APPENDIX F. NOISE REPORT

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Letter

DEPARTMENT OF THE ARMY
US ARMY INSTITUTE OF PUBLIC HEALTH
5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND, MD 21010-5403

MCHB-IP-EON

DEC 19 2012

MEMORANDUM FOR Environmental Division, U.S. Army Garrison Hawaii, Department of Public Works (IMPC-HAW-PWE/Mr. Peter Yuh), 947 Wright Avenue, Wheeler Army Airfield, Schofield Barracks, HI 96857-5013

SUBJECT: Operational Noise Consultation, W430000.02.03.01-b-12, Operational Noise Assessment for Proposed Infantry Platoon Battle Course at Pohakuloa Training Area, HI, 18 December 2012

1. We are enclosing a copy of the consultation.

2. Please contact us if we can be of any further assistance.

3. The point of contact is Ms. Kristy Broska, Environmental Protection Specialist or Ms. Catherine Stewart, Program Manager, Operational Noise, Army Institute of Public Health, at DSN 584-3829, Commercial (410) 436-3829, or email: kristy.broska@us.army.mil or catherine.stewart@us.army.mil.

FOR THE DIRECTOR:

William J. Bettin

Encl

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Operational Noise Consultation

5158 Blackhawk Road, Aberdeen Proving Ground, Maryland 21010-5403

OPERATIONAL NOISE CONSULTATION
NO. W430000.02.03.01-b-12
OPERATIONAL NOISE ASSESSMENT
PROPOSED INFANTRY PLATOON BATTLE COURSE
POHAKULOA TRAINING AREA, HI
18 DECEMBER 2012

CHPPM/PHC FORM 433-E (MCHB-CS-IP), SEP 10

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MCHB-IP-EON

EXECUTIVE SUMMARY
OPERATIONAL NOISE CONSULTATION
NO. W430000.02.03.01-b-12
PROPOSED INFANTRY PLATOON BATTLE COURSE
POHAKULOA TRAINING AREA, HI
18 DECEMBER 2012

1. PURPOSE.

a. To assess the noise impacts from a proposed Infantry Platoon Battle Course (IPBC) within Pohakuloa Training Area (PTA).

b. This analysis considers several scenarios and their associated noise impacts from training. The scenarios include: two alternative locations for the proposed Infantry IPBC; aerial gunnery and non-standard ground based weapon activity at the IPBC.

2. CONCLUSIONS. The noise levels associated with the proposed IPBC activity would be compatible with surrounding land use, both on and off-post.

a. Baseline Conditions. The noise levels are compatible with surrounding land use, both on and off-post, for both small caliber and large caliber activity.

b. Projected Conditions. Overall, the Noise Zones are similar for the baseline and the projected conditions under both IPBC locations and both standard and non-standard weapon activity scenarios. The projected noise levels are compatible with surrounding land use, both on and off-post.

c. Aviation Activity. Though aircraft flying along the perimeter road to the proposed IPBC may be audible in the vicinity of the PTA boundary, the area along the perimeter road is undeveloped land zoned Forest Reserve and can only be utilized for limited recreational purposes (i.e., hiking).

3. RECOMMENDATIONS. Include the information from this consultation in the appropriate National Environmental Policy Act documentation.

Operational Noise Consultation No. W430000.02.03.01-b-12, 18 Dec 12

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OPERATIONAL NOISE CONSULTATION
NO. W430000.02.03.01-b-12
PROPOSED INFANTRY PLATOON BATTLE COURSE
POHAKULOA TRAINING AREA, HI
10 SEPTEMBER 2012

1. REFERENCES. Appendix A contains a list of references used in this consultation. A glossary of terms and abbreviations used is in Appendix B.

2. AUTHORITY. The Army Environmental Command, San Antonio, TX funded this consultation.

3. PURPOSE.

a. To assess the noise impacts from a proposed Infantry Platoon Battle Course (IPBC) within Pohakuloa Training Area (PTA).

b. The proposed analysis considers several scenarios:

- Construction and operation of an IPBC. Two locations are under consideration.
- Additional non-standard weapon activity at the IPBC.

4. SCOPE OF CURRENT AND PREVIOUS NOISE CONSULTATIONS UPDATED NOISE ASSESSMENT.

a. In March 2011 the noise associated with a proposed IPBC in the Western Range Area was assessed (U.S. Army 2011a). The consultation concluded that the standard proposed small caliber activity would not have a noise impact beyond the PTA boundary or on any installation noise-sensitive areas.

b. An analysis of hardening the targets at the proposed Western Range IPBC to support aerial gunnery training was completed in July 2011 (U.S. Army 2011b). The hardening of the targets would permit the firing of inert (non-high explosive) rounds for the 2.75 inch Rocket. The proposed aerial gunnery activity would not have a noise impact beyond the PTA boundary or on any installation noise-sensitive areas.

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c. In August 2012 PTA requested additional analysis of the IPBC.

(1) Analysis of an alternative site for the IPBC (Charlie's Circle Alternative). The proposed sites are located on the western side of PTA approximately 3,500 meters (2.2 miles) from the boundary (Figure 1).

(2) Analysis of aerial gunnery training and non-standard ground based activity at both sites. Table 1 lists the cumulative projected activity.

TABLE 1. CUMULATIVE PROJECTED IPBC ACTIVITY

Activity	Nomenclature	Noise Assessment Methodology
IPBC	5.56mm Rifle	Included in projected IPBC small caliber noise contours.
	7.62mm Machine Gun	
	.50 caliber Machine Gun	
Aerial Gunnery	2.75 inch Rocket, inert (non-high explosive)	Included in projected IPBC demolition and large caliber noise contours.
	7.62mm	Included in projected IPBC small caliber noise contours. However, the addition of the elevated firing would not change the projected IPBC small caliber noise contours.
	.50 caliber	
Non-Standard Ground Based Activity	Demolition/Explosive Charges	Included in projected IPBC demolition and large caliber noise contours.
	Hand Grenades	
	Mortars (60mm, 81mm, 120mm High Explosive and inert)	
	TOW Missiles, inert	
	Simulators	Addressed via complaint risk table.
	.50 caliber saboted light armor penetrator tracer (SLAP-T)	Weapons utilize a small caliber training round insert in the weapon. Noise accounted for in the projected IPBC small caliber noise contours.
	AT-4 Rocket 9mm Training Round	
	Carl Gustav Recoilless Rifle FFV552 training practice round	

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5. NOISE CONTOURING PROCEDURES.

a. General. Army Regulation (AR) 200-1 partitions noise into zones, each representing an area of increasing decibel level. Table 2 summarizes each zone and its appropriate weighting by type of operation. The AR lists housing, schools, and medical facilities as examples of noise-sensitive land uses (U.S. Army 2007). Appendix C contains the regulatory requirements.

TABLE 2. NOISE ZONE DECIBEL LEVELS (AR 200-1)

Noise Zone	Large Arms, Demolitions, Etc	Small Caliber
Land Use Planning Zone (LUPZ)	57 – 62 dB CDNL	n/a
Zone I	<62 dB CDNL	< 87 dB PK15(met)
Zone II	62 – 70 dB CDNL	87 – 104 dB PK15(met)
Zone III	>70 dB CDNL	> 104 dB PK15(met)

NOTE:
CDNL = C-weighted Day-Night average sound Level
dB = decibel
PK15(met) = Peak 15 metric

b. Demolition and Large Caliber Weapons. The noise simulation program used to assess demolition and large caliber weapons (20mm and greater) noise is the Blast Noise Impact Assessment (BNOISE2) program (U.S. Army 2009). The program requires operations data concerning the types of weapons fired from each range or firing point (including demolitions), the number and types of ammunition fired from each weapon, the location of targets for each range or firing point and the amount of propellant used to reach the target. Existing range utilization records along with reasonable assumptions were used as inputs.

(a) *Land Use Planning*. The assessment period used to create the C-weighted Day-Night average sound Level (CDNL) contours was 250 days. The CDNL is an annual average noise dose from range operations and is intended for long-term land use planning. The CDNL noise metric is used for demolition and large caliber weapons to capture the low-frequency energy produced from such activities.

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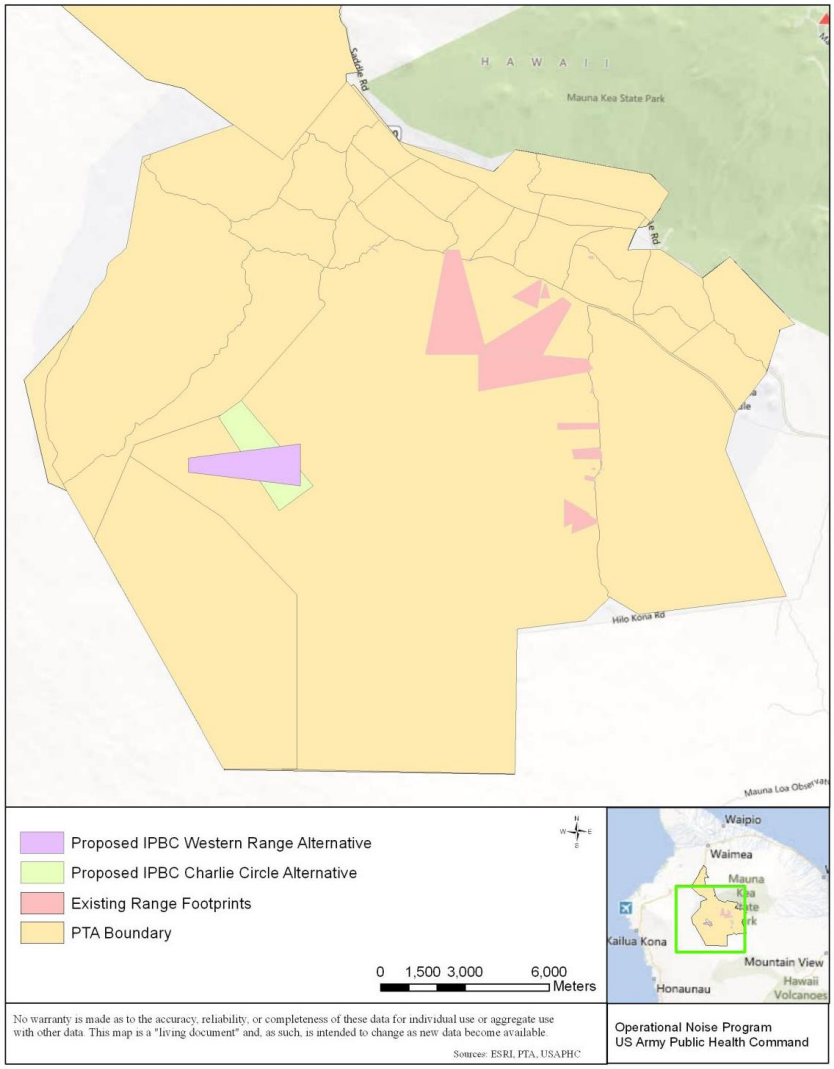

FIGURE 1. PROPOSED LOCATIONS

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(b) *Complaint Risk*. For long-term land use planning, CDNL is the primary metric considered. However, noise complaints typically are attributable to a specific event rather than annual average noise levels. Peak levels are appropriate for estimating the risk of receiving a noise complaint, as they better correlate with the receiver's perception of noise levels (Table 3). The Peak levels are based on the loudest event at each facility/range.

