Timberland Resource Consultants

165 South Fortuna Boulevard, Fortuna, CA 95540
707-725-1897 • fax 707-725-0972
trc@timberlandresource.com

May 24, 2024

Attention: Cannabis Services Division
Humboldt County Planning and Building Department
3015 H Street
Eureka, CA 95501

Re: PLN-13336-CUP
APN 218-071-003

Background

This report is in response to the Bureau of Land Management's letter dated May 10, 2022, which in part states:

> **The adjacent Bureau of Land Management (BLM) lands are designated as Critical Habitat for Northern Spotted Owl (NSO) by the U.S. Fish and Wildlife Service (USFWS). There is a potential for light, generator noise, runoff, and rodenticide use from the applicant's operation to impact BLM land and sensitive wildlife species such as the NSO. The NSO continues to suffer population loss across its range due, in part, to habitat loss and human encroachment. The BLM is concerned about the proximity of this proposed cannabis operation to NSO critical habitat.**

NSO Survey History

NSO surveys in association with Timber Harvest Plan (THP 1-20-00093-HUM) cover the subject property and a majority of the NSO Assessment Area associated with BLM Lands as shown on the NSO Map. NSO surveys are available to the public via Cal Trees at https://caltreesplans.resources.ca.gov/ in association with THP 1-20-00093.

NSO Activity Centers

NSO surveys have been conducted from 2020 to present with a new Activity Center located in the southern portion of Section 22, T5S, R5E, HB&M. NSO surveys from 2020 to present indicate that there are two NSO Activity Centers within the 1.3-mile NSO Assessment Area. HUM 655 is approximately 4,300 feet south-southeast of the cultivation site and the NEW AC is approximately 7,500 feet south of the cultivation site.

Baseline Ambient Sound Levels

Natural background noises within the property consist of typical forest sounds; wind, creek noise, birds, and other wildlife. Human generated sounds include light residential human noise such as infrequent power tools, chainsaws, small generator use, amplified music, barking dogs and shouting. In the absence of cannabis cultivation, overall background sound levels associated with rural residential and recreational use of the property vary from Low [50-60 dB(A)] to Moderate [70-80 dB(A)].

Proposed Actions Associated with the Project

Cannabis activities include the use of hand tools, pulling tarps over greenhouses, sounds generated by workers such as talking or shouting, and the occasional use of light-duty power tools, chainsaws, portable generators, small heavy equipment (skid steer), and general construction activities. The property is accessed by light vehicle traffic but workers may also use ATVs to access the rest of the facilities. Because the property is located above snow-line, there is also the potential for the seasonal use of larger heavy equipment for snow plowing and road grading after winter storms. Currently, power is supplied to the project via 2,000-3,000-watt invert generators until the project applicant switches to solar. Action-generated sounds associated with cannabis cultivation can conservatively vary from Low [50-60 dB(A)] to Very High [91-100 dB(A)].

Estimated Distance of Harassment

Based on the ambient condition and action-generated sounds, the distance of potential harassment is determined based on Table 1 below from *"Estimating the Effects of Auditory and Visual Disturbance to Northern Spotted Owls and Marbled Murrelets in Northwestern California, USFWS July 26, 2006"*.) The distance reported below is the distance at which harassment may occur, as measured from the edge of the project footprint. In this case, from the edge of the cultivation site and/or the edge of the appurtenant access road surface.

Table 1. Estimated disturbance distance (in feet) due to elevated action-generated sound levels affecting the northern spotted owl and marbled murrelet, by sound level.

Existing (Ambient) Pre-Project Sound Level (dB) [1, 2]	Anticipated Action-Generated Sound Level (dB) [2, 3]			
	Moderate (71-80)	High (81-90)	Very High (91-100)	Extreme (101-110)
"Natural Ambient" [4] (< = 50)	50 (165)[5,6]	150 (500)	400 (1,320)	400 (1,320)
Very Low (51-60)	0	100 (330)	250 (825)	400 (1,320)
Low (61-70)	0	50 (165)	250 (825)	400 (1,320)
Moderate (71-80)	0	50 (165)	100 (330)	400 (1,320)
High (81-90)	0	50 (165)	50 (165)	150 (500)

[1] Existing (ambient) sound level includes all natural and human-induced sounds occurring at the project site prior to the proposed action, and are not causally related to the proposed action.

[2] See text for full description of sound levels.

[3] Action-generated sound levels are given in decibels (dB) experienced by a receiver, when measured or estimated at 50 ft from the sound source.

[4] "Natural Ambient" refers to sound levels generally experienced in habitats not substantially influenced by human activities.

[5] All distances are given in meters, with rounded equivalent feet in parentheses.

[6] For murrelets, activities conducted during the dawn and dusk periods have special considerations for ambient sound level. Refer to page 7 for details.

Impact Assessment

Noise disturbance to NSOs as a result of daily operations at this property are unlikely to occur. The closest NSO Activity Center (HUM 655) is located approximately 4,300 feet from the cannabis cultivation site, which is a significantly greater distance than that of the recommended minimum noise buffer of 330 feet. Noise disturbance from the cannabis cultivation site is very unlikely to penetrate any BLM Lands as shown on the attached maps.

Supplemental lighting may have the potential to disturb nearby NSOs and other wildlife. Given this, it is recommended the project prevent light pollution through the implementation of light covers or shielding. Lit cultivation structures shall be covered so that no light escapes 30 minutes prior to sunset and 30 minutes post sunrise.

