 2024a); consequently, we consider these effects to be insignificant.

Subpopulations 3, 4, 5, 6, and 7 (particularly subpopulations 3 and 6) near the quarry, haul road, and South and Quarry Infill OSFs will be exposed to elevated dust levels from current conditions. WestLand (2024a) provides an air impact modeling analysis of dust flux from the haul road for early phases of quarry development (year 3 of mine operations) and peak operations (year 11 of mine operations). The speed limit on the haul road will be 35 miles per hour. WestLand conducted the modeling by using multiple inputs for background concentrations, surface silt material content, and fugitive dust control efficiency. To be conservative in this effects analysis, maximum modeled rates of dust deposition at varying levels of dust control efficiencies were used for the contents of modeled surface materials containing 1.7 and 6.4 percent silt.

No background data (*i.e.,* long-term information collected prior to implementation of the proposed action) has been collected on dust deposition in the action area. To account for the lack of background data in the action area, WestLand (2024a) assessed average daily background dust flux based on 19 sites in Nevada and California from the U.S. Geological Survey (USGS) Open-File Report 03-138 and used 0.057 g/m^2/day as a conservative proxy for background levels in the action area based on that report (USGS 2003). Without site specific data collection, this modeling provides the best available data for assessment.

As described in APCM-9 and WestLand (2024a), Ioneer will control fugitive dust on roadways and other areas of surface disturbance (*i.e.,* the quarry) with water and/or approved dust suppressants to achieve between 85 and 90 percent efficiency. Total estimated dust flux based on maximum values from model results for the haul road at year 3 under an 85 percent control efficiency will be minimal, with rates similar to the modeled background rates. This is due to the minimal traffic expected at that stage of project development.

This estimate of dust flux does not consider dust from the quarry, which is possible from blasting and excavation in the early stages of quarry development. As a result, the amount of dust flux at year 3 may be an underestimate. However, blasting within approximately 328 feet of *Eriogonum tiehmii* subpopulations will incorporate blasting mats or other suitable covering materials as described in APCM-11 to minimize dust from blasting; water or other suppressants will be used in the quarry to minimize dust.

At the peak of quarry activity (*i.e.*, year 11), dust flux due to the haul road will increase by approximately 580 to 1,475 percent for the 85 percent control efficiency scenario for 1.7 and 6.4 percent silt, respectively. At this stage, dust input from the pit is expected to be less because the deeper pit will likely capture much of the dust produced. Consequently, the modeling based only on the haul road is unlikely to have underestimated the amount of dust during year 11 peak operations. Overall, the model predicts that the proposed project will produce the greatest amount of dust during year 11.

The total estimated dust flux at 85 percent control efficiency based on both 1.7 and 6.4 percent silt values from model results for the haul road at year 11 will be less than the estimated rates that affected reproduction and growth, but greater than levels estimated to produce effects to photosynthesis (Stantec 2024). However, as described previously, *Eriogonum tiehmii* may respond differently to dust deposition than the species for which we have information. Because it is difficult to estimate the probability and magnitude of effects based on available published data and modeled dust flux, Ioneer will implement dust monitoring (APCM-9). The monitoring will be designed to monitor and minimize effects to *E. tiehmii*, and to ensure the threshold established, 4g/m^2/day, remains appropriate to minimize effects. As stated above, Ioneer will control fugitive dust on roadways and other areas of surface disturbance (*i.e.*, the quarry) with water and/or approved dust suppressants to achieve between 85 and 90 percent efficiency. While the use of water to control dust may result in the spread of nonnative, invasive plant species, we expect this stressor to be managed through the implementation of APCM-7. Effects to pollinators from the use of water or dust suppressants are not reasonably certain to occur. We reviewed the report produced by McCarthy (2024) and found that while resuspension of dust suppressant could occur, we cannot predict the extent of exposure to pollinators, nor how they or how *E. tiehmii* may respond with reasonable certainty. In addition, Ioneer will monitor dust monthly at seven locations and increase the frequency of water applications and/or approved dust suppressants if the current threshold of 4g/m^2/day is met. Should these actions not reduce fugitive dust emission levels, Ioneer will evaluate specific placement of dust control fencing and establishment of speed limits lower than 35 miles per hour along the haul road proximate to *E. tiehmii* subpopulations to reduce fugitive dust emission levels further, as appropriate. Dust suppression will not occur outside of the footprint of project disturbance. Stormwater management activities will be implemented to ensure that any water impacted by the project does not leave the disturbance footprint. The Service and BLM will review and consider approval of the procedures and protocols for monitoring and management of dust before project implementation. As a result of the proposed ongoing data collection, monitoring, and management, adverse effects to *E. tiehmii* resulting from dust will be minimized. Also, the effects are anticipated to be minor to *E. tiehmii* given that the dust flux estimates are on the low end of concentrations under which effects have been observed in other studies. As a result, population level effects to *E. tiehmii* from dust deposition are not expected to occur.

Dust deposition can also result in mortality of insect pollinators. However, the effects depend on the type of dust and vary by species of insect. APCM-9 will be implemented to monitor and manage dust, including seven on-site dust monitors to mitigate fugitive dust. Should dust monitoring adjacent to *Eriogonum tiehmii* subpopulations result in actual dust deposition exceeding the 4 g/m^2/day threshold, specific management actions will be implemented to reduce dust deposition. As a result, project-related exposure of pollinators to the stressor of dust is unlikely to alter pollinator dynamics to such an extent that reproduction in *E. tiehmii* will be appreciably altered.

Other Aerial Pollutants

In addition to the dust deposition modeling for haul traffic, the air quality impact analysis for the proposed project provided details on particulate matter emissions and other criteria pollutants,

relative to the National Ambient Air Quality Standards (NAAQS). This air quality impact analysis included point sources, volume sources, quarry sources, tail pipe emissions, on-site road sources, and off-site commuter and delivery traffic sources to assess all emission sources pertaining to the proposed project to determine compliance with the primary standards set forth in the NAAQS (Stantec 2024, WestLand 2024a).

The NAAQS secondary standards define levels necessary to protect the public "welfare" from any known or anticipated adverse effects of a pollutant. All language referring to effects on "welfare" (*i.e.*, secondary standards) includes, but is not limited to, effects on soils, water, crops, vegetation, manmade materials, animals, wildlife, weather, visibility, and climate, damage to and deterioration of property, and hazards to transportation, as well as effects on economic values and on personal comfort and well-being, whether caused by transformation, conversion, or combination with other air pollutants (WestLand 2024a).

Quantifying background concentrations is necessary to evaluate total pollutant impacts in the action area, including project-related impacts and existing conditions. For rural areas, background concentrations are established for PM_{10} and $PM_{2.5}$ (particulate matter 10 and 2.5 micrometers or less in diameter, respectively). Background concentrations for PM_{10} for the proposed project background were set for a 24-hour period at 10.2 micrograms per cubic meter ($\mu g/m^3$) and at 9 $\mu g/m^3$ annually. The approved annual and 24-hour $PM_{2.5}$ background concentration values are 2.3 $\mu g/m^3$ and 8 $\mu g/m^3$, respectively (Stantec 2024). The air quality impact analysis demonstrated that particulate matter concentrations resulting from the proposed project, exposure to which may adversely affect *Eriogonum tiehmii*, are estimated to be below the primary and secondary NAAQS for $PM_{2.5}$ and PM_{10}, for all receptors and emissions combinations. Some peak impacts are adjacent to the northwest portion of occupied habitat for *E. tiehmii*; however, where particulate matter impacts will occur in these areas, the analysis showed that the project will comply with the primary standards set forth in the NAAQS. Because the project will comply with primary NAAQS, it will also be compliant with secondary standards, so impacts to vegetation (such as *E. tiehmii*) are anticipated to comply with NAAQS. As a result, population level effects from aerial pollutants are not expected to occur.

Hydrology

The proposed project will alter both surface and groundwater hydrology within the action area. For example, surface water will be routed around the OSF and SOSF, and dewatering of the quarry will result in groundwater drawdown. Changes in groundwater levels are calculated in 10-foot increments. The extent of the 10-foot drawdown contour associated with the quarry extends up to a maximum of approximately five miles from the quarry in a westerly direction and approximately four miles in a northerly direction (see Figure 2).