TABLE 3. COMPLAINT RISK GUIDELINES

Perceptibility	dB Peak	Risk of Receiving Noise Complaints
Audible	< 115	Low
Noticeable, Distinct	115 - 130	Moderate
Loud, May Startle	> 130	High

c. Small Caliber Weapons.

(1) The noise simulation program used to assess small arms weapons (.50 caliber and below) noise is the Small Arms Range Noise Assessment Model (SARNAM) (U.S. Army 2003). The program requires operations data concerning types of weapons and range layouts. Range layouts include firing and target point locations. The SARNAM calculation algorithms assume weather conditions or wind directions that favor sound propagation.

(2) Per AR 200-1, small caliber operations were analyzed using PK15(met). The analysis depicts the predicted peak levels for individual rounds (metric term is PK15(met)). Therefore, the number of days the range is used and the number of rounds fired will have no effect on the Noise Zones; the size of the contours will not change if the number of rounds fired increases or decreases.

d. Operations Data. Appendix D contains the data utilized to develop the noise contours. The baseline contours are contained within the 2010 U.S. Army Hawaii Statewide Operational Noise Management Plan and were developed utilizing 2008 operations data.

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6. DEMOLITION AND LARGE CALIBER NOISE EVALUATION.

a. Baseline Conditions. The baseline demolition and large caliber noise contours are shown in Figure 2. Except for small portions along Saddle Road (State Road 200), the Noise Zones remain within the PTA boundary. Along Saddle Road, Zone III extends less than 200 meters, Zone II less than 900 meters and the Land Use Planning Zone (LUPZ) less than 1,800 meters. Within these areas is forest reserve land; the areas do not contain any non-recommend uses.

b. Projected Cumulative Conditions. The proposed IPBC activity includes aerial gunnery (2.75" Rocket) and non-standard ground based activity (TOW Missiles, hand grenades, and demolition/explosive charges). A second scenario of non-standard ground based activity includes mortar firing.

(1) Western Range Alternative. Figures 3 and 4 show the Noise Zones for the proposed Western Range Alternative IPBC demolition and large caliber activity plus the baseline conditions. Figure 3 is based on the aerial gunnery and non-standard ground based activity *without* mortars. Figure 4 includes the aerial gunnery and mortar firing with the non-standard ground based activity.

(2) Charlie Circle Alternative. Figures 5 and 6 show the Noise Zones for the proposed Charlie Circle Alternative IPBC demolition and large caliber activity plus the baseline conditions. Figure 5 is based on the aerial gunnery and non-standard ground based activity *without* mortars. Figure 6 includes the aerial gunnery and mortar firing with the non-standard ground based activity.

(3) Although the proposed scenarios would expand the Noise Zones near the IPBC, the additional activity would have no effect beyond the PTA boundary.

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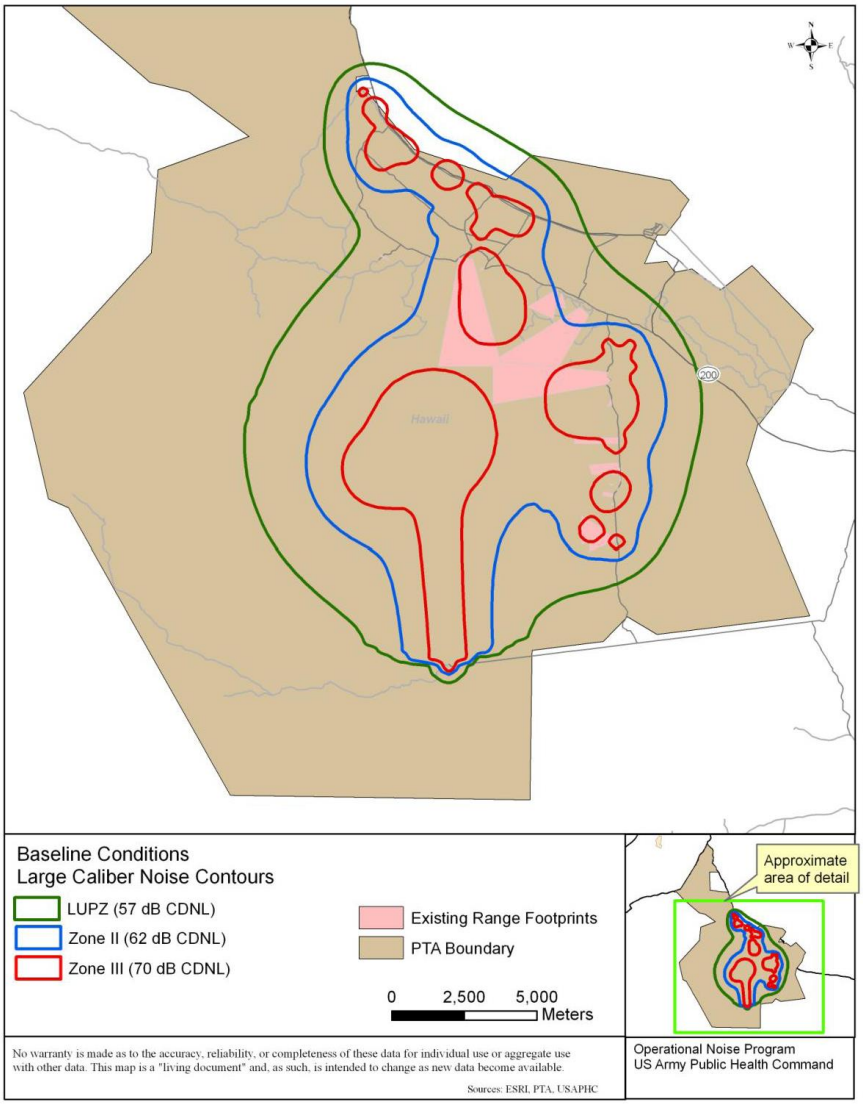

FIGURE 2. BASELINE DEMOLITION AND LARGE CALIBER NOISE ZONES

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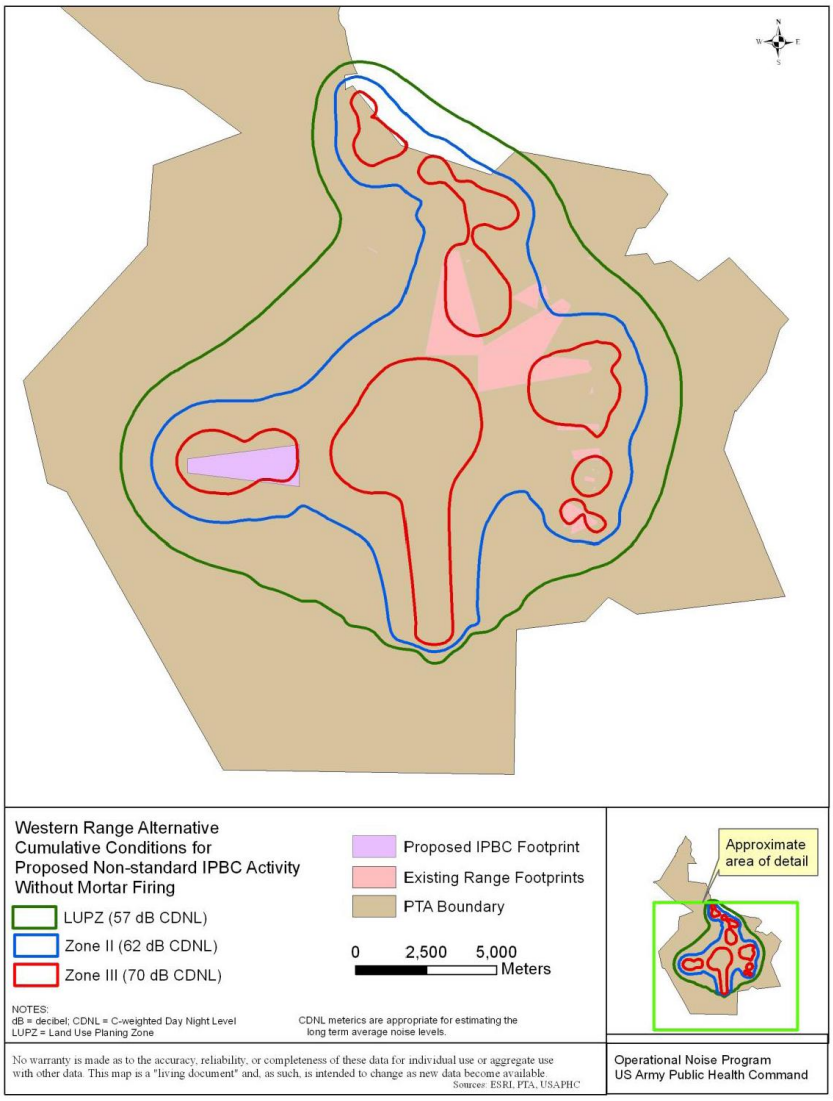