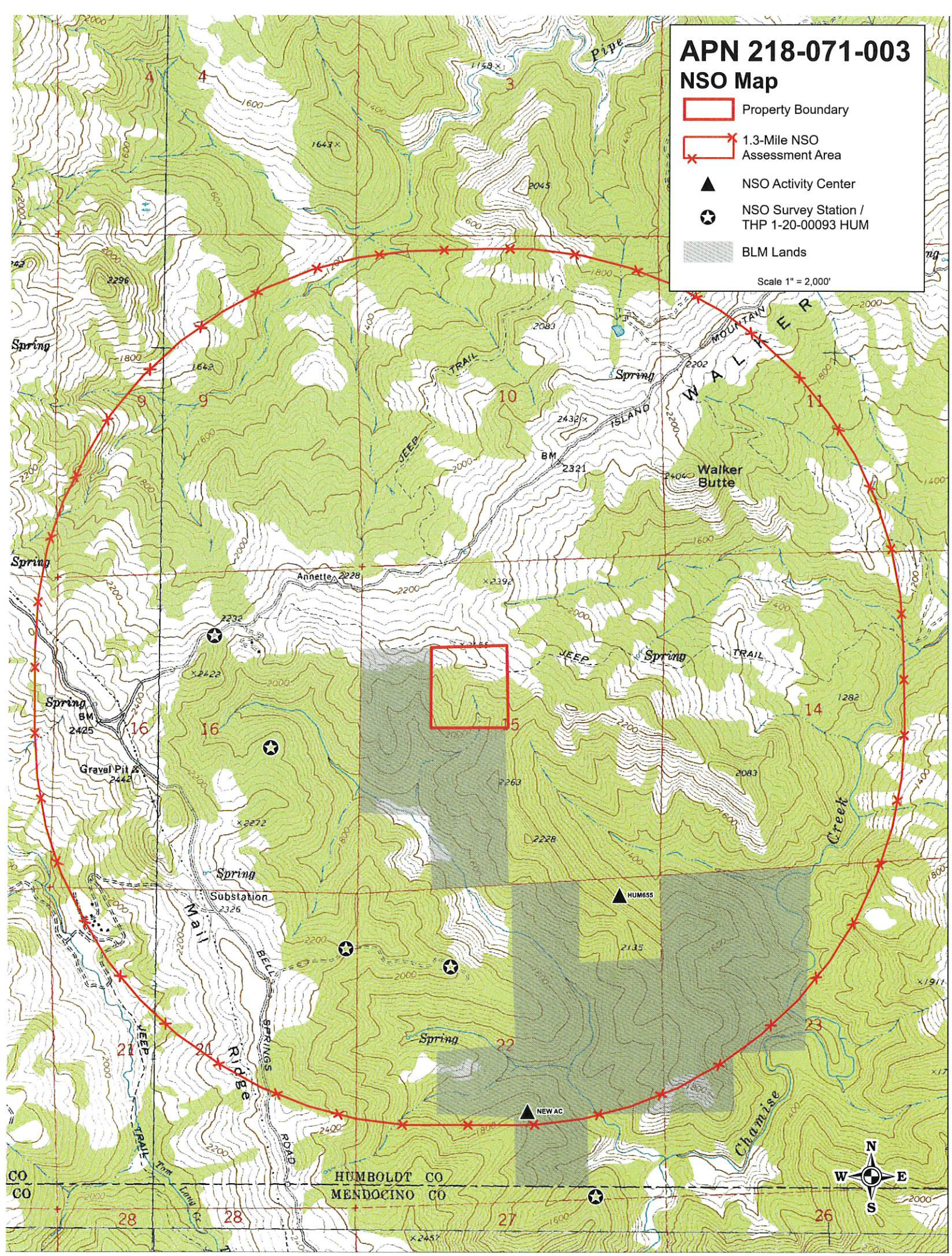
Recommendations

Potential disturbance from certain action generated sounds from this project are unlikely. However, to minimize potential disturbance effects, the following recommendations shall be followed:

1. Cover all greenhouses so that no light escapes 30 minutes prior to sunset and 30 minutes post sunrise.

Sincerely,

Evan Henricksen
Biologist
Timberland Resource Consultants


APN 218-071-003
NSO Map
Property Boundary
1.3-Mile NSO Assessment Area
NSO Activity Center
NSO Survey Station / THP 1-20-00093 HUM
BLM Lands
Scale 1" = 2,000'
HUM655
NEW AC
Walker Butte
Annette
Gravel Pit
Substation
Mail Ridge
Bell Springs Road
Mountain View Trail
Island Trail
Jeep Trail
Pipe
Chamise Creek
HUMBOLDT CO
MENDOCINO CO
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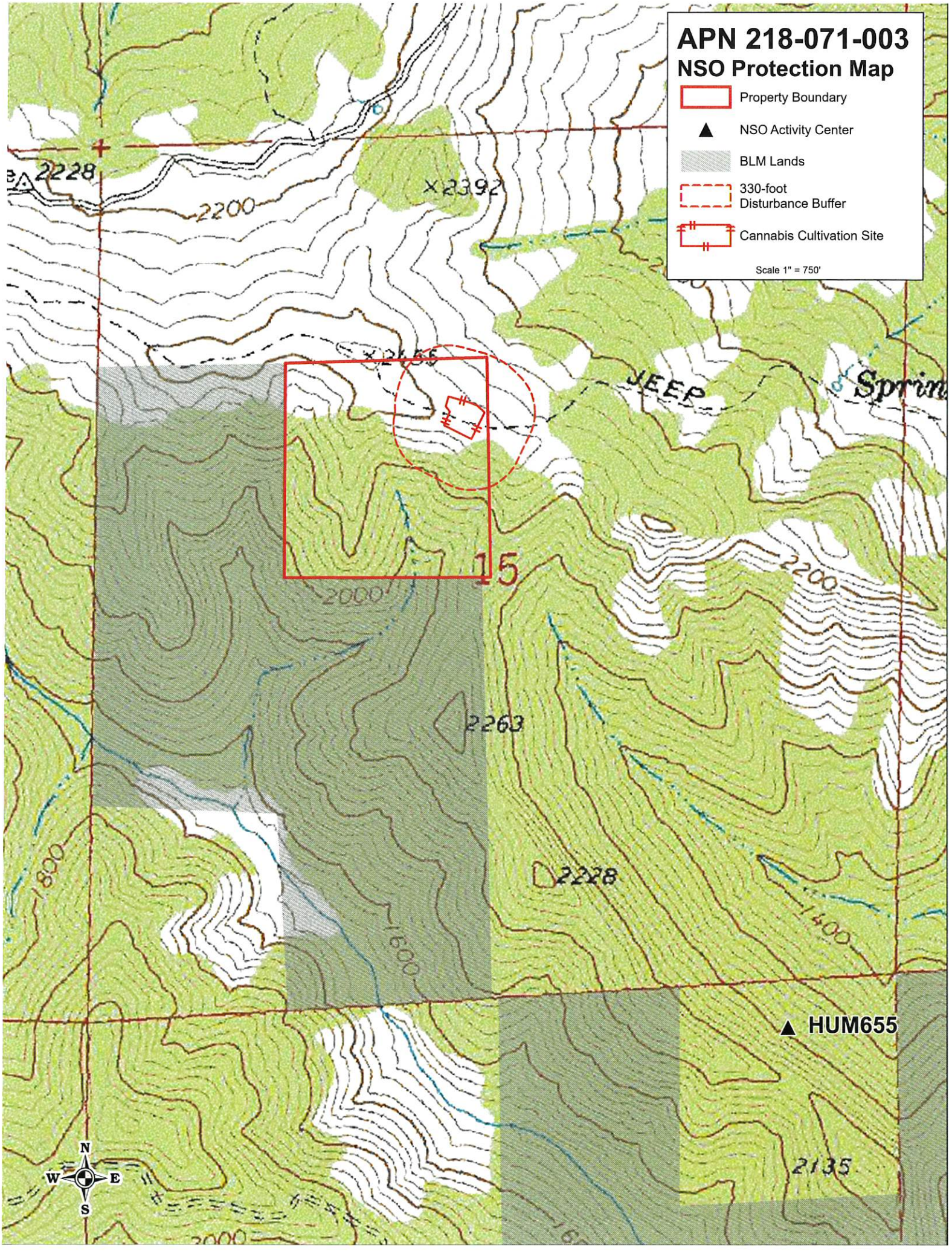
APN 218-071-003
NSO Protection Map
Property Boundary
NSO Activity Center
BLM Lands
330-foot
Disturbance Buffer
Cannabis Cultivation Site
Scale 1" = 750'
HUM655
15
2228
2200
2392
2000
2263
1800
1600
1400
2135
JEEP
N
W
E
S

Estimating the Effects of Auditory and Visual Disturbance to Northern Spotted Owls and Marbled Murrelets in Northwestern California

USFWS, July 26, 2006

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Arcata Fish and Wildlife Office
1655 Heindon Road
Arcata, California, 95521
Phone: (707) 822-7201 FAX: (707) 822-8411

Memorandum

To: All Interested Parties

From: Field Supervisor, Arcata Fish and Wildlife Office, Arcata, California

DANIEL EVERSON Digitally signed by DANIEL EVERSON Date: 2020.10.28 07:01:58 -07'00'

Subject: Revised Transmittal of Guidance: Estimating the Effects of Auditory and Visual Disturbance to Northern Spotted Owls and Marbled Murrelets in Northwestern California

This memorandum provides revised guidance from the Memorandum Transmittal of Guidance: Estimating the Effects of Auditory and Visual Disturbance to Northern Spotted Owls and Marbled Murrelets in Northwestern California dated July 31, 2006. This revised guidance addresses the effects of disturbance on the federally listed northern spotted owl (*Strix occidentalis caurina*) and marbled murrelet (*Brachyramphus marmoratus*), and applies to activities which have the potential to disturb these species as a result of elevated sound levels or human presence near nests during their breeding seasons. This guidance applies to activities occurring within the jurisdictional area of the Arcata Fish and Wildlife Office (AFWO): Humboldt, Del Norte, and Trinity counties, western Siskiyou County, and Mendocino County exclusive of the Russian River watershed. The purpose of the revised guidance is to incorporate the most recent published scientific literature on auditory and visual disturbance and update pertinent information. All ongoing or completed AFWO consultations or technical assistance following the 2006 Marbled Murrelet and Northern Spotted Owl Harassment Guidance are determined to be consistent with this guidance and will not be re-evaluated. Questions regarding implementation and interpretation of this guidance should be directed to AFWO Field Supervisor, Dan Everson at the above letterhead address.

Attachments

- Estimating the Effects of Auditory and Visual Disturbance to Northern Spotted Owls and Marbled Murrelets in Northwestern California, 2020
- Appendix A - Marbled Murrelet Auditory and Visual Disturbance Decision Support Tool Draft User Guide, 2020
- Appendix B - Northern Spotted Owl Auditory and Visual Disturbance Decision Support Tool Draft User Guide, 2020

Estimating the Effects of Auditory and Visual Disturbance to Northern Spotted Owls and Marbled Murrelets in Northwestern California

October 1, 2020

Executive Summary

The issue of human-generated disturbances to northern spotted owls and marbled murrelets has drawn increasing attention in recent years. The data available to assess impacts to terrestrial wildlife from these effects are limited, and fewer data are specific to these listed species. This guidance document builds upon and consolidates information (see Appendix A, Marbled Murrelet Sound and Visual Disturbance Decision Support Tool 2020 and Appendix B, Northern Spotted Owl Sound and Visual Disturbance Decision Support Tool 2020) to interpret the available data and draw objective conclusions about the potential for identified effects to rise to the level of take, as defined by the Endangered Species Act, during the breeding season for both species. The general breeding season for northern spotted owl is February 1 to July 31. The general breeding season for marbled murrelets is March 24 to September 15.

Through this guidance, the U.S. Fish and Wildlife Service describes behaviors of these two forest wildlife species that reasonably characterize when disturbance effects rise to the level of take (i.e. harm), as defined in the implementing regulations of the Endangered Species Act of 1973, as amended. These behaviors include but are not limited to:

- Flushing an adult or juvenile from an active nest during the reproductive period.
- Precluding adult feeding of the young for a daily feeding cycle.
- Precluding feeding attempts of the young during part of multiple feeding cycles.