The proposed project is not expected to alter surface water hydrology or moisture supply within any of the subpopulations of *Eriogonum tiehmii* based on the location and elevation of the various project elements. *E. tiehmii* subpopulations are located at elevations greater than planned facilities (WestLand 2024a). Additionally, because *E. tiehmii* is dependent on occasional

precipitation and not groundwater for moisture, the increase in the depth to groundwater below the subpopulations due to drawdown is not likely to adversely affect the species.

We also considered whether project-related increases in the depth to groundwater could affect other plant species in the area, which could in turn, adversely affect pollinators of *Eriogonum tiehmii*. Groundwater within the action area has been documented to be 140 feet or greater in depth (Stantec 2024). Typical species within the local vegetation community have a range of root depths from shallow diffuse root systems to deeper more robust root systems. Plants with deeper root systems include Nevada jointfir (*Ephedra nevadensis*) with roots that can extend up to 6.6 feet below the ground (Stantec 2024). Therefore, plants in the area surrounding occupied habitat for *Eriogonum tiehmii* which may be supporting pollinators are unlikely to be using the groundwater that may be affected by the proposed project. As a result, project-related increases in the depth to groundwater due to drawdown is not likely to adversely affect *E. tiehmii* through changes to other plant species and pollinators.

Lowering of a water table by dewatering or water production (groundwater drawdown) may result in subsidence, which can degrade soil and vegetation, but these effects are not well studied and are difficult to apply to the action area. Subsidence within *Eriogonum tiehmii* subpopulations is expected to be minimal at 4 inches or less (Stantec 2024; HydroGeoLogica 2020). The Service cannot determine how *E. tiehmii* will respond to this minimal amount of subsidence. Adverse effects to *E. tiehmii* caused by project-related subsidence are not reasonably certain to occur.

Summary

As we stated previously in this biological opinion, “jeopardize the continued existence of” means “to engage in an action that reasonably will be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species” (50 CFR 402.02). This regulatory definition focuses on how the proposed action will affect the numbers, distribution, and reproduction of the species under consideration in the biological opinion. For that reason, we have used those aspects of the status of *Eriogonum tiehmii* as the basis to assess the overall effect of the proposed action on the species.

In this section, we will synthesize the analyses contained in the previous paragraphs to determine how the BLM’s approval of the plan of operations for the proposed project are likely to affect the numbers, distribution, and reproduction of *Eriogonum tiehmii* (see *Analytical Framework for Section 7(a)(2)*). We will then assess the effects of these aspects of the proposed action on the recovery of the species; this assessment will lead to a conclusion of whether the proposed action is likely to appreciably reduce the likelihood of both the survival and recovery of *E. tiehmii* in the wild.

Effects on Numbers

The proposed project will not remove or disturb any *Eriogonum tiehmii* individuals because all ground disturbance will be located outside the subpopulations of the species. In addition, while

quarry slope wall failure could result in the loss of individuals, as discussed above, based on the best scientific information available we determined that quarry slope wall failure is unlikely to occur, and therefore a reduction of *E. tiehmii* numbers due to slope failure is unlikely. Consequently, the proposed action will not alter the number of *E. tiehmii* individuals.

Effects on Distribution

Eriogonum tiehmii exists as 1 population, composed of 8 subpopulations, on approximately 10 acres. All proposed project facilities will be located outside of occupied habitat. The placement of dust monitoring equipment within occupied habitat will remove an insignificant amount of habitat for the footings of the monitors and fence posts (on the order of a few square feet) (APCM-9). In addition, while quarry slope wall failure could result in the loss of habitat and a decreased distribution of the species, as discussed above, based on the best scientific information available we determined that quarry slope wall failure is unlikely to occur, and therefore a reduction of the distribution of *E. tiehmii* due to slope failure is unlikely. Consequently, the proposed action will not alter the distribution of *E. tiehmii*.

Effects on Reproduction

Eriogonum tiehmii plants reproduce through the production of seeds. Although *E. tiehmii* plants appear to be capable of self-pollination, pollination significantly increases seed production (McClinton *et al.* 2020) and leads to increased genetic diversity. As a result, adverse effects to pollinators may affect *E. tiehmii* through reduced seed production and genetic exchange (though not eliminated because the species is capable of self-pollination). As described below, the proposed project has the potential to affect populations of pollinators through habitat removal, collisions with mine equipment/traffic, and changes in abiotic factors such as noise, light, and dust.

Effects from Habitat Removal

The proposed project will result in the disturbance of 191 acres of habitat adjacent to occupied habitat for *Eriogonum tiehmii* where pollinators are likely present. Impacts to pollinator species and community assemblages, abundance, and diversity may occur due to reduced available habitat, which could in turn impact pollination visitation rates of *E. tiehmii*.

Reclamation of habitat will be designed to restore habitat loss for pollinators and will consist of the measures detailed in APCM-6. Quarry highwall benches will be seeded, but no further pollinator habitat reclamation will occur on quarry highwall benches due to safety and inaccessibility after construction of the highwall and benches. The South and Quarry Infill OSF will be graded to their final configuration during operations, with regrading required for construction of the buttresses, in year 18 of operations. The haul road outside of the quarry will be recontoured to match existing grades, with an approximately 16-foot-wide OHV road remaining for monitoring access. All areas of disturbance reclamation within the critical habitat boundary, except the highwall benches and the Cave Springs Road realignment, will receive the full pollinator habitat reclamation specified in APCM-6. The quarry lake, Cave Springs Road

realignment, and OHV road used for monitoring access will remain as unreclaimed features, which amount to a total of 45 acres within the critical habitat boundary.

Although approximately 146 acres will be restored to pollinator habitat or highwall bench reclamation, reclamation of habitat adjacent to *Eriogonum tiehmii* will not begin until year 19 and is not expected to achieve interim success criteria until year 23. Therefore, the disturbance to pollinators within these areas will be long term. Both the long-term and permanent removal of approximately 146 acres and 45 acres, respectively, will impact habitat important to pollinators that support reproduction of *E. tiehmii*. Pollinator habitat that will be disturbed includes: a diversity of native plants whose blooming times overlap to provide insect visitors and pollinator species with flowers for foraging throughout the seasons and provide nesting and egg laying sites; appropriate nest materials; sheltered, undisturbed habitat for hibernation and overwintering of pollinator species and insect visitors. In the following paragraphs, we will discuss how this loss of pollinator habitat will affect the reproduction of *E. tiehmii*.

As mentioned previously, studies that correlate insect visitor frequency with pollinator effectiveness or performance (the ability of a floral visitor to remove and deposit pollen) have not been conducted for *E. tiehmii*. However, during extensive pollinator surveys, WestLand (2023) found that the action area supports diverse pollinator communities, both within and adjacent to habitat occupied by *Eriogonum tiehmii* (*i.e.*, habitat that will either be directly removed or indirectly affected by project-related activities). Pollinator communities within *E. tiehmii* subpopulations differed in overall species composition and abundance from the adjacent habitat and from other occupied subpopulations. WestLand (2023) observed that the differences observed in pollinator communities are driven by species replacement, not by richness differences. This indicates there are generally different species at each subpopulation (species replacement), not differences in the overall number of different species at each subpopulation (richness). They hypothesized that the lack of identifiable ecological differences between sample locations that will drive species replacement suggests that pollinator communities are assembled based on conditions on a local scale. In other words, the local habitat conditions at each subpopulation are the most important features that drive which pollinators will occur there. Further, WestLand (2023) did not identify any regions adjacent to *E. tiehmii* subpopulations that will be of heightened importance for maintaining pollinator diversity for the subpopulations. Therefore, due to the relatively high diversity and local nature of the pollinator communities within *E. tiehmii* subpopulations, the disturbance of habitat outside of subpopulations is not likely to reduce pollinator populations within subpopulations to the extent that seed set for individual plants will be impaired. In addition, the high diversity of pollinator species throughout the action area ensures that a reduction in the abundance of one or a few species resulting from project activities or climate change will not impair reproduction of *E. tiehmii* because many other pollinator species are likely to fill their ecological role. Finally, multiple APCMs will monitor the response of *E. tiehmii* to reduced pollinator populations and Ioneer will implement management actions if biological effects are detected to ensure the effects of the proposed project to *E. tiehmii* are consistent with this analysis (APCM-12, APCM-16, and APCM-18).