FIGURE 3. PROJECTED WESTERN RANGE ALTERNATIVE (WITHOUT MORTAR FIRING) CUMULATIVE DEMOLITION AND LARGE CALIBER NOISE ZONES

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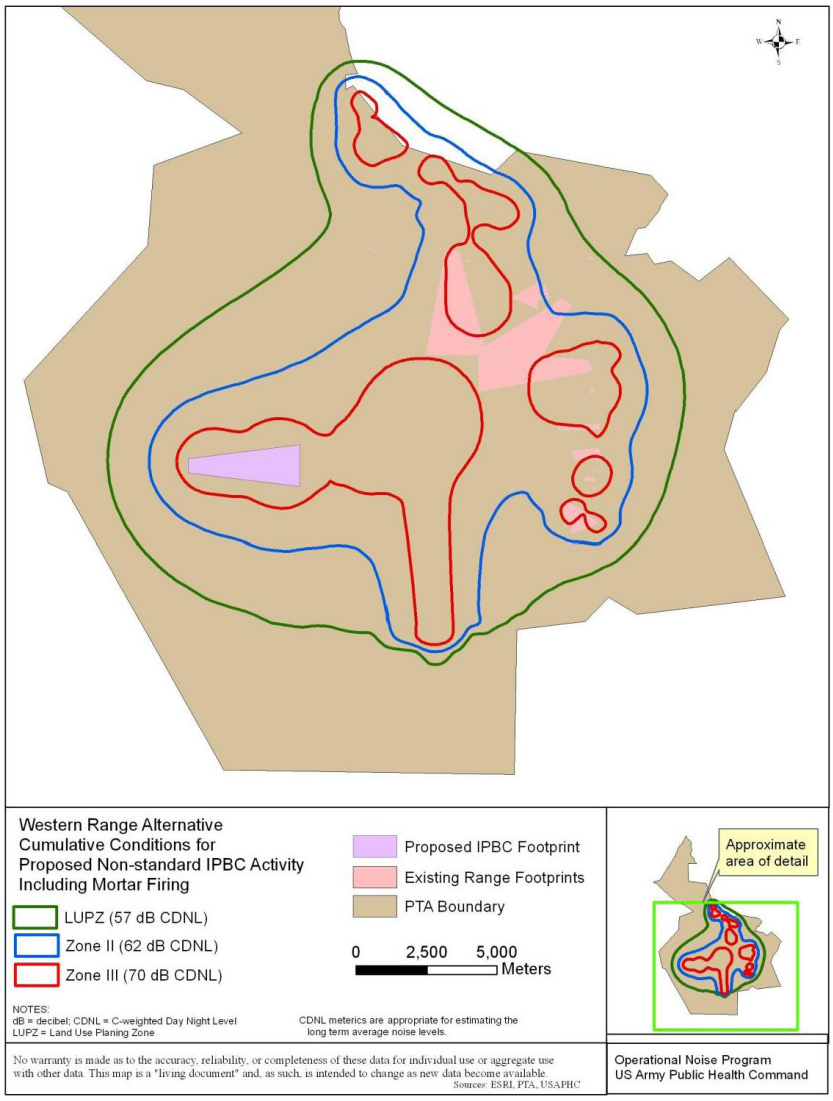

FIGURE 4. PROJECTED WESTERN RANGE ALTERNATIVE (INCLUDING MORTAR FIRING) CUMULATIVE DEMOLITION AND LARGE CALIBER NOISE ZONES

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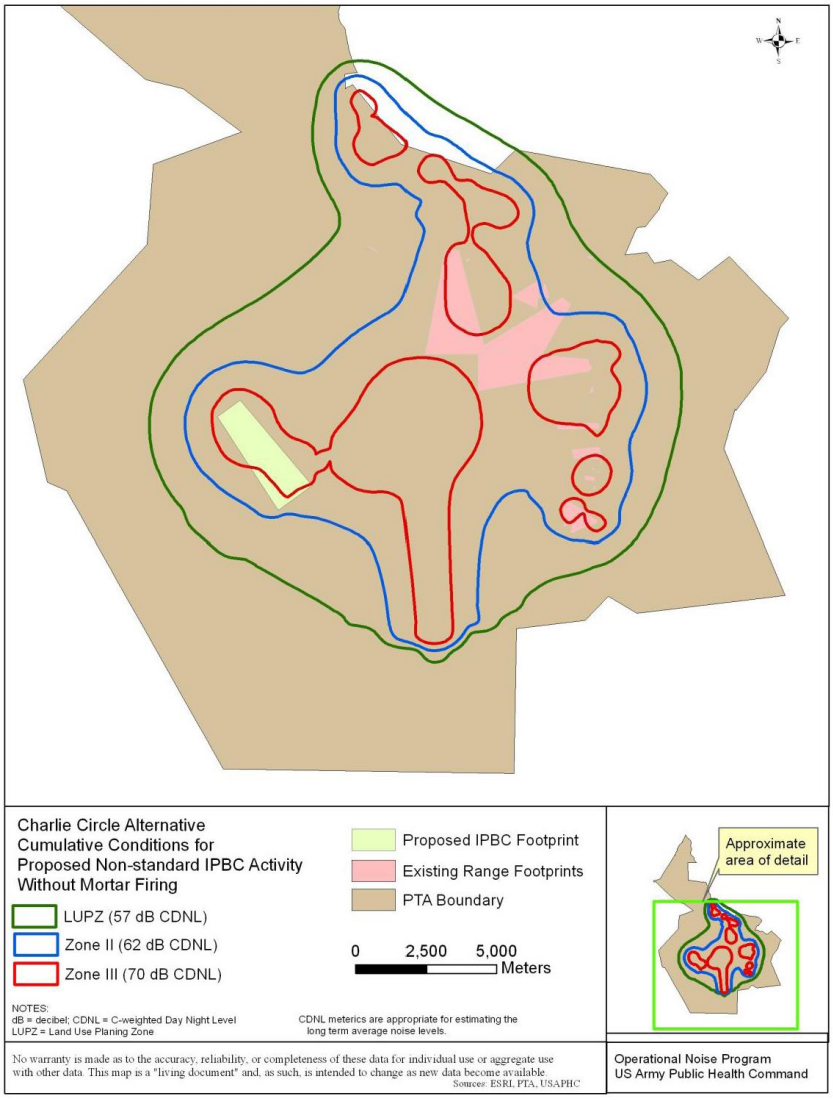

FIGURE 5. PROJECTED CHARLIE CIRCLE ALTERNATIVE (WITHOUT MORTAR FIRING) CUMULATIVE DEMOLITION AND LARGE CALIBER NOISE ZONES

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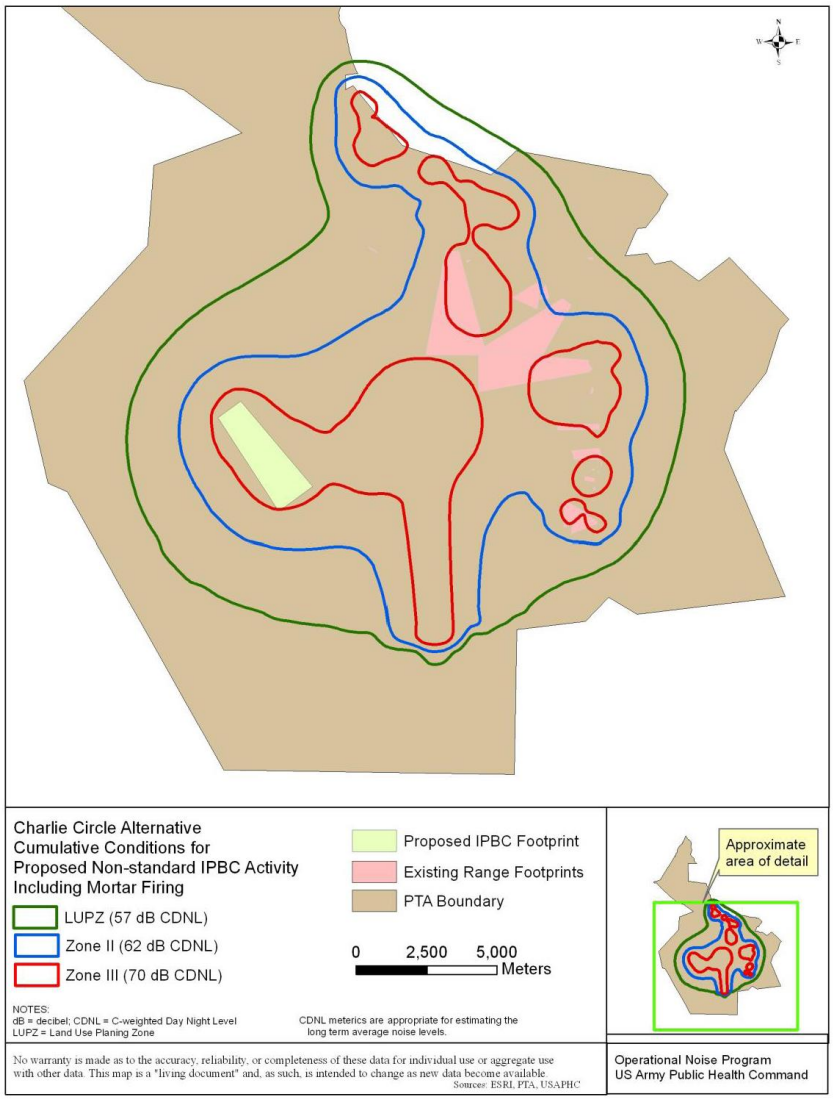

FIGURE 6. PROJECTED CHARLIE CIRCLE ALTERNATIVE (INCLUDING MORTAR FIRING) CUMULATIVE DEMOLITION AND LARGE CALIBER NOISE ZONES

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c. Complaint Risk.