These documents provide objective metrics based on a substantial review of the existing literature, as it pertains to these two wildlife species and appropriate surrogate wildlife species. Our recommended methodology relies on a comparison of sound levels generated by the proposed action to pre-project ambient conditions. Disturbance may reach the level of take when at least one of the following conditions is met:

- Project-generated sound exceeds ambient nesting conditions by 20-25 decibels (dB).
- Project-generated sound, when added to existing ambient conditions, exceeds 90 dB.
- Human activities occur within a visual line-of-sight distance of 330 feet or less from a nest.

To simplify the analysis of these potential effects, and to promote consistency in interpretation of the analytical results, we established sound level categories of 10-dB increments. The analysis relies on a comparison of project-generated sound levels against existing ambient conditions. The recommended analysis includes a simple comparison of project and pre-project sound levels within a matrix of estimated distances for which available data support a conclusion of harm by significantly impairing essential behavioral patterns in breeding and feeding. We also provide: real-world examples to assist the reader in understanding the correct application of the methodology, describe site-specific information that is important to include

in project analyses, and provide caution against inclusion of information and circumstances not relevant to the results to provide context to the project proponent analysis and final interpretation.

This current guidance is based, in large part, on the contents of Appendix A and Appendix B. Both appendices were compiled in 2004-2005. The original field evaluation process outlined in the two appendices required a two-phase process in which the user (a) selects one of ten environmental "scenarios" that best describe field conditions within their project area; and (b) follows a twelve-step process for initializing the spreadsheet auditory model to obtain an estimate of the threshold distance for noise effects. The evaluation process in this document is simplified into a five-step procedure. All probable auditory model outputs are integrated in Table 1, below, so users are not required to operate the spreadsheet model.

Introduction

The issue of elevated sound and visual disturbance of forest wildlife species, particularly as it affects the northern spotted owl (owl) and the marbled murrelet (murrelet) is important because of the federally listed status of these animals. The purposes of this guidance are: (a) to describe the scientific basis for considering the effects of auditory and visual disturbance to owls and murrelets, and (b) to provide a methodology to simplify the analysis of these effects for the large majority of project circumstances typically encountered in or near owl and/or murrelet habitat and occupied areas.

This guidance estimates the effects of elevated sound levels and visual proximity of human activities to owls and murrelets, and primarily applies to these species within their suitable forest habitats in northwestern California. This guidance applies to activities occurring within the jurisdictional area of the Arcata Fish and Wildlife Office: Humboldt, Del Norte, and Trinity counties; western Siskiyou County; and Mendocino County; exclusive of the Russian River watershed. This assessment tool may have some applicability to other forest nesting avian species, but was not developed with other species specifically in mind. Future updates of this guidance may address other forest birds and wildlife. This guidance has been developed through consideration of the available literature, incorporating species-specific information as available, but relying substantially on data from a variety of other surrogate avian species and local applications, as appropriate.

Behaviors Indicating Harm

The definition of "take" prescribed by the Endangered Species Act includes "harm". The Endangered Species Act's implementing regulations further define harm as "an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering." [50 CFR § 17.3]

Activities that create elevated sound levels or result in close visual proximity of human activities at or near sensitive locations (e.g., nest trees), have the potential to significantly disrupt essential

behavior patterns. While owls and murrelets may be disturbed by many human activities, we anticipate that such disturbance rises to the level of impairing essential behavior patterns under a limited range of conditions. For purposes of this guidance, we assume disturbance to the level of harm may occur when owls or murrelets demonstrate behavior suggesting that the safety or survival of the individual is at significant risk, or that a reproductive effort is potentially lost or compromised. Examples of this behavior include, but are not limited to:

- An adult or juvenile is flushed from a nest during the incubation, brooding, or fledging period, that potentially results in egg failure or reduced juvenile survival.
- An adult abandons a feeding attempt of a dependent juvenile, which potentially results in malnutrition or starvation of the young.
- An adult delays feeding attempts of dependent birds on multiple occasions during the breeding season, potentially reducing the growth or likelihood of survival of young.

Other essential behaviors, if disrupted, may also indicate harm.

Based on our interpretation of the best available data, these behaviors that result in detriment may occur when owls or murrelets are subject to elevated sound levels or visual detection of human activities near their active nests or dependent offspring. We interpret the best available published data on owls, murrelets and appropriate surrogate species as indicating that the above behaviors may manifest when: (a) the action-generated sound level substantially exceeds (i.e., by 20-25 dB or more as experienced by the animal) ambient conditions existing prior to the project; (b) when the total sound level, including the combined existing ambient and action-generated sound, is very high (i.e., exceeds 90 dB, as experienced by the animal); or (c) when visual proximity of human activities occurs close to (i.e., within 330 feet) of) an active nest site. Sound levels of lesser amplitude or human presence at farther distances from active nests have the potential to disturb these species, but have not been clearly shown to cause behaviors that meet the definition of take. We estimate distances at which conditions (a) and (b) occur by calculating attenuation rates of sound across habitat conditions representative of the forest habitats occupied by owls and murrelets.

Some behaviors are difficult to witness or quantify under field conditions. The difficulty associated with documentation of these behaviors, especially in species such as the murrelet that rely on cryptic coloration and behavior to avoid detection, warrants a conservative interpretation of the best data available for the purposes of this document. At this time, we have identified only those behaviors associated with active nest sites during the breading season as potentially indicating harm.

Sound Level Categories

The analysis of auditory and visual disturbance provided herein relies substantially on a comparison of the sound level generated by sources (e.g., chainsaws, dozers, etc.) anticipated for use in a proposed action against ambient sound conditions prevalent in the action area prior to implementing the project. The analysis compares the sound level that an owl or murrelet is likely to be subject to as a result of implementing a proposed action against the sound levels to which the species may be exposed under existing, pre-project conditions.