Although pollinator habitat will be removed adjacent to *Eriogonum tiehmii* subpopulations long term (*i.e.*, approximately 23 years) and permanently due to the proposed project, habitat with

alternative pollen and nectar sources, and sites for nesting and shelter will remain within each subpopulation and adjacent to each subpopulation such that we expect ecosystem processes will continue to function largely unchanged. A small amount of pollinator habitat will be affected near subpopulations 1, 2, and 8. More pollinator habitat will be removed near subpopulations 3, 4, 5, 6, and 7, but pollinator habitat will primarily remain to the north, south, and west of each of these subpopulations (*i.e.*, impacts from the proposed project will predominantly occur to the east of each subpopulation). Fraga (2024) cited concerns that habitat disturbance could affect pollinators and that sufficient habitat was needed to buffer against these effects. We found that pollinator habitat continues to border each subpopulation on most sides geographically, except to the east. Because research has not found any particular location to be of heightened importance for pollinators and the proposed project will not surround or severely limit any single subpopulation of *E. tiehmii*, we expect plant community dynamics that support pollinators to continue to function largely unchanged within each subpopulation. Although pollinator habitat near the subpopulations will be removed long term and permanently due to the proposed project and those effects are adverse, we do not expect changes in ecosystem functions to such an extent that reproduction in *E. tiehmii* will be appreciably altered.

Effects from Light, Noise, Traffic, and Dust

Increased light, noise, traffic, and dust from the project may also affect *Eriogonum tiehmii* pollinator movement, diversity, and abundance. Sources of noise will include construction of roads and facilities, operations at the processing plant, blasting activities, and vehicular traffic. Areas of increased noise production may affect movement, physiological stressors, or physiological processes of pollinators. However, facilities with the most continuous noise (*e.g.*, processing plant) are located more than 1 mile from *E. tiehmii* subpopulations and are unlikely to have an appreciable effect on pollinator populations in the vicinity of *E. tiehmii*. Regarding the haul roads, traffic will vary by year, with operations in year 11 having the highest roundtrip use occurring; however, the haul road is not adjacent to *E. tiehmii* subpopulations, which will minimize exposure to the stressor. Within the subpopulations, Ioneer will implement APCM-17 to monitor noise levels during peak flowering. Noise monitoring data, along with other biotic and abiotic monitoring data (*e.g.*, noise, light, local weather conditions, and dust deposition) will be used to explore and identify changes in site condition for *E. tiehmii* and year-over-year shifts in potential pollinator/insect visitor diversity and abundance. This measure will assist Ioneer in identifying changes in site conditions which may be caused by the proposed project and to implement measures to further minimize adverse effects to *E. tiehmii*. Because facilities with the highest noise levels (*e.g.*, processing plant) are located further than where we expect local pollinators servicing *E. tiehmii* to be exposed to levels at which population declines will occur, the haul road is not located adjacent to subpopulations, and various APCMs will be implemented to monitor noise and pollinators, we do not expect noise generated from the proposed project to alter pollinator dynamics to such an extent that reproduction in *E. tiehmii* will be appreciably altered.

Sources of light from project-related activities will include lighting for non-daytime work at the quarry, South and Quarry Infill OSF, North OSF and night-time haul truck and vehicular traffic. Areas of increased light production may affect pollinator movement and may attract insects and

associated predators such as bats. Lights that create attractants may also serve as traps, increasing predation. The adverse effects of lighting will be minimized through the implementation of APCM-8. This conservation measure was designed to minimize artificial light and avoid lighting at night, avoid light spill, avoid white and blue wavelengths to reduce insect attraction and filter lights with an amber or red tint to minimize visibility to pollinators and other insects. This will include the use of stationary lights and light plants, with lighting being directed onto the site where operations are occurring and not adjacent areas. The project will use light emitting diode (LED) or organic light emitting diode (OLED) light sources that can be switched off, dimmed easily, aimed well, and shielded to minimize up lighting. When color rendering is determined not critical, lighting will use 500-nanometer filtered LED fixtures or pure narrow-band amber LED lamps or equivalent to limit the use of sub-500-nanometer lighting spectra. Appropriate implementation of the lighting measures detailed in APCM-8 for stationary lighting sources is anticipated to minimize pollinator exposure and response to the stressor of lighting. Lighting impacts from vehicular and haul truck traffic will still occur, but the level of light from haul truck and vehicular traffic will be limited and small in extent relative to the entire action area, and roads are not located within any subpopulations. Therefore, lighting generated from the proposed project is unlikely to alter pollinator dynamics to such an extent that reproduction in *E. tiehmii* will be appreciably altered.

Traffic, particularly haul trucks proximate to subpopulation 3, has the potential to reduce populations of pollinators through direct mortality. Literature on the magnitude of vehicular mortality on insects is limited, but evidence suggests effects are focused to a narrow corridor adjacent to the road, and are influenced by habitat characteristics (*e.g.*, pollinator hotspots), seasonal timing, traffic volume, and road width (Stantec 2024; Phillips *et al.* 2020). Traffic associated with the proposed project will occur in critical habitat along the Cave Springs Road and, starting in year 4, along the eastern edges of subpopulations 3, 4, 5, and 6. Some mortality of pollinators is expected as haul road traffic increases from baseline conditions. However, as stated above, we are not aware of any location of heightened importance for pollinators in the action area where we will expect more collisions with vehicles, and haul road traffic volume will be relatively low (*e.g.*, in comparison to a public highway). The loss of a pollinators from traffic caused by the proposed project is unlikely to alter pollinator dynamics to such an extent that reproduction in *Eriogonum tiehmii* will be appreciably altered.

Dust deposition can result in mortality of insect pollinators. However, the effects depend on the type of dust and vary by species of insect. APCM-9 will be implemented to monitor and manage dust. Should dust monitoring adjacent to *Eriogonum tiehmii* subpopulations result in actual dust deposition exceeding the 4 g/m^2/day threshold, specific management actions will be implemented to reduce dust deposition. As a result, project-related exposure of pollinators to the stressor of dust is unlikely to alter pollinator dynamics to such an extent that reproduction in *E. tiehmii* will be appreciably altered.

Additional impacts from air pollution and emissions such as diesel exhaust or hydrocarbons may reduce pollinator foraging efficiency and pollinator visitation rates by affecting chemical cues and therefore decrease pollination rates and pollen flow in flowering plants (Stantec 2024). However, the proposed project will be compliant with primary and secondary National Ambient

Air Quality Standards. Therefore, although pollinators will be exposed to air pollution and emissions, the exposure will be minimized such that it is unlikely to alter pollinator dynamics to such an extent that reproduction in *E. tiehmii* will be appreciably altered.

In conclusion, the loss of pollinators and their habitat and the reduced effectiveness in pollinating *Eriogonum tiehmii* are primary threats posed by the proposed action to the reproduction of *E. tiehmii*. Overall, we expect that the proposed action will not appreciably alter the number of pollinators. We also expect that the proposed conservation measures will reduce the adverse effects of habitat loss, dust, noise, lighting, and traffic on pollinators and the monitoring program will allow Ioneer to adjust management to further reduce adverse effects detected in the future. For these reasons, we conclude that the proposed action is not likely to appreciably reduce the reproduction of *E. tiehmii*.

Effects on Recovery

The proposed project will support the following recovery objectives, described in the recovery outline (Service 2023):

- Objective 2: Continue to fill knowledge gaps on species and population needs, habitat needs, and threats;
- Objective 3: Develop a research program to identify methods to direct seed, transplant, and/or translocate *Eriogonum tiehmii*; and
- Objective 4: Implement long term ex-situ conservation measures.

Ioneer has committed to implement APCM-12 and APCM-18. The Buckwheat Protection Plan further describes how Ioneer, the Service, and BLM will work together to implement these conservation efforts (WestLand 2024a). To summarize, Ioneer will collect demographic and recruitment monitoring data that supports Objective 2 and will develop an ex-situ conservation program which supports Objectives 3 and 4. Elements of the ex-situ program are experimental; it is unclear if the program will ultimately be successful in moving the species status closer to recovery. However, implementing the Buckwheat Protection Plan will not preclude us from recovering the species.