(1) Peak levels can vary significantly for the same activity dependant on weather conditions. The complaint risk potential was assessed under unfavorable weather conditions (PK15(met)). The PK15(met) is the peak sound level, factoring in the statistical variations caused by weather, that is likely to be exceeded only 15% of the time (i.e., 85% certainty that sound will be within this range). The PK15(met) levels would occur under unfavorable weather conditions that enhance sound propagation. It should be noted that if activities take place under favorable weather conditions, such as the wind blowing away from the receiver, noise levels would be lower.

(2) The unfavorable weather conditions [PK15(met)] Complaint Risk area is a good tool to use to indicate areas that may at times be exposed to high noise levels from individual events. When land use planning programs such as real estate disclosure, a Joint Land Use Study or the Army Compatible Use Buffer are implemented, the unfavorable weather conditions [PK15(met)] Complaint Risk areas can be used to delineate areas of focus. However, since the Complaint Risk areas are based on individual event levels and are not dependant on the number of events, planners should also consider frequency of operations when making land use decisions.

(3) Figure 7 depicts the baseline complaint risk areas under unfavorable weather conditions. The complaint risk areas are driven by the live-fire bombing exercises. Although the complaint risk areas extend beyond the boundary in most directions, the risk of complaints would be low or non-existent since the land surrounding PTA is uninhabited and consists of agricultural, forest reserve, and open space.

(4) Figures 8 and 9 depict the projected complaint risk areas under unfavorable weather conditions. Although the complaint risk areas expand near the IPBC, the addition of the proposed activity does not change the complaint risk areas beyond the boundary. The activity at the IPBC includes the aerial gunnery, the non-standard ground based activity, and mortar firing.

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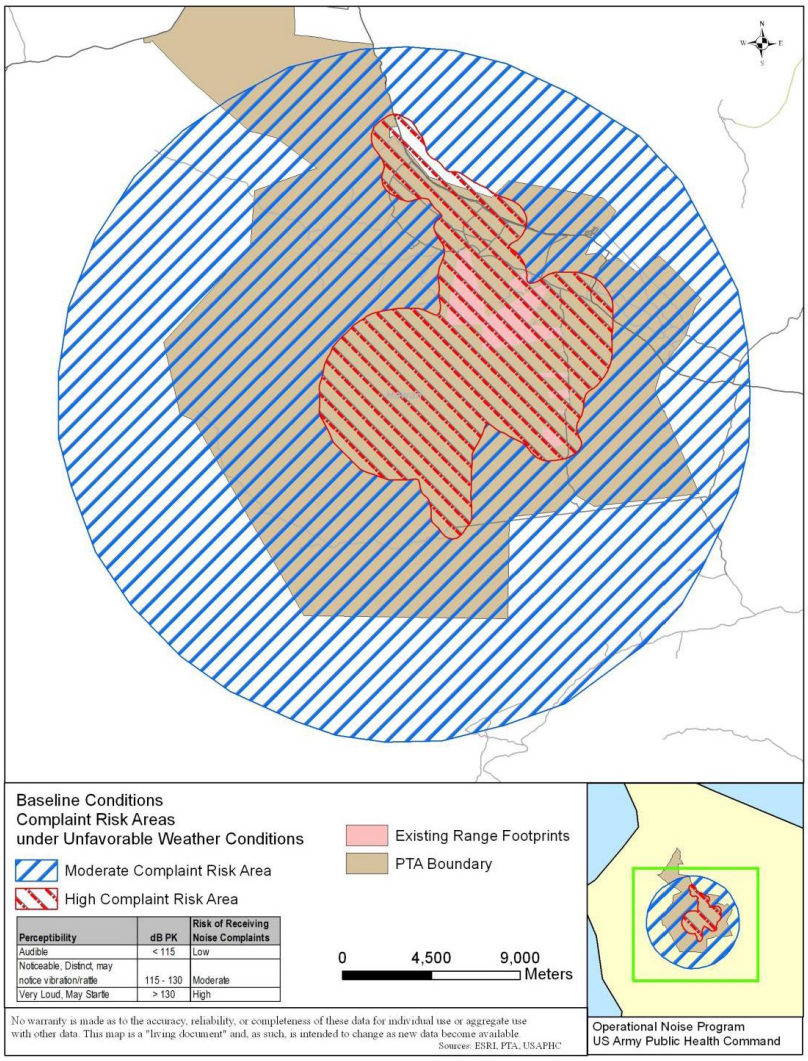

FIGURE 7. BASELINE DEMOLITION AND LARGE CALIBER COMPLAINT RISK AREAS

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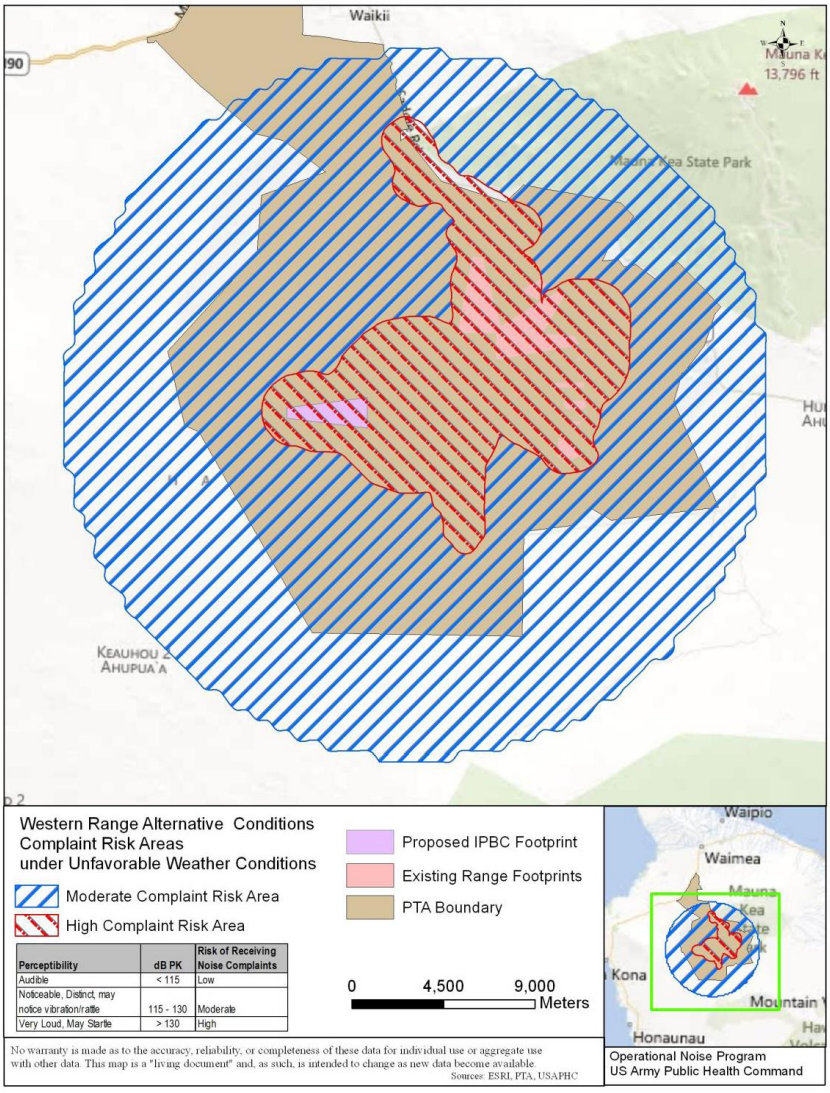

FIGURE 8. PROJECTED WESTERN RANGE ALTERNATIVE DEMOLITION AND LARGE CALIBER COMPLAINT RISK AREAS

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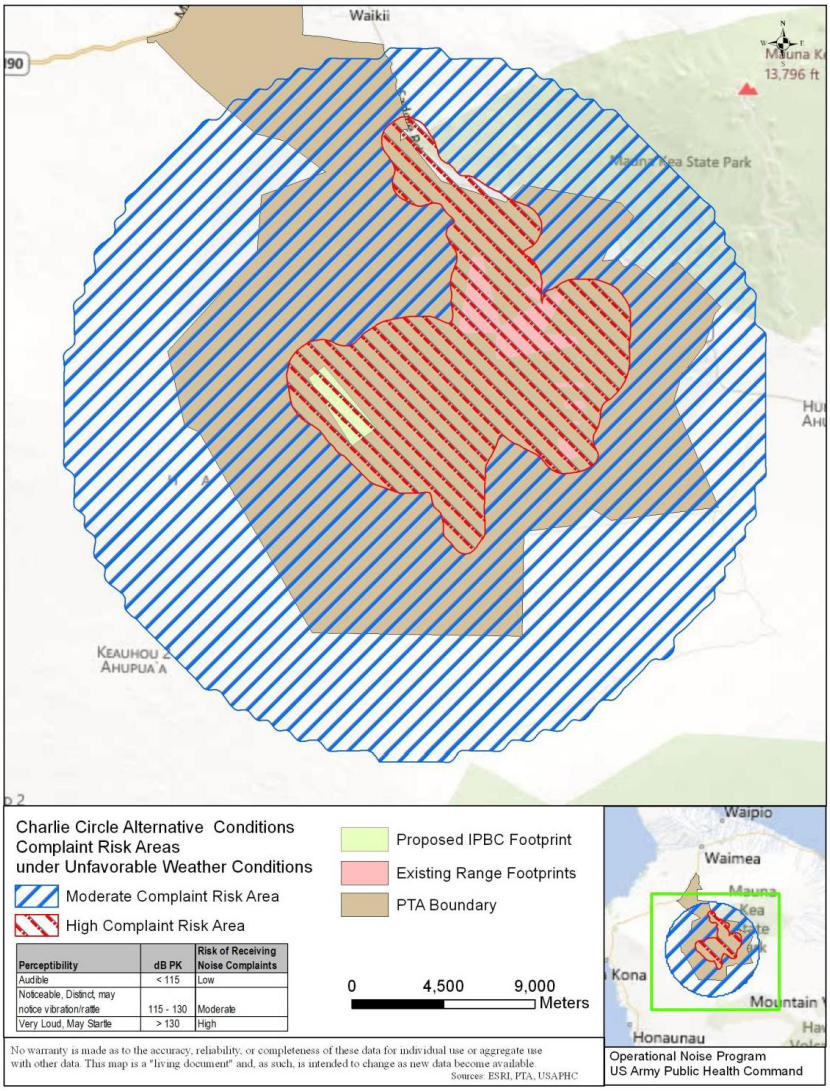

FIGURE 9. PROJECTED CHARLIE CIRCLE ALTERNATIVE DEMOLITION AND LARGE CALIBER COMPLAINT RISK AREAS

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d. 40mm Grenade. Additional activity at the IPBC could include the 40mm Target Practice (TP) Grenade rounds. The launch noise of a 40mm grenade is addressed by looking at peak levels and estimating the noise complaint risk (Table 3).