Note that in this guidance we define the "ambient" sound level as that sound environment in existence prior to the implementation of the proposed action, and may include any and all human-generated sound sources when they constitute a long-term presence in the habitat being analyzed. Temporary, short-term sources, even if in effect during or immediately prior to the proposed action, would generally not be considered as part of the ambient sound level but would instead be considered as a separate effect, or considered in combination with the sources from the proposed action. A special case of ambient is the "natural ambient", which includes sound sources native to the forested habitat being considered, such as wind in trees, bird calls, and distant water flow. Human-generated, "white noise" sources, such as a distant highway, may also be part of the natural ambient if (a) relatively distant to the area being considered, (b) relatively low in volume (i.e., <50 dB), and (c) relatively uniform in sound level over the area of consideration. Ambient sound should be estimated based on typical sources experienced on a daily or more frequent basis. For other than "natural ambient", sources are generally located within or near the footprint of the proposed action.

The following subsections and Tables provide concise descriptions of sound levels typically encountered under pre-project ambient conditions or during project implementation (including post-project use, if future use of the project area results in a long-term alteration of the sound/visual environment). In Table 1, we created sound level categories of 10-dB increments as a means to simplify the analysis. Each sound level category is described in terms of the conditions, equipment, tools, and other sound sources common to the particular level. Each description includes the decibel range, a general description, and examples of equipment or tools that typify that sound environment. Measurements and estimates from a broad range of potential sound sources are provided for reference purposes in Table 2.

Many tools and equipment demonstrate a range of sound production substantially wider than the 10-dB sound level categories provided here. That range of sound production represents the inherent variability among similar sources, and the variation that typically occurs among measurements of even identical sources. This can be seen in a cursory examination of Table 2. When the range of sound measures for a source exceed the 10- dB range of a single sound level category, the analyst should consider the sound source in the context of other sources typical to the proposed activity. For example, chain saws used in timber harvest operations would include those in the higher sound measures, and would not include lower sound levels more representative of homeowner applications. Similarly, the sound of small trees being felled is not anticipated to be substantially higher than the sound of the saws and other activities. However, the felling of larger trees may exceed the sound of the equipment used to fall and yard them; we have addressed this situation in the sound level descriptions.

We have attempted to create categories that include similar sound sources, and have applied median values (that is, we have discounted outliers) where multiple values for similar sound sources are encountered. While there may be exceptions within and among these categories, we have attempted to address this variability through an otherwise conservative approach to estimating distances at which disturbance behaviors may manifest.

Natural Ambient: Refers to ambient sound levels (generally < 50 dB) typically experienced

in owl or murrelet habitat and includes sources native to forest habitats.

Very Low: Typically 50-60 dB, and generally limited to conditions where human-generated sound would never include amplified or motorized sources. Includes forest habitats close to less-frequently encountered natural sources, such as rapids along large streams, or wind-exposure, and may include quiet human activities, such as nature trails and picnic areas.

Low: Typically 61-70 dB, and generally limited to sound from, non-gas-powered recreational activities, and residential activities, such as those associated with small parks, visitor centers, bike paths, and residences. Includes most hand tools and battery operated, hand-held tools.

Moderate: Typically 71-80 dB, generally characterized by the presence of passenger vehicles, small trail cycles (not racing), small gas-powered engines (e.g., lawn mowers, Stihl 025 chainsaws, 25 KVA or less generators, and power lines.)

High: Typically 81-90 dB, and would include medium- and large-sized construction equipment, such as backhoes, front end loaders, pumps and generators, road graders, dozers, dump trucks, drill rigs, and other moderate to large diesel engines. Would also include high speed highway traffic with passenger cars, medium trucks and sport vehicles, power saws, large chainsaws, pneumatic drills and impact wrenches, and large gasoline-powered tools.

Very High: Typically 91-100 dB, and is generally characterized by impacting devices, compression ("jake") brakes, motor boats, heavy trucks and buses, large trees falling (e.g., trees larger than 75 feet tall), clam shovels, hydromulchers and pneumatic chippers.

Extreme: Typically 101-110 dB. Generally includes use of vibratory sonic pile driver, guardrail installation and pile driving, impact pile drivers, track hoes, and helicopter S-61.

Sound Levels Exceeding 110 dB: These sound levels, typified by sources such as jet engines and military over flights, rock blasting, exterior cone blast with sand bags, and treetop blasts, heavy lift double rotor helicopters are special situations requiring operations up to one mile distance, and are not covered by the analytical methods provided herein.

Derivation of Disturbance Distances

Available data in Appendix A: Marbled Murrelet Auditory and Visual Disturbance Decision Support Tool Draft User Guide, 2020 and Appendix B: Northern Spotted Owl Auditory and Visual Disturbance Decision Support Tool Draft User Guide, 2020 suggest that disturbance occurs when sound levels resulting from project-based sound sources exceed ambient conditions by relatively substantial levels, or when those sound sources exceed a high absolute threshold. Since sound attenuates as a function of the distance from the source (within typical forest habitat, at a rate of approximately 6 dB per doubling of distance from a point source), the analyst can estimate the distance at which various sound sources exceed ambient conditions by anticipated threshold values. We estimated these distances using a spreadsheet model that simulates sound attenuation in typical forest habitats, reasonably accounting for ambient environmental conditions and sound source characteristics. We emphasize the importance that

this guidance is to be used in typical forested habitats only. In instances where sound generated is not attenuated by forest, a separate distance calculation should be made based on the environment of the project area. As a means of simplifying the analysis process, we used median sound values within the above-described categories for both source and ambient sound conditions. Table 1 reports the distances within which elevated, project-generated sound is reasonably expected to exceed ambient conditions to such a degree as to result in disturbance of murrelets or owls. The reader is referred to Appendices A and B and their references for additional, detailed discussion of sound metrics and the model used to derive these distances.