The proposed project will affect our ability to meet Objective 1, which is to work with partners to protect the existing population and critical habitat. Regarding the intent to protect the existing population, individual *Eriogonum tiehmii* plants will not be disturbed or damaged by the proposed action and our ability to protect the physical extent of the existing population will be unchanged. However, regarding the intent to protect critical habitat, the project will result in the permanent loss of 45 acres of critical habitat; this habitat would not be protected or contribute to the recovery of *E. tiehmii* in the future. In addition, 146 acres of critical habitat will be disturbed for 19 years before reclamation begins and is not expected to meet functional (interim) reclamation objectives until year 23 (see Table 1). If the proposed project is implemented, 146 acres of critical habitat that was disturbed could be protected in the future after reclamation, but recovery will be delayed for a significant period of time (*i.e.*, until after year 23). During that time, work towards achieving Objectives 2, 3 and 4 will occur because of Ioneer's obligation to

implement conservation measures as a result of BLM's approval of the plan of operations. The delay in recovery is significant but must be considered in the context of the improving our ability to achieve the other recovery objectives. Overall, we do not expect the proposed project will result in permanent habitat loss or a delay in habitat protection at the scale that our ability to recover the species will be reduced appreciably.

Effects on Critical Habitat

We identified the following project-related stressors as being relevant to designated critical habitat for *Eriogonum tiehmii*: herbicides; spread of nonnative, invasive plants, release of hazardous materials and runoff; greenhouse gas emissions; quarry slope wall failure; fencing; pollinator habitat removal; particulate matter deposition (*e.g.*, dust); changes in hydrology; and effects to pollinators (from lighting, noise, and vibration). We will analyze how the PBFs of critical habitat will respond to exposure to these stressors and, ultimately, how the proposed project may affect the conservation value of critical habitat for *E. tiehmii*.

The proposed project will result in disturbance of approximately 191 acres of critical habitat for *Eriogonum tiehmii*, out of a total of 910 acres designated. This habitat supports the plant community for (PBF 1) and pollinators for *E. tiehmii* (PBF 2). Of this disturbance, approximately 146 acres will be reclaimed, and 45 acres will not. The quarry lake, Cave Springs Road realignment, and OHV road used for monitoring access will remain as unreclaimed features. Although some reclamation activities will begin concurrent with mining, the early reclamation activities will occur outside of critical habitat and will not include pollinator habitat reclamation, except for the experimental test plots that will be conducted on the South and Quarry Infill OSF beginning in year 4 of operations. The experimental test plots will be used to refine and optimize various restoration methods during early phase reclamation efforts, increasing the likelihood that reclamation efforts will ultimately be successful.

Reclamation within critical habitat will not begin until year 19, after the buttresses will be constructed to provide for the long-term stability of the west quarry wall (reducing the risk of exposing critical habitat to wall slope failure). Ioneer anticipates functional (interim) reclamation objectives will be achieved by year 23, four years after pollinator habitat reclamation occurs. Ioneer anticipates achieving long-term reclamation objectives and release of the reclamation bond for reclamation within critical habitat by year 33, ten years after the functional (interim) reclamation objectives are achieved and 14 years after pollinator habitat reclamation occurs. Reclamation in desert environments may take certain vegetation communities up to 30 years or more following reclamation to fully establish (Stantec 2024). Fraga (2024) states that restoration in an arid landscape is challenging and results in high rates of failure. To address this uncertainity, Ioneer will experiment, refine, and optimize various restoration methods during early phase reclamation efforts (APCM-6). Beginning in year 4 of quarry operations, experimental test plots for habitat restoration will be implemented on areas outside of *E. tiehmii* critical habitat to better inform pollinator habitat reclamation within critical habitat when it begins. Reclaimed sites will be assessed both qualitatively and quantitatively. The protocols and procedures to evaluate enhanced reclamation methods to achieve the reclamation objectives

outlined in this plan will be developed in collaboration with the Service and BLM prior to year 2 of the project and will include interim and final success criteria.

The implementation of APCM-6 increases the likelihood that reclamation efforts will ultimately be successful, such that permanent loss of the 146 acres of reclaimed habitat is not reasonably certain to occur. However, as pollinator habitat reclamation will not fully occur until year 19, with reclamation establishing over a period of 14 years or potentially longer, some adverse effects to the PBF #1 and PBF #2 will be long term.

In addition to the area of critical habitat that will be disturbed or removed by project facilities, dust deposition and other project effects could alter the function of PBFs, such as the plant community and pollinators. Consequently, our analysis in this biological opinion is broader in scope than just the areal extent of impacts and related to how the project will affect the conservation value of designated critical habitat.

As we stated previously in this biological opinion, the "destruction or adverse modification" of critical habitat means "a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02). This regulatory definition focuses on how the proposed action will affect the physical and biological features of the critical habitat under consideration in the biological opinion. For that reason, we used those PBFs as the basis to assess the overall effect of the proposed action on the species.

PBF 1: Plant Community

PBF 1 is "a plant community that supports all life stages of *Eriogonum tiehmii*." The proposed project may affect PBF 1 through particulate matter deposition (*e.g.*, dust); habitat removal; changes in hydrology; exposure to hazardous materials and runoff; herbicide application; greenhouse gas emissions; quarry slope wall failure; and spread of non-native plants.

The plant community is important to the conservation of *Eriogonum tiehmii* primarily within each existing subpopulation. For example, PBF 1a and 1b describe the microhabitat conditions where E. *tiehmii* individuals have limited competition for resources, and where other plant species are present to provide important plant to plant interactions and ecosystem resiliency. The stressors of changed hydrology and exposure to hazardous materials and runoff are not likely to adversely affect PBF 1 because these stressors occur far away or lower in elevation, and conservation measures are in place to contain spills and runoff, such that exposure is unlikely for the plant communities.

As stated previously in *Effects on Eriogonum tiehmii*, greenhouse gas emissions have been linked with accelerated global climate change. As a result, the proposed project may contribute to climate change to some extent. Although the emissions likely to be emitted from the proposed project can be quantified, the Service cannot determine the extent to which the plant communities in critical habitat will be exposed to the emissions and how the plant communities will respond to that specific exposure. That is, we cannot quantify the level of impact the greenhouse gas emissions from this individual project will have on global climate change, how

that impact will translate to climatic changes within the action area, and how PBF 1 will respond to the stressors from the proposed mine. Adverse effects to PBF 1 caused by project-related emissions are not reasonably certain to occur.

Quarry slope failure, should it occur, may adversely affect PBF 1 by habitat loss. However, Ioneer designed the construction of the quarry and modeled slope stability over the long term to acceptable levels to minimize risks associated with slope failure (APCM-2). Therefore, the risk of wall slope failure has been minimized, and adverse effects to PBF 1 from wall slope failure are discountable (Geo-Logic Associates 2023, WestLand 2024a). An architect/civil engineer with the Service reviewed the Supplemental Geotehnical Report prepared by Geo-Logic Associates and found it to be acceptable (Johns 2023; Geo-Logic Associates 2023). Given the proposed design of the quarry walls (APCM-2), and ongoing monitoring of their stability during operations (APCM-3), failure of the wall slope is not reasonably certain to occur. Consequently, PBF 1 is not expected to be exposed to this stressor.

The stressor of particulate matter deposition and herbicide application could reduce the fitness or reproductive success of the other plant species within critical habitat that are serving this important role (PBF 1b); however, adverse effects from particulate matter deposition will be minimized because Ioneer will implement APCM-9 to monitor and minimize dust levels and APCM-12 to help detect changes in demographics or recruitment in *Eriogonum tiehmii*. Adverse effects to PBF 1b from herbicide application will be minimized because Ioneer will implement multiple actions, as part of APCM-7, to reduce the risk of exposure, such as utilizing a 50-foot-wide buffer from *E. tiehmii* subpopulations for herbicide application and measures to reduce herbicide drift. Weed control within the 50-foot-wide buffer will be accomplished using hand pulling or other approved hand-operated mechanical methods. All herbicide applicators will be state certified, receive site-specific training, and either be qualified as or accompanied by a biological monitor. Herbicide application will meet all product label requirements. Therefore, we do not expect that plants serving the role of PBF 1b will experience reduced fitness or reproductive success due to herbicide application.

The stressor of spreading nonnative invasive plants may increase the vegetation and cover within occupied critical habitat, adversely affecting PBF 1a and 1b through decreased fitness and reproductive success of *Eriogonum tiehmii* and other native plant species. Fraga (2024) claims that nonnative, invasive plants “are likely to spread, especially along haul roads, due to the large amounts and high frequency of water application that is proposed to occur to reduce fugitive dust” and “this amount of water is significant and would increase the spread of invasive plant species across the Project area that might otherwise be limited to Cave Spring.” Ioneer will implement a non-native, noxious, and invasive weed species control program through the life of the project, until final reclamation success criteria have been achieved and the bond has been released to minimize project-related adverse effects from non-native species (APCM-7). A noxious weed monitoring and control plan will be developed prior to implementation of project construction in coordination with the BLM and the Service. The plan will include measures for the use of herbicides, trained staff, and routine monitoring. With the implementation of APCM-7, we do not expect PBF 1a and 1b to be adversely affected by the spread of nonnative invasive plants. .