(1) Tables 4 and 5 contain the complaint risk criterion for the launch noise of the 40mm grenade launchers. The distances and levels listed represent a conservative approach and were calculated based upon hearing conservation criteria (U.S. Army 1999) and a known measurement (U.S. Army 1984). This data represents the best available scientific quantification for assessing the complaint risk for the launch noise of the 40mm grenade launcher.

(2) The IPBC is approximately 3,700 meters from the boundary and as such the risk of complaints from 40mm Grenade firing within the proposed IPBC is low.

TABLE 4. COMPLAINT RISK TO THE SIDE OF THE 40MM GRENADE LAUNCHER, INERT ROUND

Risk of Complaints	Distance from Grenade Launcher	Noise Level dBP
Low	> 300 meters^	< 115 dB
Moderate	65 - 300 meters^	115 dB
High	< 65 meters^	>130 dB
Risk of hearing damage for unprotected ears	< 19 meters+	>140 dB

˙ -- Inert is defined as any round that does not make noise upon impact, such as smoke, illum, TP
^ – Calculated value
+ – Known value, hearing conservation criteria.

TABLE 5. COMPLAINT RISK TO THE REAR OF THE 40MM GRENADE LAUNCHER, INERT ROUND

Risk of Complaints	Distance from Grenade Launcher	Noise Level dBP
Low	> 110 meters^	< 115 dB
Moderate	25 - 110 meters^	115 dB
High	< 25 meters^	>130 dB
Risk of hearing damage for unprotected ears	< 7 meters+	>140 dB

˙ -- Inert is defined as any round that does not make noise upon impact, such as smoke, illum, TP
^ – Calculated value
+ – Known value, hearing conservation criteria.

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e. Pyrotechnic and Non-pyrotechnic Simulators.

(1) Simulator noise levels will vary depending on the type (i.e., artillery, ground burst, and grenade) but typically the variation will be limited to a few decibels. Table 6 gives an approximation of noise levels that would be anticipated under average weather conditions and under weather conditions that favor sound propagation. The levels were generated using the BNOISE2 computer program, and then verified by comparing the levels with results from various noise monitoring studies (U.S. Army 1983, U.S. Army 1984, U.S. Army 1989).

(2) Based on the levels in Table 6, it can be inferred that under neutral weather conditions, the risk of complaints will be low beyond 500 meters. Under unfavorable weather conditions, such as during a temperature inversion, or when there is a strong wind blowing in the direction of the receiver, the distance increases to approximately 800 meters.

(3) The IPBC is approximately 3,700 meters from the boundary and as such, the risk of complaints from simulators within the proposed IPBC is low.

TABLE 6. PREDICTED PEAK NOISE LEVELS FOR TYPICAL ARMY SIMULATORS

Distance from source (meters)	Neutral Weather Conditions (PK50(met))	Unfavorable Weather Conditions (PK15(met))
100	134	136
200	125	130
300	120	127
400	117	123
500	114	121
600	111	118
700	109	116
800	107	114

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7. SMALL CALIBER NOISE EVALUATION.

a. Baseline Conditions. The baseline small caliber noise contours are shown in Figure 10. Except for small portions along Infantry Road, the Noise Zones remain within the PTA boundary. Along Infantry Road, Zone III extends less than 200 meters beyond the boundary. Within this area is forest reserve land which does not contain any non-recommend uses.

b. Projected Cumulative Conditions. The proposed IPBC activity (ground based and aerial gunnery) includes the 5.56mm rifle; the 7.62mm and .50 caliber machine guns. As mentioned previously, small caliber Noise Zones are based upon on peak levels rather than a cumulative or average level; the size of the Zones will not change if the number of rounds fired increases or decreases.

(1) *Western Range Alternative*. Figure 11 contains the Noise Zones for the proposed IPBC plus the baseline conditions. The addition of the Western Range IPBC would not have a noise impact beyond the PTA boundary or on installation noise-sensitive areas.

(2) *Charlie Circle Alternative*. Figure 12 contains the Noise Zones for the proposed IPBC plus the baseline conditions. The addition of the Charlie Circle IPBC would not have a noise impact beyond the PTA boundary or on installation noise-sensitive areas.

(3) For both locations, although the Noise Zones expand near the IPBC, they remain within PTA.

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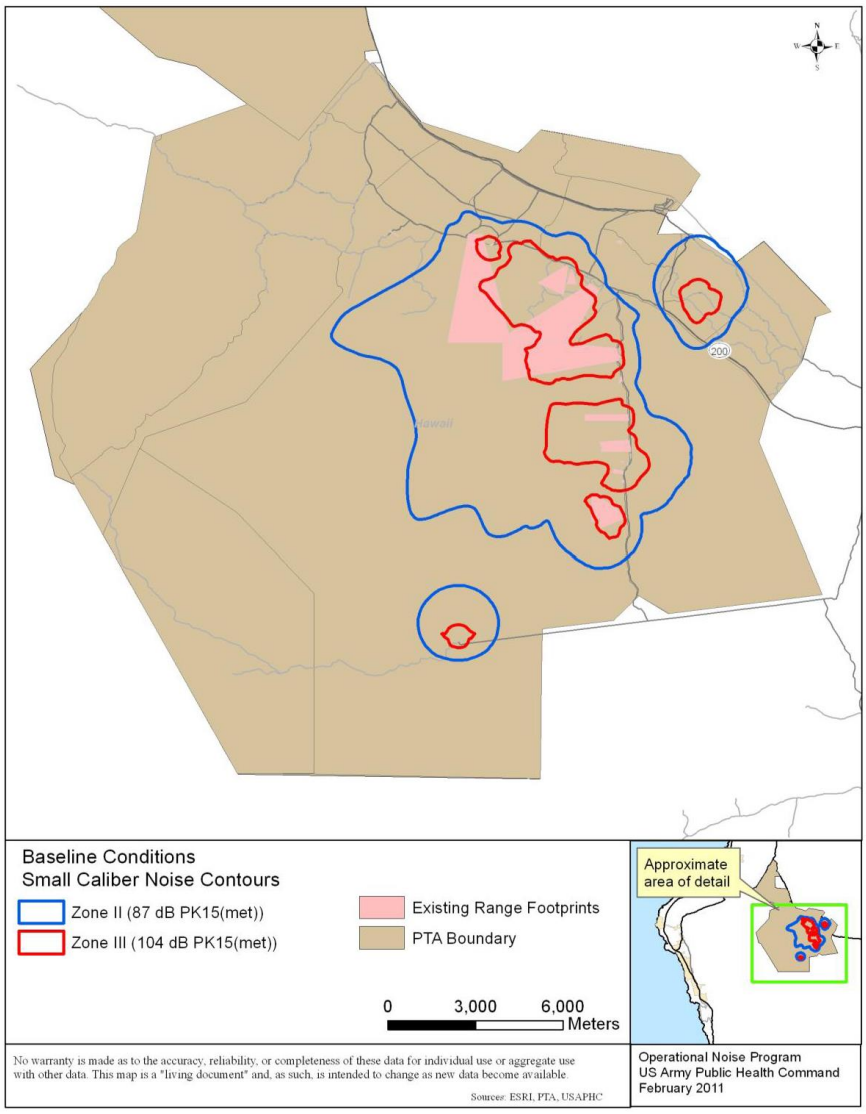

FIGURE 10. BASELINE SMALL CALIBER NOISE ZONES

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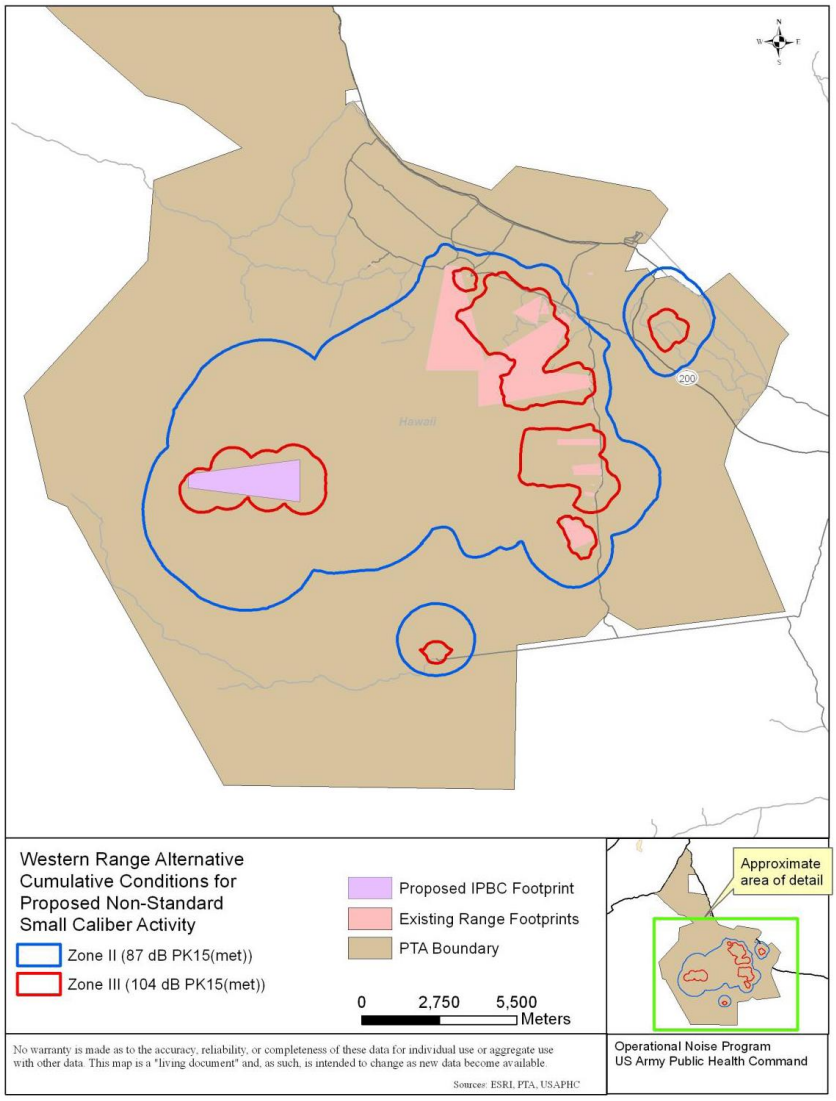