The values in Table 1 were obtained directly from the spreadsheet auditory model. When disturbance distance (y-axis) is estimated from two variables -- ambient and action-generated sound (x1- and x2-axes) – the resulting graph is a three-dimensional response surface. Table 1 is the tabular representation of the response surface created after approximately 2,000 iterations of the spreadsheet auditory model. Each table intersection (e.g., low ambient sound combined with high action-generated noise) represents 100 model iterations with one-decibel increments on each x-axis. Each intersection value in the table represents the central tendency of the 100 model iterations, with consideration of the values in the adjacent intersections.

Time of Day Adjustment for the Marbled Murrelet

The take threshold distances provided in Table 1 are based on a comparison of project generated sound levels with existing (ambient) sound levels, which themselves represent average daytime sound conditions. It is recognized, however, that ambient sound level often has a substantial time-of-day component, with nighttime, dawn and dusk ambient sound levels generally 5-10 dB lower than typical midday levels (EPA 1974). It is also known that murrelet flights into nests to feed nestlings and for nest-tending exchanges are concentrated around dawn and dusk (Nelson and Hamer 1995), during the period when ambient noise levels tend to be lower than average daytime levels (EPA 1974). Therefore, for murrelets, the disturbance threshold distances provided in Table 1 apply to noise-generating activities occurring during the midday period, when the risk of disturbance is lower. Specifically, for murrelets, the disturbance distances in Table 1 apply to noise-generating activities that are not within 2 hours of sunrise or sunset. If proposed activities will occur within 2 hours of sunrise or sunset, and if the ambient sound environment during the dawn and dusk period can reasonably be expected to be 5 dB or more quieter than the midday sound environment, then the estimated disturbance distance threshold should be calculated based on an ambient level 10 dB lower (i.e., one row up in the table) compared to the normal ambient rating in Table 1.

In some cases, applying the time-of-day factor will result in a larger disturbance threshold distance. This time-of-day measure provides the threshold criteria to the known biology of the murrelet and the anticipated sound environment during dawn and dusk periods. In many situations, a prohibition on noise generating work within 2 hours of sunrise or sunset (also known as a "diurnal restriction") is both operationally feasible and imposes minimal encumbrance during project implementation. Diurnal restrictions greatly reduce the likelihood of disturbance to murrelets during a sensitive portion of the day.

Similar time-of-day considerations and adjustments are not required for the owl.

Application of Disturbance Distances to Project Conditions

The following methodology may be used to estimate the approximate distance at which project-generated sound exceeds ambient conditions to such an extent that owls or murrelets may be subject to sound or visual disturbance.

Step 1: The analyst reviews the environment in the action area to determine the existing ambient sound level. The analyst should include any sound sources occurring in the action area, prior to and not part of the proposed action, that create ambient sound levels higher than the "natural" background. For example, if the proposed action would add a passing lane to a high-use major highway, the ambient condition should include the existing traffic and maintenance on the highway itself, in addition to other sounds native to the adjacent forest environment. As a second example, a proposed action to maintain a remote hiking trail would not include sound sources other than the "natural background" and infrequent human use as part of the existing ambient. Based on this review, the analyst assigns a sound level category to the ambient condition (equivalent to a row of Table 1).

Step 2: The analyst reviews the proposed action to determine the types of equipment, tools, etc., anticipated to be used during the project. Based on the descriptions of sound level categories, above, the analyst assigns a sound level category to the action-generated sound sources (corresponding to the columns in Table 1). Action-generated sound sources should include all major sources necessary to complete the proposed action. When project-specific sound measures are not available, the reader should refer to Table 2 for typical values for equipment, tools, and other sound sources. For projects where distinctly different sound environments (for either ambient or action-generated) may occur throughout the duration of the project implementation, the analyst may complete separate analyses for each distinct sound environment.

Step 3: From Table 1, the analyst finds the cell corresponding to the appropriate row and column for existing ambient sound and action-generated sound, respectively. This cell provides an estimate of the distance within which increased sound level may disturb an owl or murrelet. The cell values are generally reported as a distance from the outer edge of the project footprint into unsurveyed, occupied, or presumed occupied nesting habitat, unless site-specific information indicates sound sources may be more localized within the project footprint (see also "Other Considerations", below).

Step 4: When significant topographic features occur within the sound environment, appropriate consideration may be given to their sound amplifying or attenuating capabilities. Topographic features may attenuate or amplify effects on ambient noise (e.g., nearby road use) and project-generated noise. However, the analyst should have a full understanding of the effects of topography on sound amplification and attenuation, especially when the species involved typically nests at a substantial distance above the ground. That is, topography may substantially amplify or attenuate sound between the source and the receiver (i.e., owl or murrelet nest site) when that topographic barrier is sufficiently high to block line-of-sight transmission between the source and receiver.

Step 5: Consider the potential for human activities within 330 feet of potential nest trees of owls or murrelets. If there is a known or likely nest tree, or flight path to the nest itself within 330 feet of human activities, then the analyst would assume visual disturbance. Otherwise, no visual disturbance would be anticipated.

Table 1. Estimated disturbance distance (in feet) due to elevated action-generated sound levels affecting the northern spotted owl and marbled murrelet, by sound level.

Existing (Ambient) Pre-Project Sound Level (dB) [1, 2]	Anticipated Action-Generated Sound Level (dB) [2, 3]			
	Moderate (71-80)	High (81-90)	Very High (91-100)	Extreme (101-110)
"Natural Ambient" [4] (< = 50)	50 (165)[5,6]	150 (500)	400 (1,320)	400 (1,320)
Very Low (51-60)	0	100 (330)	250 (825)	400 (1,320)
Low (61-70)	0	50 (165)	250 (825)	400 (1,320)
Moderate (71-80)	0	50 (165)	100 (330)	400 (1,320)
High (81-90)	0	50 (165)	50 (165)	150 (500)

[1] Existing (ambient) sound level includes all natural and human-induced sounds occurring at the project site prior to the proposed action, and are not causally related to the proposed action.