PBF 1c describes the conservation value of having a diversity of native plants whose blooming times overlap to provide insect visitors and pollinator species with flowers for foraging throughout the seasons and to provide nesting and egg-laying sites; appropriate nest materials; and sheltered, undisturbed habitat for hibernation and overwintering of pollinator species and insect visitors. The long-term and permanent removal of 146 acres and 45 acres, respectively, of habitat containing PBF 1c is likely to adversely affect the conservation value of critical habitat for *E. tiehmii.*

A small amount of PBF 1c will be affected near subpopulations 1, 2, and 8. Critical habitat that supports PBF 1c near subpopulations 3, 4, 5, 6, and 7 will primarily remain to the north, south, and west of each subpopulation (*i.e.,* impacts from the proposed project will predominantly occur to the east of each subpopulation). Because each subpopulation will continue to be bordered by PBF 1c on most sides geographically (except for critical habitat to the east), and the proposed project will not surround or severely limit any single subpopulation, plant community dynamics that support pollinators are expected to continue to function within each subpopulation. In addition, the area that will be disturbed does not contain any unique feature that is not found in the remaining critical habitat. We expect that Ioneer's efforts to restore most of the long-term disturbed areas will ultimately be successful. Although habitat containing PBF 1c will be removed long term and permanently due to the proposed project and those effects are adverse, we do not expect the effects to rise to the scale that appreciably diminishes the function of this PBF.

PBF 2: Pollinators and insect visitors

PBF 2 describes the need for sufficient pollinators and insect visitors, particularly bees, wasps, beetles, and flies, to be present for the successful reproduction and seed production of *Eriogonum tiehmii*. The proposed project may expose PBF 2 to the stressor of effects to pollinators (*e.g.,* lighting, noise, particulate matter deposition, traffic, and vibration).

Increased sources of lighting, noise, particulate matter deposition, traffic and vibration may affect *Eriogonum tiehmii* through impacts to pollinator movement, diversity, and abundance. Sources of noise will include construction of roads and facilities, operations at the processing plant, blasting activities, and vehicular traffic. Areas of increased noise production may affect movement, physiological stressors, or physiological processes of pollinators. However, facilities with the most continuous noise (*e.g.,* processing plant) are located more than 1 mile from *E. tiehmii* subpopulations and are unlikely to have an appreciable effect on pollinator populations.

Regarding the haul road, traffic will vary by year, with Year 11 having the highest roundtrip hauling occurring. The haul road for transport of ore to the processing plant and overburden to the North OSF is located to the east side of the quarry, The haul road is mostly located outside of critical habitat, other than where it occurs along the eastern side of the quarry footprint, and where it exits the quarry to get to the processing plant and North OSF. The haul road is located away from subpopulations, within the quarry footprint, and lower in elevation than critical habitat nearby that will not be disturbed as part of the proposed project. These elements of the project design will minimize exposure of pollinators servicing *E. tiehmii* and therefore reduce the

adverse effects to the conservation value of PBF 2. However, adverse effects to PBF 2 will remain, including increased noise, light, traffic, and dust.

Within critical habitat and the subpopulations, Ioneer will implement APCM-17 to monitor noise levels during peak flowering. Noise monitoring data, along with other biotic and abiotic monitoring data (*e.g.*, noise, light, local weather conditions, and dust deposition), will be used to explore and identify changes in site conditions within critical habitat and year-over-year shifts (if any) in potential pollinator/insect visitor diversity and abundance. The goal of this measure is to assist Ioneer in identifying changes in site conditions that may be caused by the proposed project and to implement measures to further minimize adverse effects to critical habitat. Because Ioneer will implement several APCMs to monitor noise and pollinators and implement management measures if needed, we do not expect the effects from sound to rise to the scale that appreciably diminishes the function of this PBF.

Sources of light from project-related activities will include lighting for non-daytime work at the quarry, South and Quarry Infill OSF, North OSF and night-time haul truck and vehicular traffic. Areas of increased light production may affect pollinator movement and may attract insects and associated predators such as bats. Lights that create attractants may also serve as traps, increasing predation. The adverse effects of lighting to PBF 2 will be minimized through the implementation of APCM-8. This conservation measure was designed to minimize artificial light and lighting at night, avoid light spill, avoid white and blue wavelengths to reduce insect attraction, and filter lights with an amber or red tint to minimize visibility to pollinators and other insects. This will include the use of stationary lights and light plants, with lighting being directed onto the site where operations are occurring and not adjacent areas. LED or OLED light sources will be used and can be switched on or off, dimmed easily, aimed well, and shielded to minimize up lighting. When color rendering is determined not critical, lighting will use 500-nanometer filtered LED fixtures or pure narrow-band amber LED lamps or equivalent to limit the use of sub-500 nanometer lighting spectra. Appropriate implementation of the lighting measures detailed in APCM-8 for stationary lighting sources is anticipated to minimize pollinators exposure and response to the stressor of lighting, minimizing adverse effects to PBF 2. Lighting impacts from vehicular and haul truck traffic will still occur, but the level of light from haul truck and vehicular traffic will be limited and small in extent relative to the entire action area. Therefore, lighting generated from the proposed project is unlikely to alter pollinator dynamics to such an extent that it appreciably diminishes the function of this PBF.

Traffic within critical habitat has the potential to reduce populations of pollinators through direct mortality, adversely affecting PBF 2. Literature on the magnitude of vehicular mortality on insects is minimal, but limited evidence suggests effects are focused to a narrow corridor adjacent to the road, and are influenced by habitat characteristics (*e.g.*, pollinator hotspots), seasonal timing, traffic volume, and road width (Stantec 2024; Phillips *et al.* 2020). Some mortality of pollinators is expected as haul road traffic increases from baseline conditions. However, we are not aware of any location of heightened importance for pollinators in the action area where we will expect more collisions with vehicles, and haul road traffic volume will be relatively low (*e.g.*, in comparison to a public highway). We expect the loss of a small number of pollinators from traffic caused by the proposed project (Stantec 2024). The loss of pollinators

from traffic is unlikely to alter pollinator dynamics to such an extent that it appreciably diminishes the function of this PBF.

Dust deposition can result in mortality of insect pollinators. However, the effects depend on the type of dust and vary by species of insect. To minimize adverse effects for PBF 2, Ioneer will implement APCM-9 to monitor and manage dust, including seven on-site dust monitors to mitigate fugitive dust. Should dust monitoring adjacent to *Eriogonum tiehmii* subpopulations result in actual dust deposition exceeding the 4 g/m^2/day threshold, specific management actions will be implemented. As a result, project-related exposure of pollinators to dust are expected to be minimized such that adverse effects (*e.g.*, decrease in seed set or genetic diversity) at the population level for *E. tiehmii* are not expected. Additional impacts from air pollution and emissions such as diesel exhaust or hydrocarbons may reduce pollinator foraging efficiency and pollinator visitation rates by affecting chemical cues and therefore decrease pollination rates and pollen flow in flowering plants. However, the proposed project will be compliant with primary and secondary National Ambient Air Quality Standards. Therefore, although pollinators will be exposed to dust deposition, air pollution, and emissions, the exposure will be minimized such that it is unlikely to alter pollinator dynamics to such an extent that appreciably diminishes the function of this PBF.

We expect that Ioneer's efforts to restore a majority of the critical habitat will ultimately be successful and will function to support pollinators after reclamation. Pollinators will be adversely affected by project disturbance and habitat loss and, we do not understand if differences in effectiveness exist among the pollinator species. However, studies have demonstrated that the pollinators and insect visitors of *Eriogonum tiehmii*, are abundant and composed of a variety of species, and the areas of critical habitat that will be disturbed by the proposed project do not support a unique assemblage of pollinators and insect visitors. We do not expect the effects to rise to the scale that appreciably diminishes the function of this PBF.