FIGURE 11. PROPOSED WESTERN RANGE ALTERNATIVE CUMULATIVE SMALL CALIBER NOISE ZONES

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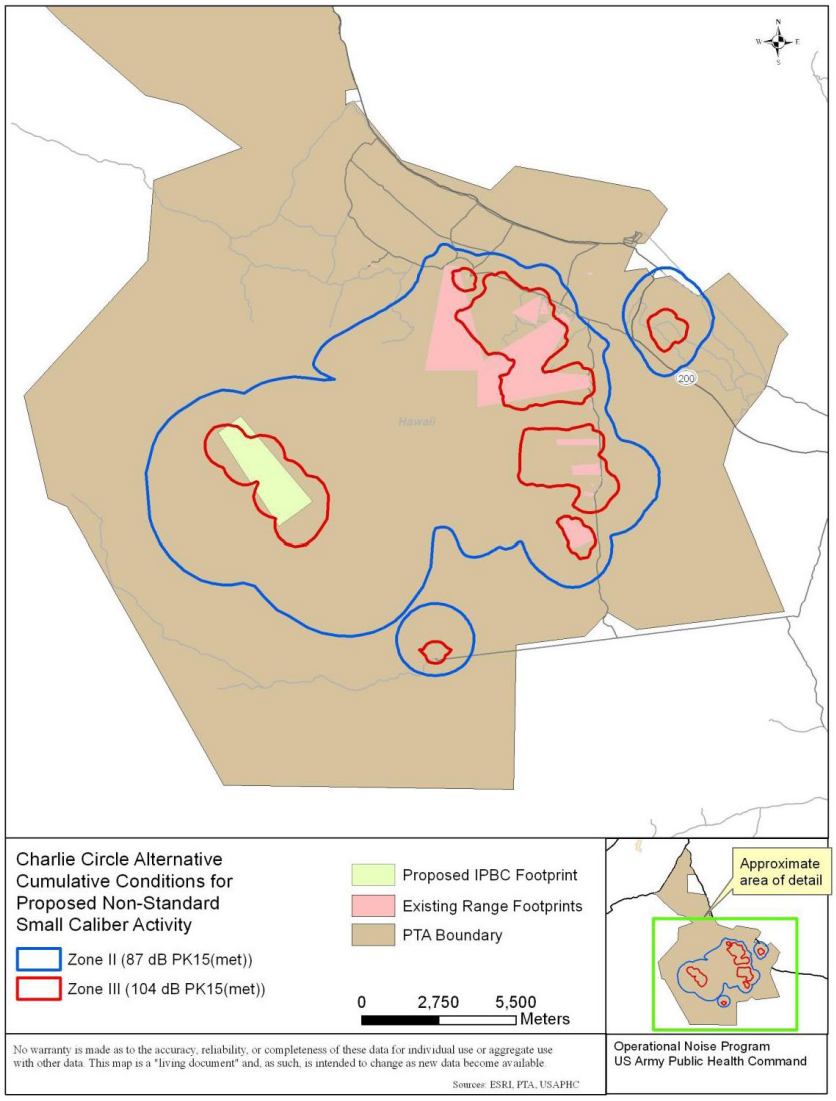

FIGURE 12. PROPOSED CHARLIE CIRCLE ALTERNATIVE CUMULATIVE SMALL CALIBER NOISE ZONES

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8. HELICOPTER ACTIVITY.

a. General.

(1) Hardening of the IPBC targets would permit aerial gunnery firing from the UH-60 Blackhawk and OH-58 Kiowa helicopters. Aerial gunnery exercises are expected to be conducted up to three times per year. Depending upon the training mission, each exercise could last 1-2 weeks, with 2 helicopters on the range at a time.

(2) To access the range, the helicopters would either follow the perimeter road into the area or transition across the PTA training lands. For noise abatement procedures, helicopters flying along the perimeter road route fly at an altitude of less than 100 feet Above Ground Level (AGL).

b. Overflight Noise Assessment.

(1) Although the limited helicopter activity would not generate noise contours that indicate incompatible land use, there is still potential that individual overflights could annoy people near the flight tracks and generate complaints.

(2) Scandinavian Studies (Rylander 1974 and Rylander 1988) have found a good predictor of annoyance at airfields with 50 to 200 operations per day is the maximum level of the 3 loudest events. While annoyance levels will most likely be much lower at flight corridors with less than 50 operations per day, it can be a tool in providing some indication of annoyance level.

(3) The SELCalc2 Program (U.S. Air Force 2005) was used to calculate the maximum A-weighted (dBA) noise levels. The levels are listed in Table 7. These maximum levels are compared with levels listed in Table 8 to determine the percent of population that would consider itself highly annoyed.

TABLE 7. MAXIMUM NOISE LEVELS OF AIRCRAFT

Slant Distance (feet)	Maximum Level, dBA	
	OH-58	UH-60
50	99	100
100	93	94
200	87	88
500	79	80
1,000	72	73

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TABLE 8. PERCENTAGE OF POPULATION HIGHLY ANNOYED FROM AIRCRAFT NOISE (Rylander 1974)

Maximum, dBA	Highly Annoyed
90	35%
85	28%
80	20%
75	13%
70	5%

(4) Table 9 indicates the percent of population that would consider itself highly annoyed correlated with maximum noise levels for overflights. The correlation is based on the Rylander studies which investigated airfields with 50 to 200 operations per day. Also based on Rylander's results, Figure 13 depicts the percent of population which would be annoyed by a UH-60 overflight. If the receivers are directly under a UH-60 at 100 foot AGL, +35 percent of the population would consider itself highly annoyed. If the receivers are 1/4 of a mile to the side, less than 1 percent of the population would consider itself highly annoyed.

TABLE 9. ROTARY WING OVERFLIGHT ANNOYANCE POTENTIAL[1]

Source	Ground Track Distance[2]	dBA Maximum[3]	Population Highly Annoyed[4]
OH-58 – 50' AGL	0'	99	+35%
	1320' (1/4 mile)	71	7%
	1760' (1/3 mile)	66	<1%
OH-58 – 100' AGL	0'	93	+35%
	1320' (1/4 mile)	65	<1%
	1760' (1/3 mile)	60	<1%
UH-60 – 50' AGL	0'	100	+35%
	1320' (1/4 mile)	72	8%
	1760' (1/3 mile)	67	1%
UH-60 – 100' AGL	0'	94	+35%
	1320' (1/4 mile)	66	<1%
	1760' (1/3 mile)	61	<1%

[1] Percent annoyance shown is based upon 50 to 200 overflights per day. (Rylander 1974)
[2] Distance between receiver and the point on Earth at which the aircraft is directly overhead.
[3] Obtained via SelCalc Program (U.S. Air Force 2005)
[4] Calculated percentage based upon regression using the known values in Table 8.
+ 35% The Rylander studies did not include sampling in excess of 90 dBA.

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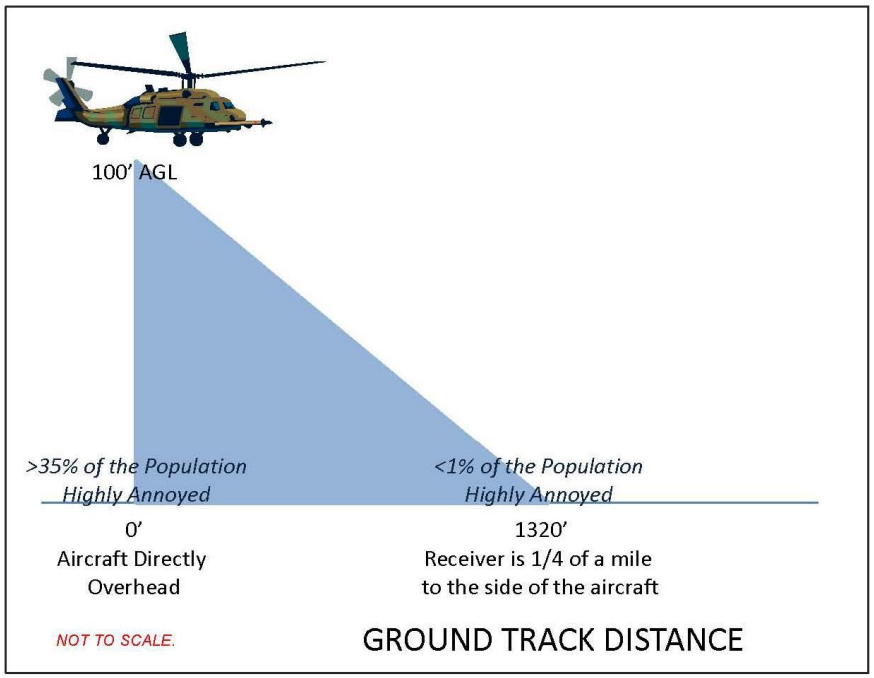

FIGURE 13. UH-60 OVERFLIGHT ANNOYANCE POTENTIAL
(More than 50 Daily Overflights)

(5) The overflight levels indicate there is a potential that aircraft flying along the perimeter road to the proposed IPBC may annoy those alongside the PTA boundary. Although the area along the perimeter road is undeveloped land zoned Forest Reserve, it can be utilized for limited recreational purposes (i.e., hiking). However, the low number of operations, minimum flight altitudes, and imposed standoff distances greatly minimize this potential.