[2] See text for full description of sound levels.

[3] Action-generated sound levels are given in decibels (dB) experienced by a receiver, when measured or estimated at 50 ft from the sound source.

[4] "Natural Ambient" refers to sound levels generally experienced in habitats not substantially influenced by human activities.

[5] All distances are given in meters, with rounded equivalent feet in parentheses.

[6] For murrelets, activities conducted during the dawn and dusk periods have special considerations for ambient sound level. Refer to page 7 for details.

Example Analysis

The following example is provided to assist the reader in understanding the application of this recommended methodology to a hypothetical yet typical project circumstance.

Proposed Project: A project proponent proposes to construct an informational kiosk, restroom, and six graveled parking slots at an existing, undeveloped, trailhead parking area along a low-speed (<45 mph), paved road closed to large trucks and buses. The footprint of the proposed project is a roughly circular area of approximately 75-foot diameter (about 1/10 acre). The surrounding forest is suitable nesting habitat for murrelets, and the agency proposes to do construction during the nest season. Topography in the action area is low

rolling ridges less than 50 feet high. No other sound sources of significance are located nearby. The construction project will not remove any large trees, but will require the use of several pieces of equipment (e.g., backhoe, dump truck), as well as smaller power equipment (e.g., cement mixer, portable generator, small chain saw) and hand tools. No jackhammering, pile driving, or larger diesel equipment will be needed. The agency agrees to conduct all on-site noise-generating activities during the midday time period between 2 hours after sunrise to 2 hours before sunset (i.e. they will implement a diurnal restriction).

Analysis: The ambient sound level at the proposed kiosk includes the existing passenger vehicle/light truck traffic on a paved surface immediately adjacent to the work area, and existing human presence of hikers. Using the above-described sound level categories, this ambient sound level classifies as "low" (61-70 dB). The large construction equipment (i.e., the backhoe and truck) are the greatest sources of increased sound to be considered here, as they exceed the level of the other tools. From the above-described sound levels, the analyst anticipates that action-generated sound levels will fit into the "high" category (81-90 dB). Choosing the appropriate row (Ambient = Low) and column (Action-generated = High) in Table 1, the analyst will estimate that disturbance may rise to the level of disturbance over an area within 50 m (165 ft) from the footprint of the project. Since all activities will be conducted during the mid-day period, no further adjustment of the tabled value to account for murrelet activity periods is necessary. This 50 m distance, when used as a buffer around the project footprint, results in an estimate of 2.9 acres (1.2 ha) subject to auditory disturbance. Large potential nest trees exist immediately adjacent to the work area, so visual disturbance may also be a consideration. However, human presence already occurs at the trailhead on a daily basis, and the proposed project will not substantially alter that effect. The topographic features in the action area are unlikely to further attenuate any sound experienced by murrelets, which commonly nest more than 50 feet above ground level. Since construction of the kiosk and restroom would not appreciably change the effects of the existing roadway or parking area, the duration of effects would be for a single breeding season, and would not alter effects already at the site in future years.

Interpretation and Application of the Results

The estimated disturbance distance resulting from the analysis of any particular project conditions requires careful interpretation. Although seemingly precise, the reported distance represents a reasonable *approximation* of the distance wherein "the likelihood of injury" occurs, as supported by currently available data. That is, the resultant number estimates the distance within which available disturbance data on owls or murrelets (or surrogate species, as appropriate) show that at least some individuals would demonstrate one or more behaviors indicating disturbance as a result of anticipated sound levels or visual detection of human activities near nest sites. Given the many sources of variability in such an analysis, such as differences in individual bird response, variation in actual sound level produced by similar sources, variability in sound transmission during daily weather patterns, and non-standardization in sound metrics reported in the published literature, exact estimates of disturbance distances are currently infeasible, and likely will remain so.

It is reasonable to assume that owls or murrelets closer to sources of disturbance have a higher likelihood of significant disruption of normal behavior patterns than those at the outer

limits of the estimated disturbance distance, due to louder sound levels or a visually closer perceived threat to the nest. Further, not all owls or murrelets, except those in the very closest proximity to the audio and visual activities, may respond to a degree indicating disturbance. Thus, the likelihood of injury for any particular individual would range from some low proportion to a higher value depending on its actual proximity to a particular sound/visual source. It is neither reasonable nor necessary for purposes of analysis and estimation of take to predict that all (or even a high proportion of) owls or murrelets within this distance show disturbance behaviors. Conversely, it is also unreasonable to conclude that owls or murrelets beyond this distance would never be disturbed. A more supportable interpretation is that currently available information does not support a conclusion that owls or murrelets more distant to the anticipated sound/visual disturbances are likely to suffer a significant disruption of normal behavior patterns.

The reporting of take associated with auditory and visual disturbances is necessary, even if somewhat imprecise. It is appropriate to consider all reasonable means to minimize take including, but not limited to, seasonal restrictions and substitution of equipment type to reduce the likelihood of injury. When considering measures to reduce the effects of disturbance, the analyst should bear in mind not only the spatial extent of the auditory and visual disturbance, but also the timing and duration of the disturbance.

Other Considerations

A site-specific assessment of topography should be considered. Steep slopes, ridges, and designed sound barriers may increase sound attenuation when they form barriers to the direct line of sound transmission between source and the location of the receiver (here, the actual location of the species). Small ridges or walls, not clearly blocking the sources from a highly elevated nest, would provide little or no attenuation. When clearly supported by site-specific information regarding topography, action-generated sound may be reduced by one or two levels in the analysis, when compared to existing ambient sound levels.

For some projects, elevated sound levels may cease following completion of the project. For example, sound level following the completion of timber harvest is likely to return to pre-harvest levels, and so would not result in long-term or permanent sound and visual disturbance to owls and murrelets. On the other hand, actions such as the creation of a new road may result in elevated sound levels both during construction and during future use and maintenance of the road. The analyst should carefully consider both spatial and temporal aspects of noise and visual disturbance for each project.