PBF 3: Hydrology

PBF 3 is hydrology that is suitable for *Eriogonum tiehmii*. The stressor of changed hydrology may affect PBF 3. Critical habitat will be exposed to changed hydrology from facilities such as the quarry, quarry infill area, access roads, and fencing. In particular, fencing construction (APCM-4 and APCM-9) will involve construction within areas of critical habitat where surface water flows support PBF 3, which could affect the conservation value of critical habitat for *E. tiehmii*. All other project elements will be at lower elevations such that changes in surface water flows from the proposed project are not expected to affect the conservation value of PBF 3. To minimize adverse effects from fence construction (*e.g.*, digging soils which can change surface flows), vegetation and soil disturbance will be limited to the smallest amount necessary. Monitoring of the fenced areas will occur during the quarterly critical habitat monitoring (APCM-15) and will minimize potential adverse effects from modifying the flow of existing hydrology in the area to insignificant levels. We expect the proposed project will not change the hydrology supporting *E. tiehmii* at the scale that appreciably diminishes the function of this PBF.

PBF 4: Suitable soils

PBF 4 is soils that are suitable for *Eriogonum tiehmii*. Current research suggests that *E. tiehmii* is a soil specialist, so the soils where individuals currently occur are the most important for the conservation of the species. The proposed project may affect PBF 4 due to exposure to hazardous materials, runoff, and subsidence. If PBF 4 is exposed to hazardous materials and runoff, soils may be rendered unsuitable for *E. tiehmii*. However, suitable soils contributing to the conservation value of critical habitat to *E. tiehmii* are unlikely to be exposed to this stressor because equipment containing petroleum, or other hazardous wastes will not be used within or above critical habitat where spills could expose and damage suitable soils. Because we do not expect critical habitat will be exposed to hazardous materials or runoff, those potential stressors will not appreciably diminish the function of this PBF.

Lowering of a water table by dewatering or water production (groundwater drawdown) may result in subsidence, which can degrade soil and vegetation, but these effects are not well studied and are difficult to apply to the action area. Subsidence within *Eriogonum tiehmii* critical habitat is expected to be minimal (*i.e.,* 6 inches or less; Stantec 2024; HydroGeoLogica 2020). The Service cannot determine how *E. tiehmii* critical habitat will respond to this minimal amount of subsidence. Adverse effects to *E. tiehmii* critical habitat caused by project-related subsidence are not reasonably certain to occur.

CUMULATIVE EFFECTS

Cumulative effects are “effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation” (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. Because the action area is located entirely on Federal land administered by the BLM, no cumulative effects are associated with the proposed action.

CONCLUSION

After reviewing the current status of *Eriogonum tiehmii* and its critical habitat, the environmental baseline for the action area, the effects of the proposed activities, and the cumulative effects, we have determined that the activities considered in this biological opinion are not likely to jeopardize the continued existence of *E. tiehmii* or result in the destruction or adverse modification of its critical habitat. We have reached these conclusions for the following reasons.

Eriogonum tiehmii

The proposed project is not likely to reduce appreciably the survival and recovery of *Eriogonum tiehmii* in the wild by reducing the numbers, distribution, reproduction or recovery of the species. The proposed action will not result in the loss or removal of any *E. tiehmii* plants (*i.e.*, numbers), or decrease its distribution. The proposed project will have adverse effects on the species’ reproduction because of effects to pollinators and their habitats for approximately 23 years, and due to the permanent loss of a smaller portion of habitat. However, these effects will be

minimized, monitored, and reduced with the implementation of the APCMs. Further, we do not expect effects to pollinators and their habitats to appreciably disrupt the ecosystem services that the pollinators provide to *E. tiehmii*. We do not expect to see an appreciable reduction in the reproduction, numbers, or distribution of *E. tiehmii*; additionally, recovery objectives for the species will remain attainable.

***Eriogonum tiehmii* Critical Habitat**

The proposed project is not likely to appreciably diminish the value of critical habitat as a whole for the conservation of *Eriogonium tiehmii*. The proposed project will result in adverse effects to the first and second physical and biological features of critical habitat. Although the proposed project will result in the long-term disturbance (approximately 23 years) of 146 acres of the plant community that is the basis of PBF 1, and the permanent loss of 45 acres, we do not expect the adverse effects to appreciably diminish the value of critical habitat as a whole because: Ioneer's efforts to restore a majority of the disturbed areas will ultimately be successful; over the 23 years that critical habitat is disturbed, enough habitat will remain and be in a favorable configuration that plant-pollinator interactions will continue to function; and the area that will be disturbed does not contain any unique feature that is not found in the remaining critical habitat. Although the proposed project will result in long-term disturbance to pollinators, PBF 2, we do not expect the adverse effects to diminish the value of critical habitat as a whole because: Ioneer's restoration of the plant community will also restore the pollinator community; studies have demonstrated that the pollinators and insect visitors of *E. tiehmii*, are abundant and composed of a variety of species; and, as with the plant community, the disturbed areas of critical habitat do not support a unique assemblage of pollinators and insect visitors. Project effects to hydrology and soils will be minor and have insignificant effects on PBFs 3 and 4, respectively.

INCIDENTAL TAKE STATEMENT

"Take" as defined in section 3(19) of the Act applies only to listed animal species. Therefore, this biological opinion does not include an incidental take statement.

Ioneer should be aware that section 9(a)(2)(B) of the Act states that it is unlawful to, among other actions related to their transport or sale, "remove and reduce to possession any (endangered plant) species from areas under Federal jurisdiction; maliciously damage or destroy any such species on any such area; or remove, cut, dig up, or damage or destroy any such species on any other area in knowing violation of any law or regulation of any State or in the course of any violation of a State criminal trespass law."

If Ioneer wishes to collect *Eriogonum tiehmii* plants, seeds, or other parts of the plant from areas under BLM jurisdiction, it should apply to the Service for a for an enhancement of propagation or survival permit pursuant to section 10(a)(1)(A) of the Act.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened

species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The conservation recommendations below are described in further detail in the recovery outline for *Eriogonum tiehmii* (Service 2023) and have been limited to those that the Service believes to be within the authority of BLM; however, additional conservation actions may be considered by BLM to support the conservation of *E. tiehmii*. We recommend that BLM consider implementing the following actions to support the conservation of *E. tiehmii:*

1. Utilize regulatory authorities to permanently conserve *E. tiehmii* occupied and critical habitat.
2. Conduct and support research on *E. tiehmii* insect visitors (*e.g.,* observations of visitation frequency) and pollinator effectiveness or performance (*e.g.*, pollen collection from insects visiting flowers) to better understand important pollinators for the species.
3. Contribute to and support an ex-situ seed storage program at a Service-approved seedbank through the collection of *Eriogonum tiehmii* seed and following the collection guidelines in Center for Plant Conservation *Best Plant Conservation Practices to Support Species Survival in the Wild* (2019).

REINITIATION NOTICE

Reinitiation of consultation is required and must be requested by the Federal agency, where discretionary Federal involvement or control over the action has been retained or is authorized by law and:

1. If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered;
2. If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this biological opinion; or
3. If a new species is listed or critical habitat designated that may be affected by the identified action.

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APPENDIX

Several documents regarding specific protocols and procedures are detailed in the biological assessment (Stantec 20204) and Buckwheat Protection Plan (WestLand 2024a) but have yet to be developed. Table 1 in this Appendix provides a list of the stand-alone documents that will be prepared for the Applicant-Proposed Conservation Measures (APCMs), as described in the *Conservation Measures* section of this biological opinion. These documents will provide the protocols and procedures required to implement the conservation plans provided in this document as APCMs. These protocols and procedures will be reviewed and approved by the USFWS and BLM, as described in Table 1. These stand-alone documents are intended to facilitate implementation of the APCMs by outlining the specific protocols and procedures for each plan. All APCMs discussed in the following sections have been taken directly from the Buckwheat Protection Plan (WestLand 2024a).