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9. CONCLUSIONS.

a. The noise levels associated with the proposed IPBC activity are compatible with surrounding land use, both on and off-post.

b. The addition of the IPBC would not change the Noise Zones beyond the PTA boundary. Overall, the Noise Zones are similar for the baseline and the projected conditions under both IPBC locations and both non-standard weapon activity scenarios.

c. There is a potential that aircraft flying along the perimeter road to the proposed IPBC may annoy those alongside the PTA boundary. Although the area along the perimeter road is undeveloped land zoned Forest Reserve, it can be utilized for limited recreational purposes (i.e., hiking).

10. RECOMMENDATIONS. Include the information from this consultation in the appropriate National Environmental Policy Act documentation.

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APPENDIX A

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APPENDIX B

GLOSSARY OF TERMS, ACRONYMS & ABBREVIATIONS

B-1. GLOSSARY OF TERMS.

Above Ground Level – distance of the aircraft above the ground.

A-weighted Sound Level – the ear does not respond equally to sounds of all frequencies, but is less efficient at low and high frequencies than it is at medium or speech range frequencies. Thus, to obtain a single number representing the sound pressure level of a noise containing a wide range of frequencies in a manner approximating the response of the ear, it is necessary to reduce, or weight, the effects of the low and high frequencies with respect to the medium frequencies. Thus, the low and high frequencies are de-emphasized with the A-weighting. The A-scale sound level is a quantity, in decibels, read from a standard sound-level meter with A-weighting circuitry. The A-scale weighting discriminates against the lower frequencies according to a relationship approximating the auditory sensitivity of the human ear. The A-scale sound level measures approximately the relative "noisiness" or "annoyance" of many common sounds.

Average Sound Level – the mean-squared sound exposure level of all events occurring in a stated time interval, plus ten times the common logarithm of the quotient formed by the number of events in the time interval, divided by the duration of the time interval in seconds.

C-weighted Sound Level – a quantity, in decibels, read from a standard sound level meter with C-weighting circuitry. The C-scale incorporates slight de-emphasis of the low and high portion of the audible frequency spectrum.

Day-Night Average Sound Level (DNL) – the 24-hour average frequency-weighted sound level, in decibels, from midnight to midnight, obtained after addition of 10 decibels to sound levels in the night from midnight up to 7 a.m. and from 10 p.m. to midnight (0000 up to 0700 and 2200 up to 2400 hours).

Decibels (dB) – a logarithmic sound pressure unit of measure.

Ground Track Distance – the distance between the receiver and the point on the Earth at which the aircraft is directly overhead.

Noise – any sound without value.

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PK15(met) – the maximum value of the instantaneous sound pressure for each unique sound source, and applying the 15 percentile rule accounting for meteorological variation.

PK85(met) – The Peak sound level, factoring in statistical variations caused by weather, that is likely to be exceeded 85% of the time. PK85(met) levels occur under favorable weather conditions, such as the wind blowing away from the receiver.

Slant Distance – the line of sight distance between the receiver and the aircraft. The slant distance is the hypotenuse of the triangle represented by the altitude AGL of the aircraft and the distance between the receiver and the aircraft's ground track distance.

B-2. GLOSSARY OF ACRONYMS AND ABBREVIATIONS.

AGL	Above Ground Level
CDNL	C-weighted average Day Night Level
dB	Decibels
dBA	Decibels, A-weighted
IPBC	Infantry Platoon Battle Course
MAX	Maximum sound level
PK15(met)	Unweighted Peak, 15% Metric
PTA	Pohakuloa Training Area (PTA)
SARNAM	Small Arms Range Noise Assessment Model
TP	Target Practice

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APPENDIX C

REGULATORY REQUIREMENT SUMMARY

1. REFERENCE. U.S. Army, 2007, Army Regulation 200-1, Environmental Protection and Enhancement, Chapter 14 Operational Noise.

2. NOISE ZONES AS THEY RELATE TO LAND USE

a. The Army uses a system which partitions noise into three zones, each labeled by Roman numerals and each representing an area of increasing noise. Army Regulation (AR) 200-1 lists housing, schools, and medical facilities as examples of noise-sensitive land uses. The noise exposure on communities is translated into Noise Zones. The program defines four Noise Zones:

- Noise-sensitive land uses are not recommended in *Zone III*.
- Although local conditions such as availability of developable land or cost may require noise-sensitive land uses in *Zone II*, this type of land use is strongly discouraged on the installation and in surrounding communities. All viable alternatives should be considered to limit development in *Zone II* to non-sensitive activities such as industry, manufacturing, transportation and agriculture.
- Noise-sensitive land uses are generally acceptable within the *Zone I*. However, though an area may only receive *Zone I* levels, military operations may be loud enough to be heard - or even judged loud on occasion. *Zone I* is not one of the contours shown on the map; rather it is the entire area outside of the *Zone II* contour.
- The *Land Use Planning Zone (LUPZ)* is a subdivision of *Zone I*. The *LUPZ* is 5 dB lower than the *Zone II*. Within this area, noise-sensitive land uses are generally acceptable. However, communities and individuals often have different views regarding what level of noise is acceptable or desirable. To address this, some local governments have implemented land use planning measures out beyond the *Zone II* limits. Additionally, implementing planning controls within the *LUPZ* can develop a buffer to avert the possibility of future noise conflicts.

Table C shows all of the noise zones by the respective noise levels.

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Table C. Noise Zone Decibel Levels (U.S. Army 2007)

Noise Zone	Aviation (ADNL)	Small Arms (PK15(met))	Large Arms, Demolitions, Etc. (CDNL)
Land Use Planning Zone (LUPZ)	60-65	N/A	57 – 62
Zone I	<65	<87	<62
Zone II	65-75	87 – 104	62 – 70
Zone III	>75	>104	>70
Legend: > = greater than; < = less than; N/A = not applicable; ADNL = A-weighted average Day Night Level; CDNL = C-weighted average Day-Night Level			

b. Often, there are existing “noise-sensitive” land uses that could be defined as non-conforming. In most cases, this is not a risk to community quality of life or mission sustainment. Long-term neighbors often acknowledge that they hear training, but most are not bothered by it. The intent of AR 200-1 is to offer land use recommendations, which if adopted both on and off the installation, would facilitate future development that is unaffected by military noise.

c. Though Noise Zones are used to delineate land use compatibility, factors such as meteorological conditions and the receiver's perception of the source can influence the level or impact of noise from day to day. The Noise Zones are intended to provide the best available solution to quantify noise impacts and assist in the land use policy decision making process.

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APPENDIX D

WEAPON OPERATIONS DATA

D-1. The baseline demolition and large caliber Noise Zones shown in Figure 2 were developed using the data in Table D-2. These baseline contours are contained within the 2010 U.S. Army Hawaii Statewide Operational Noise Management Plan and were developed utilizing 2008 operations data

D-2. Table D-1 summarizes the projected activity.

TABLE D-1. PROJECTED ACTIVITY SUMMARY

Activity	Nomenclature	Noise Assessment Methodology
IPBC	5.56mm Rifle	Included in projected IPBC small caliber noise contours.
	7.62mm Machine Gun	
	.50 caliber Machine Gun	
Aerial Gunnery	2.75 inch Rocket, inert (non-high explosive)	Included in projected IPBC demolition and large caliber noise contours.
	7.62mm	Included in projected IPBC small caliber noise contours. However, the addition of the elevated firing would not change the projected IPBC small caliber noise contours
	.50 caliber	
Non-Standard Ground Based Activity	Demolition/Explosive Charges	Included in projected IPBC demolition and large caliber noise contours.
	Hand Grenades	
	Mortars (60mm, 81mm, 120mm High Explosive and inert)	
	TOW Missiles, inert	
	Simulators	Addressed via complaint risk table.
	.50 caliber saboted light armor penetrator tracer (SLAP-T)	Weapons utilize a small caliber training round insert in the weapon. Noise accounted for in the projected IPBC small caliber noise contours.
	AT-4 Rocket 9mm Training Round	
	Carl Gustav Recoilless Rifle FFV552 training practice round	

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D-3. The projected cumulative demolition and large caliber Noise Zones shown in Figures 3 and 5 were developed using the data in Tables D-2 and D-3. This scenario included aerial gunnery and the non-standard ground based activity (*without* mortar firing).

D-4. The projected cumulative demolition and large caliber Noise Zones shown in Figures 4 and 6 were developed using the data in Tables D-2 and D-4. This scenario included aerial gunnery and non-standard ground based activity (*including* mortar firing).

D-5. The baseline small caliber Noise Zones shown in Figure 10 were developed using the data in Table D-5. These baseline contours are contained within the 2010 U.S. Army Hawaii Statewide Operational Noise Management Plan and were developed utilizing 2008 operations data

D-6. The projected cumulative small caliber Noise Zones shown in Figures 11 and 12 were developed based on the data in Tables D-5 and D-6. . As mentioned previously, small caliber noise contours are based upon on peak levels rather than an average level, the size of the contours will not change if the number of rounds fired increases or decreases.