Activities producing sound levels of 70 dB or less (estimated at 50 feet from the sources), such as use of hand tools, small hand-held electric tools, or non-motorized recreation, would not generally rise to the level of disturbance, except in certain circumstances, such as when used in very close proximity (i.e., <82 feet) to an active nest. Under these circumstances, visual detection of human activities by the species near its nest is assumed to be of more consequence than auditory disturbance, and take should be described in such terms. Activities producing sound levels greater than 110 dB (estimated at 50 feet from the sources), such as open-air blasting, aircraft, or impact pile-driving, are not addressed in this analysis, and

should be evaluated through a more detailed site-specific analysis. Some activities (i.e. heavy lift double rotor helicopters) warrant a large buffer including up to one mile.

This guidance does not address the direct effects of predation by corvids (e.g., ravens, crows and jays) and other predators as a result of human-mediated activities in murrelet and owl habitat. Distance estimates reported in this guidance reflect only the effects of sound attenuation and visual detection on behaviors appropriately interpreted as disturbance. We have considered predation only in the sense that detection of the nest as a result of owl or murrelet disturbance behavior (e.g., flushing from the nest) may increase the risk of predation, regardless of density of predators, and thus represents a "likelihood of injury."

This analytical method addresses most forest habitat conditions that affect the attenuation rate of sound (and thus the level of sound detected by the owl or murrelet at its location). These conditions include dampening effects of forest vegetation, variability in natural ambient sound typically encountered under forest conditions, use of multiple pieces of identical equipment, and the effect of elevated nest sites on sound attenuation. Departure from the tabled values in this guidance to account for special forest conditions (i.e. clearcut between the project and the habitat) is generally inappropriate except under highly unusual circumstances.

Table 2. Some Common Sound Levels for Equipment/Activities[1]

	Range of Reported dB Values @ Distance Measure *Distance Measure assumed to be 50 ft unless otherwise indicated.*	
Project Sound Sources	**Reported Decibel Level @ 50 ft.**	**Relative Noise Level [2]**
Conversation	34	Ambient
Speech (normal)	41	Ambient
Milling Machine	61	Low
Motorcycle on Trail (620 cc street legal, meter at ground level)	62	Low
Power Lawn Mower	68	Low
Yelling	70	Low
Generator (25 KVA or less)	70	Low
Gas Lawn Mower	72	Moderate
Chainsaw (Stihl 025)	73	Moderate
Welder	74[3]	Moderate
Pickup Truck (driving)	75[3]	Moderate
Flatbed Pickup Truck	77	Moderate
Powerline	78	Moderate
Cat-skidder	80	Moderate
Compressor (air)	80[3]	Moderate
Backhoe	80[3]	Moderate
Concrete Mixer (Vibratory)	80[3]	Moderate
Pumps	81[3]	High
Horizontal Boring Hydraulic Jack	82[3]	High
Slurry Machine	82[3]	High
Vacuum Street Sweeper	82[3]	High
Concrete Pump	82	High
Log Loader	83	High
Ground Compactor	83[3]	High
Concrete Batch Plant	83	High
Dump Truck	84	High
Flat Bed Truck	84	High
Roller	85[3]	High
Mowers, leaf blowers	85	High
Passenger Cars/Light Trucks (65 mph)	85	High
Auger Drill Rig	85	High

Project Sound Sources	Reported Decibel Level @ 50 ft.	Relative Noise Level [2]
Truck Horn (Warning)	85[3]	High
Equipment > 5 horsepower	85	High
Impact Wrench	85	High
Concrete Truck	85	High
Road Grader	85	High
Chain saws	85[3]	High
Highway-Traffic	85	High
Dozer	85[3]	High
Rock Drill	85[3]	High
Crane	85[3]	High
Paver	85[3]	High
Scraper	85[3]	High
Pneumatic tools	85[3]	High
Large Diesel Engine	86	High
Generator	87	High
Front-end Loader	87	High
Drill Rig	88	High
Medium Trucks & Sport Vehicles (65 mph)	89	High
General construction	89	High
Large Truck	89	High
Jackhammer	89[3]	High
Concrete Saw	90	High
Hydra Break Ram	90	High
Mounted Impact Hammer Hoe-Ram	90	High
Large Tree Falling	92	Very High
Clam Shovel	93	Very High
Jake Brake on Truck	94	Very High
Hydromulcher	94	Very High
Boat motors	95	Very High
RVs (large)	95	Very High
Pneumatic Chipper	95	Very High
Heavy Trucks and Buses	95	Very High
Heavy Construction	96	Very High
Logging Truck	97	Very High
Railroad	98	Very High
Vibratory (Sonic) Pile Driver	101[3]	Extreme
Impact Pile Driver	101	Extreme

Project Sound Sources	Reported Decibel Level @ 50 ft.	Relative Noise Level [2]
Guardrail Installation and Pile Driving	105	Extreme
23 ft Detonation Cord, on surface	106	Extreme
Track Hoe	106	Extreme
Helicopter S-61 (large, single rotor, loaded)	112	Extreme
Rock Blast	112	Extreme
12 ft Detonation Cord, buried	112	Extreme
Exterior Cone Blast w/ sand bags	120	Extreme
Jet Overflight	136	Extreme
Exterior Cone Blast (obstructed)	127	Extreme
Treetop Blast	137	Extreme

[1] Most values in this table are derived from U.S. Department of Transportation. FHA. 2017. Construction Noise Handbook. Table 9.1 RCNM Default Noise Emission Reference Levels and Usage Factors.
[2] Relative Noise Level: a general, subjective ranking of relative noise levels created by the sources considered here, when used for analysis of relative noise effects on species.
[3] Equipment decibel level has been revised from the 2003 guidance with data provided from U.S. Department of Transportation (2017)

Literature Cited

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U.S. Department of Transportation. FHA. 2017. Construction Noise Handbook. Table 9.1 RCNM Default Noise Emission Reference Levels and Usage Factors.