Table 1 Monitoring and Implementation Plan Schedule and Requirements

Protocol and Procedures and Applicable APCMs	Due Date	Protocol/Procedure Description	Qualifications of Plan Author
Geotechnical Slope Management and Monitoring Procedures and Protocols Documentation/APCM-2 and APCM-3	Draft due three months prior to start of construction	In accordance with standard mining geotechnical protocol and MSHA requirements identifying the specific procedures that will be used to implement APCM-2 and ACPM-3 will be documented. Elements of the site-specific implementation procedures will include more specific description of the monitoring protocols described in APCM-3 and provided in the geotechnical reports prepared for the Action (Geo-Logic Associates 2022 and 2023), as well as the timing of the inspections and internal and external reporting requirements.	Ioneer will be responsible for funding the ongoing professional services contract. It is anticipated that a professional geotechnical and engineering firm will be retained to prepare and implement the monitoring procedures and protocol document. The preparation of the document shall be overseen and approved by a Professional Geotechnical Engineer with 10 or more years of relevant experience
Native Seed Collection and Propagation Protocols and Procedures (to support APCM-6)	Draft due third quarter of 2024	This protocol will be developed in coordination with the Great Basin Ecoregional Coordinator at the BLM Nevada State Office and the USFWS. It will provide guidance for venders and contractors that Ioneer will work with to accomplish the objectives of APCM-6. The protocol shall identify specific seed zones suitable for seed collection for the species in **Section 3.9.5** of this document, their propagation and use for the Action, estimate anticipated quantities of seed and plants needed per year, and outline planned seed collection and propagation schedules to ensure that sufficient locally sourced plants are available for experimental studies and reclamation needs. These procedures will utilize, as appropriate, the standard	Ioneer will fund the development of the procedures and protocols document and implementation of this aspect of APCM- 6. Ioneer anticipates that a qualified contractor selected for the preparation of the procedures and protocols document may include team members that have training as a horticulturalist, reclamation/restoration ecologist, or biologist and will benefit from participation in the BLM Arid Lands Reclamation Course. Ioneer will select a qualified contractor or individual to prepare the procedures and protocols document and Ioneer shall provide its recommendation to BLM and USFWS for review and confirmation that the contractor or individual meets the requirements set forth here. Such confirmation shall not be unreasonably withheld.

Protocol and Procedures and Applicable APCMs	Due Date	Protocol/Procedure Description	Qualifications of Plan Author
		techniques, such as those outlined in the BLM's Seeds of Success Technical Protocol (BLM 2024) for collection from native plant species.	
Pollinator Habitat Reclamation Experimentation and Optimization Study Procedures and Protocols (APCM-6)	Draft due Year 2 of operations	APCM-6 requires implementation of study plots to evaluate reclamation methods outlined in the conservation measure. Several methods to optimize the procedures provided to establish pollinator habitat vegetation within disturbed portions of critical habitat will be evaluated during the early phases of concurrent reclamation, through Year 18. These methods will include, but may not be limited to, soil amendments to facilitate establishment of the soil biome, enhanced (diversity and quantity) seed mixes based on the species identified in APCM-6, containerized plantings, supplemental irrigation approaches to support containerized plants used in reclamation until establishment, and the use of salvaged succulents. The procedures and protocols for implementation of the study plots called for in APCM-6 will lay out an experimental design that includes the treatments above, the monitoring and analytical approach for evaluation of the treatments identified and reporting requirements to optimize the pollinator habitat reclamation program.	Ioneer will fund the development of the procedures and protocols document and implementation of APCM-6. Ioneer anticipates that a qualified contractor selected for the preparation of the procedures and protocols document may include team members that have training as a restoration/reclamation ecologist or biologist with at least 10 years of relevant experience and participation in Center for Plant Conservation Rare Plant Academy courses. The development of the document will benefit from the participation of a pollinator ecologist familiar with the ecology and participation in BLM Arid Lands Reclamation Course by document preparers. Ioneer will select a qualified contractor or individual(s) to prepare the procedures and protocol document and Ioneer shall provide its recommendation to the BLM and the USFWS for review and confirmation that the contractor or individual meets the requirements set forth here. Such confirmation shall not be unreasonably withheld.
Pollinator Habitat Reclamation Implementation and Monitoring Protocols and Procedures (APCM-6)	Draft due three months prior to start of construction.	Using the plan provided in APCM-6, a stand-alone Pollinator Habitat Reclamation Implementation and Monitoring Protocols and Procedures document will be developed in coordination with the Great Basin Ecoregional Coordinator at the BLM Nevada State Office and USFWS in support of Ioneer's implementation of plan requirements in APCM-6 and its coordination and communication with vendors and contractors that may be retained to execute the work described in APCM-6. Specific monitoring protocols for annual quantitative sampling, including sampling design, field methods, data reduction, and statistical analysis to document progress towards success criteria are outlined in APCM-6 and will be included in the stand-alone protocol and procedures document. The stand-alone protocol and procedures document will outline the requirements for planning, implementation, and agency coordination for specific reclamation campaigns that will be implemented for the life of the Action. As appropriate, new information learned during test plot experimentation, lessons learned during ongoing monitoring activities, and/or general advances in reclamation science	Ioneer will fund the development of the procedures and protocols document and implementation of the pollinator habitat reclamation and implementation plan outlined in APCM-6. We anticipate that a qualified contractor selected for the preparation of the procedures and protocol document may include team members that have training as a horticulturalist, reclamation/restoration ecologist or biologist with 10 years of relevant experience. The development of the document will benefit from the participation of a pollinator ecologist and participation in the BLM Arid Lands Reclamation Course by document preparers. Ioneer will select a qualified contractor or individual(s) to prepare the procedures and protocols document and Ioneer shall provide its recommendation to the BLM and the USFWS for review and confirmation that the contractor or individual meets the requirements set forth here. Such confirmation shall not be unreasonably withheld.

Protocol and Procedures and Applicable APCMs	Due Date	Protocol/Procedure Description	Qualifications of Plan Author
		will be incorporated into the stand-alone protocol and procedure document, as appropriate. For planned pollinator habitat reclamation activities anticipated in Year 2, detailed implementation plans will be prepared as part of this effort.	
Non-Native, Invasive, and Noxious Species Management and Monitoring Protocols and Procedures (APCM-7)	Draft due three months prior to start of construction	A stand-alone noxious weed monitoring and control procedures and protocols guide will be developed in coordination with the Weeds Coordinator at the BLM Nevada State Office and USFWS. The procedures and protocols guide will build on the plan outlined in APCM-7 to provide specific guidance to field personnel for implementation and monitoring activities, including the frequency of monitoring efforts, data collection to track distribution of invasive and noxious plant species, control efficacy, and reporting requirements.	Ioneer will fund the development of the detailed procedures and protocols documentation and implementation of APCM-7. Ioneer anticipates that a qualified contractor selected for the preparation of the procedures and protocol document may include team members that include qualified biologist familiar with biology and identification of the targeted noxious and invasive plant species and Tiehm's buckwheat, who have completed the Nevada weed identification training or have completed comparable training protocols or have relevant experience/expertise, in conjunction with a certified weed applicator. Ioneer will select a qualified contractor or individual(s) to prepare the procedures and protocol document and Ioneer shall provide its recommendation to BLM and USFWS for review and confirmation that the contractor or individual meets the requirements set forth here. Such confirmation shall not be unreasonably withheld.
Light Monitoring Protocols and Procedures (APCM-8)	Draft due third quarter of 2024	Specific procedures and protocols will be developed to aid operations with the implementation of APCM-8. The procedures and protocols will provide the operations and maintenance requirements for the light monitors to be deployed, detailed data reduction, and reporting protocols.	Ioneer will fund the development of the detailed procedures and protocols documentation and implementation of APCM-8. It is anticipated that a qualified contractor selected for the preparation of the procedures and protocol document may include team members that include a qualified biologist familiar with light and its impacts on biological resources and knowledge of industrial lighting. Ioneer will select a qualified contractor or individual(s) to prepare the procedures and protocol document, and Ioneer shall provide its recommendation to the BLM and the USFWS for review and confirmation that the contractor or individual meets the requirements set forth here. Such confirmation shall not be unreasonably withheld.