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TABLE D-2. BASELINE DEMOLITION AND LARGE CALIBER AMMUNITION EXPENDITURE

RANGE	WEAPON	DAYTIME (0700-2200)	NIGHTTIME (2200-0700)
PTA FP 401/9	105mm Howitzer, Inert	51.3	5.7
	105mm Howitzer, HE	1552.5	172.5
	155mm Howitzer, HE	174.6	19.4
PTA FP 402/9	105mm Howitzer, Inert	270.9	30.1
	105mm Howitzer, HE	602.1	66.9
	155mm Howitzer, HE	108.9	12.1
PTA FP 405/9	155mm Howitzer, Inert	11.7	1.3
	155mm Howitzer, HE	297	33
PTA FP 409/9	155mm Howitzer, HE	38.7	4.3
PTA FP 410/12	155mm Howitzer, Inert	46.8	5.2
	155mm Howitzer, HE	153	17
PTA FP 411/9	155mm Howitzer, Inert	31.5	3.5
	155mm Howitzer, HE	114.3	12.7
PTA FP 420/12	155mm Howitzer, Inert	107.1	11.9
	155mm Howitzer, HE	489.6	54.4
PTA FP 424/12	105mm Howitzer, Inert	16.2	1.8
	105mm Howitzer, HE	100.8	11.2
PTA FP 431/15	155mm Howitzer, Inert	11.7	1.3
	155mm Howitzer, HE	350.1	38.9
PTA FP 435/15	155mm Howitzer, Inert	99	11
	155mm Howitzer, HE	383.4	42.6
PTA FP 436/15	155mm Howitzer, Inert	10.8	1.2
	155mm Howitzer, HE	48.6	5.4
PTA FP 438/15	105mm Howitzer, Inert	426.6	47.4
	105mm Howitzer, HE	321.3	35.7
	155mm Howitzer, Inert	42.3	4.7
	155mm Howitzer, HE	218.7	24.3
PTA FP 442M/9	60mm Mortar, Inert	164	0
	60mm Mortar, HE	232	0
	81mm Mortar, Inert	1072	0
	81mm Mortar, HE	2729	0
	120mm Mortar, Inert	177	0
	120mm Mortar, HE	68	0
	90mm Gun, HE	15	0
PTA FP 501/16	105mm Howizer, HE	108	12
	155mm Howitzer, Inert	24.3	2.7
	155mm Howitzer, HE	292.5	32.5
PTA FP 503/16	155mm Howitzer, HE	36.9	4.1
PTA FP 801M	60mm Mortar, Inert	6	0
	120mm Mortar, Inert	441	0
	120mm Mortar, HE	197	0

NOTE: Inert is defined as any round that does not make noise upon impact, (i.e. Smoke, Illum, Target Practice)

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TABLE D-2. BASELINE DEMOLITION AND LARGE CALIBER AMMUNITION EXPENDITURE, cont'd

RANGE	WEAPON	DAYTIME (0700-2200)	NIGHTTIME (2200-0700)
PTA FP 802M	60mm Mortar, Inert	32	0
	60mm Mortar, HE	666	0
	81mm Mortar, Inert	875	0
	81mm Mortar, HE	235	0
	120mm Mortar, Inert	7	0
	120mm Mortar, HE	78	0
	Demolition, MK74 (M832), 0.31 lbs	22	0
PTA FP 804M	60mm Mortar, Inert	96	0
	60mm Mortar, HE	1389	0
	120mm Mortar, Inert	902	0
	120mm Mortar, HE	22	0
PTA FP 807M	60mm Mortar, Inert	193	0
	60mm Mortar, HE	898	0
PTA POW CAMP	Simulator, Ground Burst M115A2	5	0
PTA RG 01 DEF	2.75 IN Rocket, HE	21	0
	Demolition Sheet, 38 Ft 0.5 lbs/Ft	2	0
PTA RG 01 OFF	Simulator, Hand Grenade M116	20	0
	Demolition, 1 lbs	400	0
PTA RG 03	40mm Grenade, HE	1772	0
PTA RG 05	Hand Grenade, Fragmenting	1696	0
PTA RG 05A	Hand Grenade, Fragmenting	206	0
PTA RG 08A	AT4 Rocket, HE	9	0
	Dragon Rocket, HE	4	0
	TOW Missile, HE	20	0
PTA RG 09	Bangalore, Kit (M1A1)	36	0
	Bangalore, Kit (M1A2)	5	0
	Cratering Charge, 40 lbs	5	0
	Demolition, 1 lbs	142	0
	Demolition, 1.25 lbs	202	0
	Demolition, 2 lbs	2	0
	Demolition, 2.25 lbs	2	0
	Demolition, 2.5 lbs Block M5	45	0
	Demolition, 2.5 lbs Block M2	6	0
	Demolition Flex Linear, 0.1926 lbs (MM46)	1	0
	Demolition Flex Linear, 0.44 lbs (MM30)	4	0
	Demolition Kit, 1.25 lbs (M757)	150	0
	Demolition Sheet, 25 Ft 0.8 lbs/Ft	32	0
	Mine, Claymore M18A1	25	0
	Shape Charge, 15 lbs	6	0
	Shape Charge, 40 lbs	5	0

NOTE: Inert is defined as any round that does not make noise upon impact, (i.e. Smoke, Illum, Target Practice)

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TABLE D-2. BASELINE DEMOLITION AND LARGE CALIBER AMMUNITION EXPENDITURE, cont'd

RANGE	WEAPON	DAYTIME (0700-2200)	NIGHTTIME (2200-0700)
PTA RG 10	Simulator, Ground Burst M115A2	1	0
PTA RG 10 OFF	60mm Mortar, HE	48	0
	81mm Mortar, Inert	2	0
	AT4 Rocket, Inert	57	0
	AT4 Rocket, HE	57	0
	Hand Grenade, Fragmenting	107	0
	40mm Grenade, HE	96	0
PTA RG 13	105mm Howitzer, Inert	163.8	18.2
PTA RG 13A	AT4 Rocket, Inert	41	0
	AT4 Rocket, HE	11	0
	40mm Grenade, HE	2284	0
	Demolition, 0.25 lbs	64	0
	Demolition Kit, APOBS (MN79)	8	0
PTA RG 15	2.75 IN Rocket, Inert	7133	0
	Hellfire Missle, HE	38	0
PTA RG 16	20mm Gun, Inert	2600	0
	20mm Gun, HE	200	0
	30mm Gun, HE	400	0
	Bomb, CBU-59A/B (E016)	6	0
	Bomb, MK82 500 lbs.	181	0
	Bomb, MK83 1000 lbs.	22	0
	Bomb, 2000 lbs. (E756)	16	0
	Bomb, Practice 9 lbs. (E962)	34	0
	Bomb, Practice 25 lbs. (E969)	10	0
	2.75 IN Rocket, Inert	36	0
PTA RG 20	2.75 IN Rocket, Inert	91	0
	Hellfire Missle, HE	19	0
PTA RG 8C SHOOTHOUSE	Simulator, Hand Grenade M116	15	0

NOTE: Inert is defined as any round that does not make noise upon impact, (i.e. Smoke, Illum, Target Practice)

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TABLE D-3. PROJECTED IPBC LARGE CALIBER AMMUNITION EXPENDITURE

	PROJECTED ANNUAL ACTIVITY	
	Day-time (0700-2200)	Nighttime (2200-0700)
2.75" Rocket, Inert	588	252
TOW Missile, Inert	6	3
Hand Grenade, M67 Live	366	144
Demolition, Bangalore, M026/M028/MP03	42	18
Demolition, C-4, M023	700	300
Mine, Claymore, K143/K146	4	2

NOTES:
Inert is defined as any round that does not make noise upon impact, (i.e. smoke, target practice, target practice tracer)

TABLE D-4. PROJECTED IPBC LARGE CALIBER AMMUNITION EXPENDITURE INCLUDING MORTARS

	PROJECTED ANNUAL ACTIVITY	
	Day-time (0700-2200)	Nighttime (2200-0700)
2.75" Rocket, Inert	588	252
TOW Missile, Inert	6	3
60mm Mortar, HE	462	198
60mm Mortar, Inert	198	85
81mm Mortar, HE	286	122
81mm Mortar, Inert	129	55
120mm Mortar, HE	613	263
120mm Mortar, Inert	370	158
Hand Grenade, M67 Live	366	144
Demolition, Bangalore, M026/M028/MP03	42	18
Demolition, C-4, M023	700	300
Mine, Claymore, K143/K146	4	2

NOTES:
HE = High Explosive; Inert is defined as any round that does not make noise upon impact, (i.e. smoke, target practice, target practice tracer)

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TABLE D-5. BASELINE SMALL CALIBER AMMUNITION UTILIZATION

RANGE	PISTOL 9MM, LIVE	RIFLE 5.56MM LIVE	RIFLE 7.62MM, LIVE	MACHINE GUN 50 CAL, LIVE	MACHINE GUN 50 CAL, BLANK	RIFLE 5.56MM BLANK	RIFLE 7.62MM BLANK	SHOTGUN 12 GAUGE	SHOTGUN .410
PTA FP 424/12						◊	◊		
PTA FP 429/13						◊			
PTA FP 501/16						◊			
PTA LZ ROB/1						◊			
PTA POW CAMP						◊	◊		
PTA RG 01 DEF		◊		◊		◊	◊		
PTA RG 01 OFF	◊	◊	◊	◊	◊	◊	◊		
PTA RG 02	◊							◊	
PTA RG 03				◊					
PTA RG 04		◊							
PTA RG 05		◊							
PTA RG 05A		◊							
PTA RG 07		◊	◊						
PTA RG 08	◊	◊	◊	◊			◊		◊
PTA RG 08B				◊					
PTA RG 08S		◊	◊	◊					
PTA RG 10		◊		◊	◊	◊			
PTA RG 10 OFF	◊	◊	◊	◊	◊	◊	◊		
PTA RG 11T		◊	◊	◊	◊	◊	◊		
PTA RG 12		◊	◊	◊	◊	◊	◊	◊	
PTA RG 12A		◊	◊	◊	◊	◊	◊		
PTA RG 13		◊	◊	◊	◊	◊			
PTA RG 13A	◊		◊						
PTA RG 20		◊	◊	◊		◊			
PTA RG 8C SHOOTHOUSE	◊	◊	◊			◊			
PTA TA 03		◊			◊	◊		◊	
PTA TA 08					◊	◊		◊	
PTA TA 12							◊	◊	
PTA TA 13						◊	◊		
PTA/RG 01		◊	◊			◊			

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TABLE D-6. PROJECTED IPBC SMALL CALIBER AMMUNITION EXPENDITURE

	AT-4 Training Round	Carl Gustav Training Round	Rifle 5.56mm	Machine Gun 7.62mm	Machine Gun .50 cal
IPBC			X	X	X
Aerial Gunnery				X	X
Non-standard Ground Based	X	X			

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