Protocol and Procedures and Applicable APCMs	Due Date	Protocol/Procedure Description	Qualifications of Plan Author
Dust Monitoring Protocols and Procedures (APCM-9)	Draft due third quarter of 2024	Specific procedures and protocols will be developed to aid operations with the implementation of the plan outlined in APCM-9. The procedures and protocols will provide the design of the dust monitors to be deployed, and detailed sampling and reporting protocols.	Ioneer will fund the development of the detailed procedures and protocols document to implement the plan outlined in APCM-9. Procedures and protocols document development will be led by an air quality specialist with 10-plus years of experience in the monitoring and modeling of air resources. Ioneer will select a qualified contractor or individual to prepare the procedures and protocols document and Ioneer shall provide its recommendation to the BLM and the USFWS for review and confirmation that the contractor or individual meets the requirements set forth here. Such confirmation shall not be unreasonably withheld.
Study Design to Refine Trigger Thresholds for Dust Deposition on Tiehm's Buckwheat Subpopulations (APCM-9)	Draft due Year 1	The study design will lay out the statistical design including the treatments proposed, means and methods to administer the treatments, sample size, specific physiological parameters to be measured, and schedule. The experimental design will include, to the extent authorized by the USFWS, in situ experiments on individual Tiehm's buckwheat within the subpopulations.	Ioneer will fund the development of the study and its implementation. The lead researcher overseeing the study will be a plant ecologist/biologist with appropriate expertise in the ecophysiology of plants and will have access to lab facilities and field equipment necessary to conduct the study. Ioneer will select a qualified contractor or individual to prepare the study plan and Ioneer shall provide its recommendation to the BLM and the USFWS for review and confirmation that the contractor or individual meets the requirements set forth here. Such confirmation shall not be unreasonably withheld.
Tiehm's Buckwheat Demographic and Recruitment Monitoring Protocols and Procedures (APCM-12)	Draft due three months prior to start of construction	The procedures and protocols document will provide a stand-alone document to guide long-term implementation of APCM-12. It will provide an opportunity to refine and enhance the procedures currently being used. The annual quantitative monitoring component of the plan will document the specific sampling protocols and data analysis to track and monitor subpopulation demographics and recruitment.	Ioneer will be responsible for funding the preparation of the procedures and protocols document. Ioneer anticipates that a qualified contractor selected for the preparation of the procedures and protocols document may include team members that have an advanced degree in plant ecology or allied ecological field, 10 years of relevant experience, and participation in available courses offered by the Center for Plant Conservation Rare Plant Academy (note: only one of the nine training modules is complete at this time [March 15, 2024]). Ioneer will select a qualified contractor or individual to prepare the procedures and protocols document and Ioneer shall provide its recommendation to the BLM and the USFWS for review and confirmation that the contractor or individual meets the requirements set forth here. Such confirmation shall not be unreasonably withheld.
Tiehm's Buckwheat-Specific Environmental Awareness Program (APCM-13)	Draft due three months prior to start of construction	The training module will focus on general awareness (including identification and natural history) and restrictions put in place to protect Tiehm's buckwheat.	Ioneer will fund the development of the awareness program and its implementation. The program will be prepared by Ioneer personnel or contractors familiar with the requirements of the Buckwheat Protection Plan (WestLand 2024a)/APCMs and the final Biological Opinion issued by the USFWS, and the Record of Decision issued by the BLM.

Protocol and Procedures and Applicable APCMs	Due Date	Protocol/Procedure Description	Qualifications of Plan Author
Operation-Specific Training Modules (APCM-13)	Draft due three months prior to start of construction	These modules will be developed in addition to the Tiehm's buckwheat-specific environmental awareness program and will be tied to specific operational disciplines (*e.g.*, general maintenance staff responsible for lighting systems, autonomous haul truck operators, water truck operators, OSF managers, supervisors, and foreman responsible for any field operations within or proximate to critical habitat) at the mine that interface with the requirements of this Buckwheat Protection Plan (WestLand 2024a)/APCMs. These training modules will be updated, as necessary.	Ioneer will fund the development of the work plan and its implementation. The program will be prepared by Ioneer personnel or contractors familiar with the requirements of the Buckwheat Protection Plan (WestLand 2024a)/APCMs and the final Biological Opinion issued by the USFWS. Those implementing the awareness program will be supported by personnel with specific operations expertise.
Stormwater Management Plan Monitoring and Reporting Procedures and Protocols for Action Operations Within or Having Potential to Discharge to Designated Critical Habitat (APCM-14)	Draft due three months prior to start of construction	To facilitate focused reporting on stormwater management activities in and proximate to critical habitat to the USFWS and the BLM a stand-alone document will be prepared. This document will include descriptions and mapping of the stormwater plan elements established within or proximate to critical habitat and a description of monitoring and reporting protocols based on the stormwater plan provided in the Plan of Operations (Ioneer 2022).	Ioneer will fund the development of this stand-alone document and implementation of stormwater plan requirements. The stand-alone stormwater document will be prepared by an individual familiar with the requirements of stormwater management in industrial operations, and preparation will be at the direction of a registered professional engineer or surface water hydrologist. Ioneer will select a qualified contractor or individual to compile the stand-alone stormwater document included in the Plan of Operations, and Ioneer shall provide its recommendation to the BLM and the USFWS for review and confirmation that the contractor or individual meets the requirements set forth here. Such confirmation shall not be unreasonably withheld.
Critical Habitat Monitoring Protocols and Procedures (APCM-15)	Draft due three months prior to start of construction	This monitoring protocol and procedures document will outline specific quarterly monitoring elements required by APCM-15 including the planned location of long-term monitoring photo points. The protocol and procedures document will also include required skill sets/training for biological monitors conducting quarterly monitoring activities and monitoring of Project development activities within or adjacent to critical habitat.	Ioneer will be responsible for funding the preparation of the critical habitat monitoring procedures and protocol document. Ioneer anticipates that a qualified contractor selected for the preparation of the procedures and protocol document may include team members that have an advanced degree in plant ecology or allied ecological field, 10 years of relevant experience, and participation in available courses offered by the Center for Plant Conservation Rare Plant Academy. Ioneer will select a qualified contractor or individual to prepare the monitoring procedures and protocols document and Ioneer shall provide its recommendation to BLM and USFWS for review and confirmation that the contractor or individual meets the requirements set forth in the Buckwheat Protection Plan (WestLand 2024)/APCMs. Such confirmation shall not be unreasonably withheld.
Insect Visitors and Pollinator Monitoring (APCM-16)	Draft due three months prior to start of construction	The monitoring procedures and protocols document will outline the specific methods and protocols for establishing insect sampling sites, collecting field data, data retention and storage, data analysis, and reporting requirements.	Ioneer will be responsible for funding the preparation of the insect and pollinator abundance and diversity monitoring procedures and protocols document. It is anticipated that a qualified contractor selected for the preparation of the procedures and protocols document may include team members that have an

Protocol and Procedures and Applicable APCMs	Due Date	Protocol/Procedure Description	Qualifications of Plan Author
			advanced degree in entomology or allied ecological field with demonstrated taxonomic skills and 10 years of relevant experience. Ioneer will select a qualified contractor or individual to prepare the monitoring procedures and protocols document, and Ioneer shall provide its recommendation to the BLM and the USFWS for review and confirmation that the contractor or individual meets the requirements set forth in the Buckwheat Protection Plan (WestLand 2024a)/APCMs. Such confirmation shall not be unreasonably withheld.
Noise Monitoring Proximate to Tiehm's Buckwheat Subpopulations (APCM-17)	Draft due three months prior to start of construction	The monitoring procedures and protocols document will outline the specific methods and protocols for establishing noise monitoring sites, collecting field data, data retention and storage, data analysis, and reporting requirements.	Ioneer will be responsible for funding the preparation of the noise monitoring procedures and protocols document. It is anticipated that a qualified contractor selected for the preparation of the procedures and protocols document may include team members that have a minimum of 10 years of relevant experience monitoring and analyzing noise data. Ioneer will select a qualified contractor or individual to prepare the monitoring procedures and protocols document, and Ioneer shall provide its recommendation to the BLM and the USFWS for review and confirmation that the contractor or individual meets the requirements set forth in the Buckwheat Protection Plan (WestLand 20245)/APCMs. Such confirmation shall not be unreasonably withheld.
Develop an Ex-Situ Conservation Program in Cooperation with the USFWS and BLM (APCM-18)	Draft due in Year 1 of operations	Specific procedures and protocols to implement and monitor the studies outlined in this APCM will be documented in conformance with the requirements of the USFWS Policy Regarding Controlled Propagation of Species Listed under the ESA (65 FR 56916).	Ioneer will be responsible for funding the preparation of the procedures and protocols documents that conform with the requirements of 65 FR 56916 It is anticipated that a qualified contractor selected for the preparation of this document may include team members that have an advanced degree in plant ecology or allied field, experience in endangered species conservation, 10 years of relevant experience, and participation in available courses offered by the Center for Plant Conservation Rare Plant Academy. Ioneer will select a qualified contractor or individual to prepare the ex-situ conservation procedures and protocols document, and Ioneer shall provide its recommendation to the BLM and the USFWS for review and confirmation that the contractor or individual meets the requirements set forth in the Buckwheat Protection Plan (WestLand 2024a)/APCMs. Such confirmation shall not be unreasonably withheld.